

2013 Emerging Researchers National (ERN) Conference in STEM

February 28-March 2, 2013
Washington, D.C.



AAAS
2014
ANNUAL
MEETING
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Call for Symposium Proposals

Symposium proposals for the 2014 AAAS Annual Meeting are now being solicited.

To submit a proposal, visit www.aaas.org/meetings. The deadline for submission is **23 April 2013**.

Meeting Global Challenges: Discovery and Innovation

Scientific discovery and innovation are helping to drive solutions to current and future global challenges. Economic progress in every community worldwide has meanwhile become increasingly interdependent with advances in science and technology. Challenges related to ensuring sufficient food for a growing population, quality healthcare, renewable fuels, and a sustainable and enriching environment demand innovation and international dialogue. Addressing these challenges depends upon discoveries emerging from the convergence of physical, life, engineering, and social sciences in innovative ways that are most useful to society.

In a weakened global economy, many countries have begun to limit their investments in the future. Yet, investments in innovations – including funding for education as well as basic and applied research – represent our best prospect for a sustainable environment and increased economic growth. Economists estimate, after all, that innovation in science and technology are the source of more than half of the economic growth in many countries. By increasing innovation in sustainable products and processes, world economies can continue to enhance human welfare across society.

Innovation springs from the translation, production, and distribution of discovery and invention to society. In the contemporary world, this is not a linear process, but rather, a matrix of interactions. Societies, with support from public and private sectors and institutions, struggle to integrate the necessary disciplines and interests into this matrix. Within the scientific and engineering community, we need to better integrate different disciplines and voices into a consensus supporting innovation. Developed and developing countries that accomplish this will become the economies of the future.

At the same time, it is imperative that we work in ways that are transparent and open to a diversity of contributors and ideas. Assessing risk versus benefit in adopting an innovation is complex and depends upon an open dialogue. Only then will we realize the promise of furthering scientific discovery and innovation to meet pressing global challenges and improve quality of life.

Call for Poster Submissions

Online entries will be accepted at www.aaas.org/meetings beginning **14 May 2013**.

Emerging Researchers National (ERN) Conference in STEM

Co-hosted by the
American Association for the Advancement of Science (AAAS)
Education and Human Resources Program (EHR)

National Science Foundation (NSF)
Division of Human Resources Development (HRD)
Directorate of Education and Human Resources Program



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Overview of the Conference

Emerging Researchers National (ERN) Conference in STEM

The 2013 Emerging Researchers National (ERN) Conference in Science, Technology, Engineering and Mathematics (STEM) is hosted by the American Association for the Advancement of Science (AAAS), Education and Human Resources Programs (EHR) and the National Science Foundation (NSF) Division of Human Resource Development (HRD), within the Directorate for Education and Human Resources (EHR). The conference is aimed at college and university undergraduate and graduate students who participate in programs funded by the NSF HRD Unit, including underrepresented minorities and persons with disabilities.

In particular, the conference seeks to highlight the research of undergraduate and graduate students who participate in the NSF Research Experiences for Undergraduates (REUs) Program and the following NSF HRD-funded programs:

- Alliance for Graduate Education and the Professoriate (AGEP);
- Centers of Research Excellence in Science and Technology (CREST);
- Historically Black Colleges and Universities Undergraduate Program (HBCU-UP);
- Louis Stokes Alliances for Minority Participation (LSAMP) and LSAMP Bridges to the Doctorate;
- Research in Disabilities Education (RDE); and
- Tribal Colleges and Universities Program (TCUP).

The objectives of the conference are to help undergraduate and graduate students to enhance their science communication skills and to better understand how to prepare for science careers in a global workforce. Towards this end, the general format for the 2-1/2 day conference includes:

- Student poster and oral presentations.

Other conference activities include workshops focused on:

- Strategies for applying for and succeeding in graduate programs and finding funding for graduate school;
- Career preparation for the STEM workforce, including employment searches and retention; and
- Understanding STEM careers in a global context and identifying international research and education opportunities for undergraduate and graduate students and faculty.

Exhibitors include representatives from academic, government, business, and the non-profit sector with information about graduate school admissions, fellowships, summer research opportunities, professional development activities, and employment opportunities.

For more information, visit the Web site at <http://www.emerging-researchers.org/>.

The National Science Foundation (NSF) Division of Human Resource Development (HRD)

The Division of Human Resource Development (HRD) serves as a focal point for NSF's agency-wide commitment to enhancing the quality and excellence of STEM education and research through broadening participation by historically underrepresented groups - minorities, women, and persons with disabilities. Priority is placed on investments that promise innovation and transformative strategies and that focus on creating and testing models that ensure the full participation of and provide opportunities for the educators, researchers, and institutions dedicated to serving these populations. Programs within HRD have a strong focus on partnerships and collaborations in order to maximize the preparation of a well-trained scientific and instructional workforce for the new millennium.

HRD VISION:

HRD envisions a well-prepared and competitive U.S. workforce of scientists, technologists, engineers, mathematicians, and educators that reflects the diversity of the U.S. population.

HRD MISSION:

HRD's mission is to grow the innovative and competitive U.S. science, technology, engineering and mathematics (STEM) workforce that is vital for sustaining and advancing the Nation's prosperity by supporting the broader participation and success of individuals currently underrepresented in STEM and the institutions that serve them.

STRATEGIC GOAL 1:

The creation of new knowledge, innovations, and models for broadening participation in the STEM enterprise.

STRATEGIC GOAL 2:

The translation of knowledge, innovations, and models for broadening participation in STEM for use by stakeholders.¹

STRATEGIC GOAL 3:

Expand Opportunities: The expansion of stakeholder capacity to support and engage diverse populations in high quality STEM education and research programs.

HRD THEORY OF CHANGE:

HRD's fundamental mission of broadening participation in STEM is embedded in the greater EHR and NSF goals. A basic premise of all HRD programs is that increasing the successful participation of individuals from historically underrepresented groups in STEM will result in a diverse, highly capable STEM workforce that can lead innovation and sustain U.S. competitiveness in the science and engineering enterprise.

Therefore, HRD has an overall goal to increase the successful participation of underrepresented minorities, women and girls, and persons with disabilities in STEM. This is done through the implementation and testing of evidence-based practices, critical review of program results to assess impact, data-driven continuous improvement, and broad dissemination of program findings for wide adoption or scale-up of effective strategies.

¹Stakeholders include a wide range of organizations and individuals such as but not limited to: NSF and other Federal agencies, federally funded STEM labs and centers, institutions of higher education including minority-serving institutions, State and local governments, education researchers and practitioners, policy makers, STEM employers, professional STEM societies, STEM organizations, and private funders.

About

About AAAS

The American Association for the Advancement of Science, (AAAS), is an international non-profit organization dedicated to advancing science around the world by serving as an educator, leader, spokesperson and professional association. In addition to organizing membership activities, AAAS publishes the journal *Science*, <http://www.sciencemag.org/>, as well as many scientific newsletters, books and reports, and spearheads programs that raise the bar of understanding for science worldwide.

AAAS was founded in 1848, and includes some 261 affiliated societies and academies of science, serving 10 million individuals. *Science* has the largest paid circulation of any peer-reviewed general science journal in the world, with an estimated total readership of one million. The non-profit AAAS is open to all and fulfills its mission to "advance science and serve society" through initiatives in science policy; international programs; science education; and more. For the latest research news, log onto **EurekAlert!**, <http://www.eurekalert.org/>, the premier science-news website, a service of AAAS.

Membership and Programs

Open to all, AAAS membership includes a subscription to *Science*. Four primary program areas fulfill the AAAS mission:

- Science and Policy
- International Activities

- Education and Human Resources
- Project 2061

AAAS Mission

AAAS seeks to "advance science, engineering, and innovation throughout the world for the benefit of all people." To fulfill this mission, the AAAS Board has set these broad goals:

- Enhance communication among scientists, engineers, and the public;
- Promote and defend the integrity of science and its use;
- Strengthen support for the science and technology enterprise;
- Provide a voice for science on societal issues;
- Promote the responsible use of science in public policy;
- Strengthen and diversify the science and technology workforce;
- Foster education in science and technology for everyone;
- Increase public engagement with science and technology; and
- Advance international cooperation in science.

Visit the AAAS website at <http://www.aaas.org/>.



Joan Ferrini-Mundy



NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

February 28, 2013



Sylvia James

Dear Conference Participants:

On behalf of the National Science Foundation (NSF), the Directorate for Education and Human Resources, and the Division of Human Resource Development, we welcome you to the 2013 *Emerging Researchers National Conference in Science, Technology, Engineering and Mathematics (STEM)*. This research conference for undergraduate and graduate students builds on and continues NSF's commitment to increase participation in STEM fields for underrepresented minorities, women, and individuals with disabilities as a means to foster the research and education capacity of the nation.

Student scholarship goes beyond classroom learning, to include the creation of scientific knowledge, collaboration with other students, researchers, and faculty, and dissemination of research at conferences and in journals. We applaud your enthusiasm for research experiences as part of your ongoing studies.

This conference is designed to provide you with information and resources to become successful with the next steps in your career. We hope that you find the research presentations, plenary session, panels, workshops, and exhibits informative. Please take advantage of all of the opportunities that this conference has to offer.

Sincerely,

A handwritten signature in blue ink that reads "Joan Ferrini-Mundy".

Joan Ferrini-Mundy
Assistant Director
Directorate for Education and Human Resources

A handwritten signature in blue ink that reads "Sylvia James".

Sylvia James
Division Director (Acting)
Human Resource Development

Welcome



Alan I. Leshner



Shirley M. Malcom



Yolanda S. George



February 28, 2013

Dear ERN Conference Participants:

Welcome to the 2013 *Emerging Researchers National (ERN) Conference in Science, Technology, Engineering and Mathematics (STEM)*. The American Association for the Advancement of Science (AAAS), publisher of the journal *Science*, is pleased to join the National Science Foundation (NSF) in co-sponsoring this important gathering of the next generation of STEM professionals. We applaud the NSF's commitment to enhancing the quality and excellence of STEM education and research through broadening participation by underrepresented minorities, persons with disabilities as well as the institutions which serve them.

We wish to acknowledge the efforts of faculty and administrators who develop and implement innovative undergraduate and graduate educational initiatives, key components in keeping the U.S. at the forefront of technological innovation and in building a strong economy. We appreciate the continued support and efforts of the exhibitors at this Conference, many of whom are or have been grantees of the NSF Alliances for Graduate Education and the Professoriate (AGEP) or the Integrative Graduate Education Research Traineeship (IGERT) Programs. These organizations provide very important information about graduate school admissions, fellowships, summer research opportunities, professional development activities, and employment opportunities.

This conference provides one of the few national venues for STEM undergraduate and graduate students to network, build their scientific communications skills, and showcase their research. This year we welcome over 600 undergraduate and graduate student presenters at the Conference.

We are grateful to the PhD alumni and current graduate students of the David and Lucile Packard HBCU Graduate Scholars Program, the AAAS Policy Fellows, and the alumni of the SACNAS Summer Leadership Institute who are joining us at the Conference this year to help with judging student oral and poster presentations, as well as presenting workshops.

- From 1992 to 2003, the Packard Foundation provided fellowships for 120 graduates of HBCUs who were admitted to science and technology doctoral programs at U.S. universities. Since the inception of the Program in 1992, ninety-seven (97) African American participants in the HBCU Packard Program have earned PhDs, primarily in physical sciences, engineering, and mathematics and statistics.
- The AAAS manages and administers Science & Technology Policy Fellowships in five program areas to provide the opportunity for accomplished scientists and engineers to participate in and contribute to the federal policymaking process while learning firsthand about the intersection of science and policy. The fellowships in congressional offices are funded by approximately 30 partner scientific and engineering societies. The fellowships in executive branch agencies are funded by the hosting offices.
- SACNAS is a society of scientists dedicated to fostering the success of Hispanic/Chicano and Native American scientists—from college students to professionals—to attain advanced degrees, careers, and positions of leadership in science

As a part of its mission to “advance science, engineering, and innovation throughout the world for the benefit of all people,” AAAS provides a wide array of programs and resources. To find out more about the internships, fellowships, and educational and career resources offered by AAAS, we invite you to visit online at <http://www.aaas.org/>.

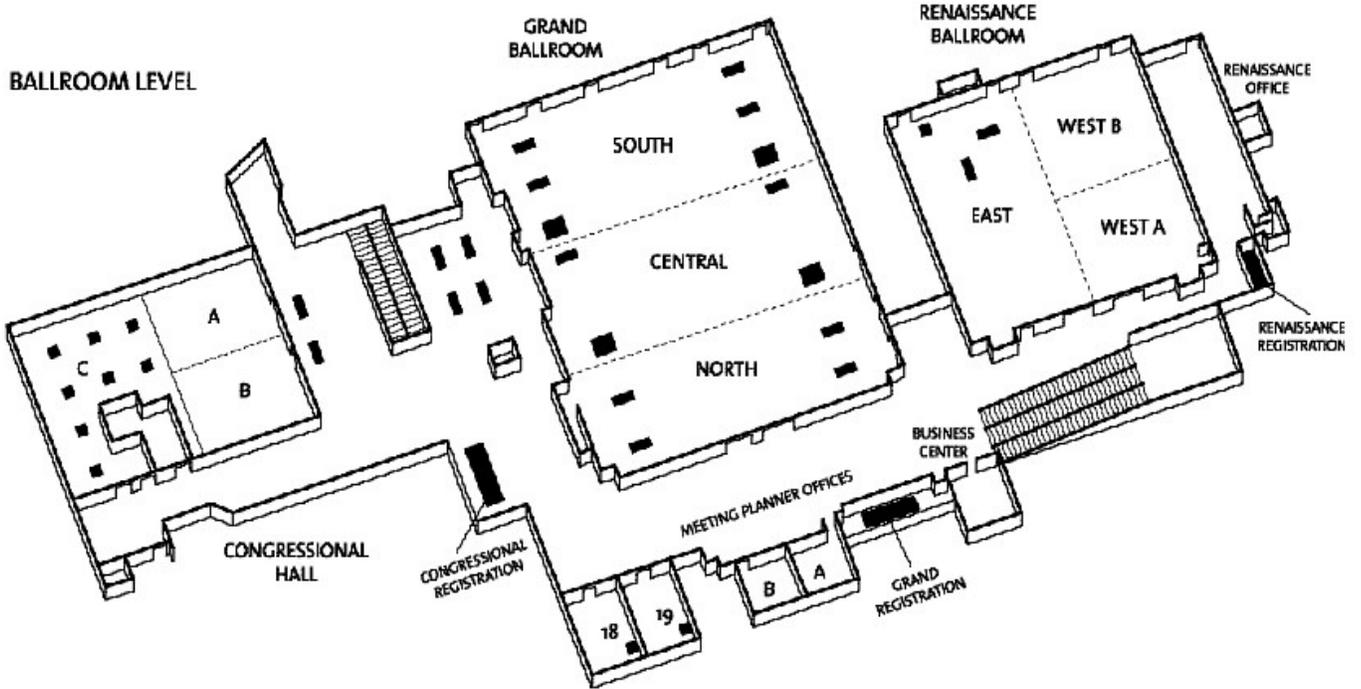
We hope the contacts, strategies, and online resources that you discover at this Conference and via our Web site are useful in helping you meet your institutional or career goals.

Sincerely,

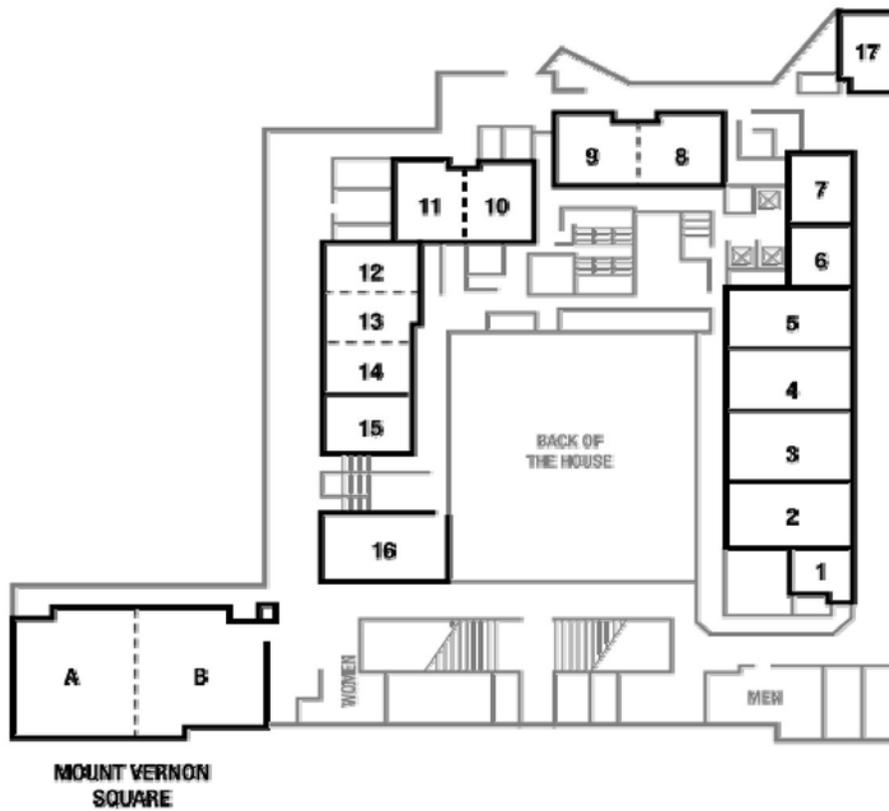
Alan I. Leshner, Chief Executive Officer, AAAS and Executive Publisher, *Science*

Shirley M. Malcom, Director, AAAS Education and Human Resources (EHR) Programs

Yolanda S. George, Deputy Director and Program Director, EHR



MEETING ROOM LEVEL



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Sally O'Connor, *Division of Biological Infrastructure*

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Aziza Baccouche, President and Chief Executive Officer, Aziza Productions

Aziza Baccouche (Dr. Aziza) is a physicist by training and currently works as a science media producer in affiliation with AZIZA Productions, a science media production company she established in the year 2000. She has always been inter-

ested in communicating science to the lay public through television.

While working on her Ph.D. in theoretical nuclear physics at the University of Maryland at College Park, Aziza received a Mass Media Science & Engineering fellowship from the American Association for the Advancement of Science (AAAS) and was assigned to CNN's science and technology unit in Atlanta Georgia. During her fellowship, she gained hands-on experience producing science news video segments which aired on CNN's newscasts. This experience launched her career as a TV science producer and on-air correspondent.

Subsequent to her AAAS fellowship, Aziza continued to produce science news segments for CNN based out of its Washington bureau on a freelance basis for a couple additional years. During this time, she had the opportunity to produce a short motivational documentary film that aired on CNN in the year 2000 and seen by K-12 students in the classroom throughout the United States. Titled *The Changing Face & Image of Science & Engineering*, this short film profiled six dynamic young African-American scientists.

After receiving her doctorate in physics in 2002, Aziza became a regular science producer and correspondent for Evening Exchange on Howard University Television, a PBS affiliate station. Hosted by veteran Washington, DC journalist Kojo Nnamdi, Aziza helped stimulate the on-air roundtable discussions with experts, and also produced five to ten minute-long video segments, which were broadcast before the roundtable discussions. Stories she produced include discussions regarding the benefits and drawbacks of genetically modified foods and the significance of the human genome project, among others.

As president and CEO of AZIZA Productions, Aziza spends most of her time running the day-to-day operations of her company and takes an active role in her company's productions.

Aziza is currently producing a personal television documentary titled *Seeking Vision*. Through this film, she hopes to change the general public's perception and attitudes about the abilities of blind people like her.



Joan Ferrini-Mundy, Assistant Director, Directorate for Education and Human Resources, NSF

Joan Ferrini-Mundy is the Acting Assistant Director of the National Science Foundation (NSF) for Education and Human Resources (EHR). In 2009, she served as Acting Executive Officer for the

EHR Directorate, and from January 2007 through December 2009 was Director of EHR's Division of Research on Learning in Formal and Informal Settings (DRL).

While at NSF, Ferrini-Mundy continues to hold appointments at Michigan State University (MSU) as a University Distinguished Professor of Mathematics Education in the Departments of Mathematics and Teacher Education. She served as Associate Dean for Science and Mathematics Education in the College of Natural Science at MSU from 1999-2006.

Ferrini-Mundy was a Visiting Scientist in NSF's Teacher Enhancement Program from 1989-1991, and served as Director of the Mathematical Sciences Education Board and Associate Executive Director of the Center for Science, Mathematics, and Engineering Education at the National Research Council from 1995-1999. She directed the Michigan Department of Education Teacher Preparation Policy Study Group (2006-2007) and chaired the MI Mathematics High School Content Expectations Development Committee.

From 1983-1999, Ferrini-Mundy was a member of the Mathematics Department at the University of New Hampshire, and in 1982-1983 she was a mathematics faculty member at Mount Holyoke College, where she co-founded the Summer-Math for Teachers Program. She has served on the Board of Directors of the National Council of Teachers of Mathematics (NCTM), chaired the Writing Group for NCTM's 2000 Principles and Standards for School Mathematics, and served on the Board of Governors of the Mathematical Association of America.

In 2007-2008, representing NSF, she served as an ex officio member of the President's National Mathematics Advisory Panel, and co-chaired the Instructional Practices Task Group. Ferrini-Mundy holds a Ph.D. in mathematics education from the University of New Hampshire; her research interests include calculus teaching and learning, the development and assessment of teachers' mathematical knowledge for teaching, and mathematics and science education policy.

Biographies



Kristine M. Garza, Executive Director, SACNAS

Tina (Kristine M. Garza) obtained her B.S. in Biology at St. Mary's University, her Ph.D. in Immunology at the University of Virginia, and conducted her postdoctoral studies at the Ontario Cancer Institute.

She returned to her hometown of El Paso in 2000 to join the University of Texas at El Paso (UTEP) Department of Biological Sciences.

Her research program is focused in three areas: 1) the role of the adipocyte-derived cytokine, leptin, on the induction of effective T cell-mediated immunity; 2) the impact of leptin on cancer chemotherapy; and 3) the influence anthropogenic carbon particulates on microbial clearance by innate immune cells. Her research is supported by the National Institutes of General Medical Sciences (NIGMS) and the Texas Higher Education Coordinating Board (Norman Hackerman Advanced Research Program).

Through her teaching, research, and service activities, she focuses on the training and mentoring of underrepresented minority students in STEM. For example, she is the PI and Program Director of the UTEP Summer REU Program in Molecular and Cellular Biology; she is the Program Director of the UTEP-HHMI Undergraduate Science Education Program; she has served on the Board of Directors of the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS); and as of July 2012, is serving as the Executive Director for SACNAS. Her efforts have been recognized regionally (Distinguished Achievement Award for Service to the UTEP College of Science, Jack Bristol Distinguished Achievement Award in Teaching), by the state of Texas (Regents Outstanding Teaching Award), and nationally (National Academies Education and Training Mentor in the Life Sciences).



Sylvester "Jim" Gates, John S. Toll Professor of Physics and Director, Center for String and Particle Theory, University of Maryland

Sylvester James (Jim) Gates, Jr. (born December 15, 1950), a University System of Maryland Regents Professor, the John S. Toll Professor of Physics, and Center for

String and Particle Theory Director, is a theoretical physicist at the University of Maryland, College Park. Gates serves on the U. S. President's Council of Advisors on Science and Technology and on the Maryland State Board of Education.

He received two B. S. (mathematics & physics - 1973) and Ph. D. degrees all from the Massachusetts Institute of Technology, the

latter in 1977. His Ph.D. dissertation was the first at MIT to deal with supersymmetry and was followed by postgraduate works at Harvard University and the California Institute of Technology (Caltech). In 1984, with M. T. Grisaru, M. Rocek, W. Siegel, Gates co-authored *Superspace*, the first comprehensive book on the topic of supersymmetry.

Gates has been featured on many documentaries programs on physics. Among these "The Elegant Universe," "Einstein's Big Idea," "Fabric of the Cosmos," and "The Hunt for the Higgs." In 2006, he completed a DVD series titled "Superstring Theory: The DNA of Reality" (for The Teaching Company) composed of 24 half-hour lectures to make unification in fundamental physics accessible to non-scientists. At the 2008 World Science Festival, Professor Gates narrated a ballet "The Elegant Universe" with an on-line resource presentation of the artist forms (called adinkras) connected to his scientific research. These were the topic of "Symbols of power: Adinkras and the nature of reality," a cover story of the British magazine *Physics World* in 2010. This has led to websites on the topic that have been viewed over 600,000 times.

He is a Fellow of the American Physics Society, the American Association for the Advancement of Science, the National Society of Black Physicists, and the British Institute of Physics. He is also a member of the board of trustees of Society for Science & the Public and of the Board of Advisors for the Department of Energy's Fermi National Laboratory. In October 2011, he was inducted into the American Academy of Arts and Sciences and 2012 into the American Philosophical Society. He also is currently serving as a Distinguished Research Chair at Canada's Perimeter Institute. In 2013, he became a recipient of the Medal of Science, the highest recognition given by the U.S. to scientists with the citation, "For his contribution to the mathematics of supersymmetry in particle, field, and string theories and his extraordinary efforts to engage the public on the beauty and wonder of fundamental physics."

His continuing research in Supersymmetry, Supergravity and Superstring/M-Theory can be seen via a link on his homepage that leads to a popular-level discussion entitled, "Symbols of Power" and as well the link marked as "Q2C Festival 2009 Talk" describing some of his current investigations on links of adinkras, error-correcting codes, and equations of fundamental physics.



Yolanda S. George, Deputy Director, Education and Human Resources Programs, AAAS

Yolanda Scott George is Deputy Director and Program Director, Education and Human Resources Programs, American Association for the Advancement of

Science (AAAS). She has served as Director of Development, Association of Science-Technology Centers (ASTC), Washington, DC; Director, Professional Development Program, University of California, Berkeley, CA; and as a research biologist at Lawrence Livermore Laboratory, Livermore, California involved in cancer research and cell cycle studies using flow cytometer and cell sorters.

George conducts evaluations, workshops and reviews for the National Institutes of Health and National Science Foundation, as well as for private foundation and public agencies, including the European Commission. She develops and coordinates conferences and workshops related to STEM undergraduate reform and recruitment and retention of minorities, women, and persons with disabilities in STEM. She works with UNIFEM, UNESCO, L'Oreal USA and Paris and non-governmental organizations on gender, science, and technology initiatives related to college and university recruitment and retention and women leadership in STEM.

She currently serves as principal investigator (PI) or co-PI on several National Science Foundation (NSF) grants, including Vision and Change in Undergraduate Biology Education; National Science Education Digital Library (NSDL) Biological Sciences Pathways; Historically Black Colleges and Universities-Undergraduate Programs (HBCU-UP); Robert Noyce Teacher Scholarship Program; Transforming Undergraduate Education in STEM (TUES) and Virtual Faculty Workshop; and Women's International Research Collaborations at Minority Serving Institutions. In addition, George is the lead AAAS staff person for the L'Oréal USA Fellowships for Women in Science Program (postdoctoral fellowships) and the David and Lucile Packard Foundation HBCU Graduate Scholars Program (graduate school fellowships).

George serves on a number of boards or committees, including: Maria Mitchell Women in Science Awards Committee; McNeil/Lehrer Productions Online Science Reports Advisory Committee; Burroughs Wellcome Fund, Science Enrichment Program Grants, Advisory Board; The HistoryMakers, ScienceMakers, Advisory Board; and the National Advisory Board of The American Physical Society Physics Bridge Program.

George has authored or co-authored over 50 papers, pamphlets, and hands-on science manuals. She received her B.S. and M.S. from Xavier University of Louisiana and Atlanta University in Georgia, respectively.



Sylvia M. James, Acting Division Director, Division of Human Resource Development, Directorate for Education and Human Resources, NSF

Sylvia M. James is currently the Acting Division Director of the National Science Foundation's Division of Human Resource Development (HRD) in the Directorate for Education and Human Resources (EHR). Prior to that time, she served as the Acting Deputy Division Director in the Division of Research on Learning in Formal and Informal Settings (DRL), as well as the Lifelong Learning Cluster Coordinator. As Cluster Coordinator, she managed the Informal Science Education Program (ISE) which had a budget of \$64 million dollars, while also providing direction for the Innovative Technology Experiences for Students and Teachers (ITEST) program. She specializes in youth and community projects and has served as a program officer for the ISE, ITEST, Faculty Early Career (CAREER), and Advanced Technological Education (ATE) programs. She has also worked with the Innovation through Institutional Integration (I³) and Academies for Young Scientists (AYS) programs. Dr. James previously served as the Lead Program Officer for ITEST, and its predecessor, the After School Centers for Exploration and New Discovery (ASCEND).

Prior to coming to NSF, she was the Director of Education at the National Aquarium in Baltimore where she was employed for 14 years. She has served as an education consultant for science education radio, youth publications, and museums. Dr. James is the author of seven children's books on marine animals, in addition to science education publications and reports and has been an adjunct science faculty member at Sojourner-Douglass College since 2010. She holds a Bachelor of Science degree in Biology from Loyola University, a Master of Science degree from the Johns Hopkins University, and a Doctorate in Science Education from Morgan State University, all located in Baltimore, Maryland.



The Honorable Eddie Bernice Johnson, 30th Congressional District of Texas, U.S. House of Representatives

Congresswoman Eddie Bernice Johnson is serving her 10th term representing the 30th Congressional District of Texas. The 30th District is entirely within Dallas County and encompasses a large portion of the City of Dallas as well as the entire cities of DeSoto, Lancaster, Wilmer, Hutchins, and Balch Springs. Portions of the cities of Cedar Hill, Duncanville, Glenn Heights, Ferris, and Ovilla are also in the district. The Dallas portion of the district is home to the downtown central business district and Arts District, as well as

Biographies

the neighborhoods of Fair Park, Cadillac Heights, the Cedars, Victory Park, Uptown, Oak Lawn, Love Field, Urban Park, Pleasant Grove, Joppa, South Oak Cliff, Deep Ellum, Munger Place, Swiss Avenue, Lower Greenville, Forest Hills, and West Dallas.

In December 2010, Congresswoman Johnson was elected as the first African-American female Ranking Member of the House Committee on Science, Space and Technology. From 2000 to 2002, she was the Ranking Member of the Subcommittee on Research and Science Education where she emphasized education in STEM (Science, Technology, Engineering and Mathematics) disciplines.

Congresswoman Johnson has been a member of the House Transportation and Infrastructure Committee since being sworn into office in January 1993. In 2007, Congresswoman Johnson was appointed by House Transportation and Infrastructure Committee Chairman James L. Oberstar (D-MN) to serve as Chairwoman of the Subcommittee on Water Resources and Environment during the 110th and 111th Congresses. The Subcommittee on Water Resources and Environment has jurisdiction over water conservation, pollution control, infrastructure, and hazardous waste cleanup. The subcommittee is also responsible for reauthorizing the Clean Water Act. She has served on the Transportation and Infrastructure Committee as the highest ranking Texan. She has also served on the Subcommittee on Aviation, the Subcommittee on Railroad, Pipelines, and Hazardous Materials and the Subcommittee on Highways and Transit. She was the first African-American and female in Congress to hold this position of Subcommittee Chair. Congresswoman Johnson has also served in position of Senior Democratic Deputy Whip; Chair of the House Metro Congestion Coalition; Co-Chair for the Congressional Caucus on Homelessness, and Co-Chair for the TEX-21 Congressional Caucus that is a forum to address Texas transportation needs through the reauthorization of TEA-21. She is Founder and Co-Chair of the Diversity and Innovation Caucus and of the House Historical Black Colleges and Universities Caucus. In addition, Congresswoman Johnson served as Chair of the Congressional Black Caucus during the 107th Congress.

Congresswoman Johnson presently serves on the Aviation Subcommittee, Highways and Transit Subcommittee and Water Resources and Environment Subcommittee.

Since coming to Congress, Congresswoman Johnson has earned the reputation of being a stateswoman who is dedicated to improving U.S. foreign relationships and policies. She works tirelessly towards improving human rights around the globe. Congresswoman Johnson's acclaimed initiative "A World of Women for World Peace" has been nationally and internationally recognized.

Congresswoman Johnson studied nursing at St. Mary's College at the University of Notre Dame. She returned to Texas when she successfully passed the National Board Examination in Nursing. She later became Chief Psychiatric Nurse at the VA Hospital in Dallas and received a bachelor's degree in nursing from Texas Christian University in 1967. She received a master's degree in public administration from Southern Methodist University in 1976. Congresswoman Johnson is the first nurse to be elected to the U.S. Congress.

Congresswoman Johnson was elected to the Texas House of Representatives in 1972 and became the first woman in Texas history to lead a major Texas House committee, the Labor Committee. As an advocate for workers, children, and families, she was recognized and appointed by President Jimmy Carter to serve as Regional Director of the Department of Health, Education, and Welfare in 1977. In 1986, she was elected a Texas state Senator, becoming the first female and African-American from the Dallas area to hold this office since Reconstruction.

Congresswoman Johnson is widely recognized as one of the most effective legislators in Congress. She is credited with originally authoring and co-authoring more than 150 bills that were passed by the House and Senate and signed into law. She also has a long-standing reputation for providing excellent constituent services. Her district office in downtown Dallas specializes in working with all federal departments and agencies to assist constituents in solving a wide range of individual problems.

Congresswoman Johnson is the proud mother of her son, Kirk, and of her three grandsons, Kirk Jr., David, and James.



Alan I. Leshner, Chief Executive Officer, AAAS, and Executive Publisher, Science

Alan I. Leshner has been Chief Executive Officer of the American Association for the Advancement of Science and Executive Publisher of the journal *Science* since December 2001. AAAS (triple A-S) was founded in 1848 and is the world's largest, multi-disciplinary scientific and engineering society.

Before coming to AAAS, Leshner was Director of the National Institute on Drug Abuse (NIDA) from 1994-2001. One of the scientific institutes of the U.S. National Institutes of Health, NIDA supports over 85% of the world's research on the health aspects of drug abuse and addiction.

Before becoming Director of NIDA, Leshner had been the Deputy Director and Acting Director of the National Institute of

Mental Health. He went to NIMH from the National Science Foundation (NSF), where he held a variety of senior positions, focusing on basic research in the biological, behavioral and social sciences, science policy and science education. Leshner went to NSF after 10 years at Bucknell University, where he was Professor of Psychology. He has also held long-term appointments at the Postgraduate Medical School in Budapest, Hungary; at the Wisconsin Regional Primate Research Center; and as a Fulbright Scholar at the Weizmann Institute of Science in Israel. Dr. Leshner is the author of a textbook on the relationship between hormones and behavior, and has published over 150 papers for both the scientific and lay communities on the biology of behavior, science and technology policy, science education, and public engagement with science.

Leshner received an undergraduate degree in psychology from Franklin and Marshall College, and M.S. and Ph.D. degrees in physiological psychology from Rutgers University. He also has been awarded six honorary Doctor of Science degrees. Dr. Leshner is an elected fellow of AAAS, the National Academy of Public Administration, the American Academy of Arts and Sciences, and many other professional societies. He is a member of the Institute of Medicine of the National Academies of Science and Vice-Chair of its governing Council. He was appointed to the National Science Board by President Bush in 2004 and reappointed by President Obama in 2011.



Shirley M. Malcom, Director, EHR Programs, AAAS

Shirley M. Malcom, Director for Education and Human Resources (EHR) Programs at AAAS, has served as a program officer in the NSF Science Education Directorate; an assistant professor of biology, University of North Carolina, Wilmington; and a high school science teacher. Malcom received her Ph.D. in Ecology from The Pennsylvania State University; Master's in Zoology from the University of California, Los Angeles; and Bachelor's with distinction in Zoology from the University of Washington. In addition, she holds 16 honorary degrees.

Malcom serves on several boards, including the Heinz Endowments and Public Agenda. She serves as a trustee of Caltech and as a Regent of Morgan State University. In 2003, Malcom received the Public Welfare Medal of the National Academy of Science, the highest award granted by the Academy. She was a member of the National Science Board, the policymaking body of NSF, from 1994 to 1998, and of the President's Committee of Advisors on Science and Technology from 1994 to 2001.



Leland D. Melvin, Associate Administrator for Education, NASA

Leland D. Melvin, NASA associate administrator for education, is responsible for the development and implementation of the agency's education programs that strengthen student involvement and public awareness about its scientific goals and missions. In this role, he leads the agency in inspiring interest in science, technology, engineering and mathematics, or STEM, through NASA's unique mission, workforce, facilities, research and innovations.

As associate administrator for education, Melvin chairs the Education Coordinating Committee, or ECC, an agency-wide collaborative structure that maximizes NASA's ability to manage and implement its education portfolio. The ECC works to ensure that the agency's education investments are focused on supporting the nation's education efforts to develop the skilled workforce necessary to achieve NASA's goals and objectives.

Melvin currently serves on the White House National Science and Technology Council's Committee on Science, Technology, Engineering and Mathematics Education, or CoSTEM. CoSTEM coordinates the STEM education activities and programs for all federal agencies, encourages the teaching of innovation and entrepreneurship as part of STEM education, reviews STEM education activities and programs to ensure they are not duplicative within the Federal government and develops and implements a five-year STEM education strategy for all federal agencies. He is the United States representative on the International Space Education Board, or ISEB, a global collaboration in space education between NASA, the Canadian Space Agency, the European Space Agency, the Japan Aerospace Exploration Agency and the Centre National d'Études Spatiales. The ISEB shares best practices and unites efforts to foster interest in space, science and technology among the student community worldwide.

Melvin began his NASA career in 1989 as an aerospace research engineer at the agency's Langley Research Center in Hampton, VA. He entered NASA's astronaut corps in 1998 and served as a mission specialist operating the robotic arm on two space shuttle missions to the International Space Station: STS-122 in 2008 and STS-129 in 2009.

Melvin earned a Bachelor of Science degree in chemistry from the University of Richmond, where he also excelled as a wide receiver for the Spiders' football team. He became a National Collegiate Athletic Association Division I Academic All American and University of Richmond Athletic Hall of Fame Inductee. He was then drafted into the National Football League, or NFL, by the Detroit Lions in 1986 and also spent time with the Dallas Cowboys and the Toronto Argonauts. After injuries sidelined his

Biographies

football career, he returned to academia and earned his Master of Science degree in materials science engineering from the University of Virginia in Charlottesville. He holds honorary doctorates from Centre College, St Paul's College and Campbellsville University.



Gisèle Muller-Parker, NSF, Program Director, Graduate Research Fellowship Programs (GRFP)

Gisèle Muller-Parker joined NSF as Program Director for the Graduate Research Fellowship Program in October 2008. From 2004-2006, she served as Associate Program Director at NSF in

GEO, Division of Ocean Sciences, Ocean Education Program, as a rotator from Western Washington University. She was Professor of Biology at Western Washington University from 1990-2010, where she taught courses in marine biology, symbiosis, and botany and served as the Assistant Director of Shannon Point Marine Center. She received degrees from SUNY at Stony Brook (BS in Biology), the University of Delaware (MS in Marine Studies), and UCLA (PhD in Biology). She has served on the editorial boards of the *Biological Bulletin*, *Coral Reefs*, and the *Journal of Phycology*. Her research on algal symbiosis in sea anemones and corals has engaged many undergraduate and graduate students. Her current research focuses on the benefits of algal symbiosis to temperate intertidal sea anemones on the Pacific coast.



Ronke Olabisi, Assistant Professor, Biomedical Engineering, Rutgers University

Ronke Olabisi is a member of the Biomedical Engineering Department of Rutgers University. Her Ph.D. research centered on limb lengthening (1) muscle and joint function; (2) the elastic and

viscoelastic properties of tendon; and (3) the lengthened tissue histomorphology. As a postdoctoral fellow Olabisi studied the biophysics of bone and seashell at Wisconsin's Synchrotron Radiation Center, bone tissue engineering at Rice University using hydrogel microencapsulated cells genetically modified to express bone morphogenetic protein, and differentiating mesenchymal stem cells down an osteogenic lineage by varying microencapsulation parameters. Olabisi's current research interests include orthopedic tissue engineering and regenerative medicine for injury, aging, disease, and space flight.

Olabisi received her B.S. Degree in Mechanical Engineering from Massachusetts Institute of Technology, an M.S. Degree in Mechanical Engineering and an M.S. in Aerospace Engineering

from University of Michigan, and her Ph.D. in Biomedical Engineering from University of Wisconsin-Madison.



Pendred "Penny" Noyce, Trustee, Noyce Foundation

Pendred (Penny) Noyce is a doctor, educator, and writer. She grew up in California, completed a degree in biochemistry at Harvard and a medical degree at Stanford, and did her residency in internal medicine in Minnesota. She

practiced internal medicine at a community health center in Boston for several years. In 1991, she helped establish the Noyce Foundation in honor of her father, Robert Noyce, co-inventor of the integrated circuit and co-founder of Intel. The foundation focuses on improving K-12 education, particularly in mathematics and science. From 1993-2002, Penny helped lead a statewide math and science improvement effort called PALMS in the state of Massachusetts. She has served on the boards of numerous non-profits, including most recently the Gulf of Maine Research Institute, the Rennie Center for Education Research and Policy, TERC, the Libra Foundation of Maine, the Concord Consortium, and the Consortium for Mathematics and Its Applications.

As her older children set off for college, Penny began writing for middle-grade children. Her first two novels for children, *Lost in Lexicon: An Adventure in Words and Numbers*, and *The Ice Castle: An Adventure in Music* are published by Scarletta Press. In 2011, Penny joined with two friends to found Tumblehome Learning, a company devoted to getting kids excited about science through mystery and adventure stories, activity kits and apps. Tumblehome Learning represents a convergence of Penny's interests in science, education, and great writing for kids.



Claudia Rankins, Program Director, HRD, NSF

Claudia Rankins is a Program Officer in the Directorate for Education and Human Resources at the National Science Foundation. She manages the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)

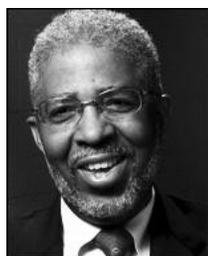
which provides awards to enhance the quality of undergraduate science, technology, engineering and mathematics (STEM) education and research at HBCUs as a means to broaden participation in the nation's STEM workforce. She also manages the Centers of Research Excellence in Science and Technology program which makes resources available to enhance the research capabilities of minority-serving institutions through the

establishment of centers that effectively integrate education and research.

Prior to this post, Rankins served at Hampton University for 22 years in a number of capacities, including endowed university professor, chair of the department of physics, assistant dean for research, and dean of the School of Science. She also directed STEM enrichment and research programs for students ranging from middle school through post baccalaureate studies.

Her formal education includes military training, certification as translator and interpreter for German, French and English, a B.S. in Mathematics, an M.S. in Statistics, an M.S. in Physics, and a Ph.D. in Physics.

Since 1998, Rankins secured over \$10 million in external grants that supported pre-college activities as well as undergraduate education and research in STEM. Her current research interests focus on the underrepresentation of women faculty of color in STEM disciplines.



James Stith, Vice President Emeritus, American Institute of Physics

James Stith is Vice President Emeritus for the American Institute of Physics (AIP). While an officer of the Institute, he had oversight responsibilities for AIP's Magazine Division, the Media and Government Relations Division, the

Education Division, the Center for the History of Physics, the Statistical Research Division and the Careers Division. His doctorate in physics was earned from The Pennsylvania State University, and his masters and bachelors in physics were received from Virginia State University. A physics education researcher, his primary interests are in Program Evaluation, and Teacher Preparation and Enhancement.

Stith was formerly a Professor of Physics at The Ohio State University and Professor of Physics at the United States Military Academy. He has also been a Visiting Associate Professor at the United Air Force Academy, a Visiting Scientist at the Lawrence Livermore National Laboratory, a Visiting Scientist at the University of Washington, and an Associate Engineer at the Radio Cooperation of America.

He is a past president of the American Association of Physics Teachers, past president of the National Society of Black Physicists, a Fellow of the American Association for the Advancement of Science, a Fellow of the American Physical Society, a Chartered Fellow of the National Society of Black Physicists, and a member of the Ohio Academy of Science. He was named a Distinguished Alumni of Penn State, the Alumni Association's highest award, an Honorary Member of Sigma Pi

Sigma (its highest award) the physics honor society, a National Academies Education Mentor in the Life Sciences and a Science-Maker (by HistoryMakers). Additionally, he serves on a number of national and international advisory boards and has been awarded a Doctor of Humane Letters by his alma mater, Virginia State University. He is married and has three adult daughters and two grandchildren.



Valerie Wilson, NSF, Deputy Director, Graduate Education

Valerie Petit Wilson, PhD, is the Deputy Division Director for Graduate Education. Prior to her position at NSF, Wilson was Associate Provost and Director of Institutional Diversity and Clinical Professor of Health Services, Policy and

Practice at Brown University. Concurrently, for seven years, she was also Executive Director of the Leadership Alliance a consortium of leading teaching and research institutions dedicated to preparing underrepresented students for careers in academic, government and private sectors through research and clinical doctoral training. Under her guidance, the Leadership Alliance became a 2007 institutional award recipient of the Presidential Award for Excellence in Science Mathematics and Engineering Mentoring, among other awards received by the consortium. From 2005-2009, she served as Associate Dean of the Graduate School at Brown, focusing on recruitment, retention and professional development activities and serving as co-PI of Brown's project in the PhD Completion Project of the Council of Graduate Schools, and Ethics in Physical Sciences grants.

Prior to her tenure at Brown, she was Deputy Center Director and Chief of Operations of the Center for Bioenvironmental Research and Clinical Professor of Environmental Health at Tulane University (1998-2003). From 1993-1997, she directed the Division of Health Sciences Policy at the Institute of Medicine, a part of the National Academy of Sciences. Earlier, her career focused on a variety of increasingly responsible positions in the Federal government, beginning as a staff research fellow and Program Director at National Institute of Diabetes, Digestive and Kidney Diseases of NIH, and then as Policy Analyst in biomedical research, and Policy Director in HIV and AIDS policy activities at the Department of Health and Human Services.

Wilson holds a BS degree in Chemistry from Xavier University of Louisiana, and a PhD in Molecular Biology from The Johns Hopkins University.

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Sabrina McCormick, PhD

Sociology and
Environmental Sciences,
Brown University

2009-11 S&T Policy
Fellow, Environmental
Protection Agency,
Office of Research
and Development

Now president,
Evidence Based Media



Full details at fellowships.aaas.org

SCIENCE & TECHNOLOGY
POLICY FELLOWSHIPS



Thursday, February 28, 2013

- 3:00pm - 9:00pm **Registration**
Grand Ballroom Foyer
- 1:00pm - 7:00pm **Exhibitor Setup**
Congressional A&B
- 4:00pm - 5:00pm **Exhibitor Orientation**
Congressional A&B
- 5:00pm - 6:00pm **Judges Orientation**
Congressional C
- 6:00pm - 8:00pm **Opening Plenary Session 1**
Grand Ballroom
- Moderator & Welcome:**
Shirley M. Malcom, Director, AAAS, EHR
- Welcome Remarks:**
Sylvia M. James, Acting Division Director, NSF, HRD
- Speakers:**
The Honorable Eddie Bernice Johnson,
U.S. House of Representatives
- Pendred Noyce,** *Founder and Trustee, Noyce Foundation*
- Leland D. Melvin,** *Associate Administrator for Education, NASA*
- Closing Remarks:**
Yolanda S. George, *Deputy Director, AAAS*
- “How to Get the Most out of the Conference”**
- 8:00pm - 10:00pm **Exhibits Open / Judges Room Open**
Congressional A&B / Congressional C

Friday, March 1, 2013

- 7:00am - 7:00pm **Registration**
Grand Ballroom Foyer

- 7:00am - 7:45am **Oral and Poster Presentations Session 1 (Set-Up)**
Renaissance Ballroom/Renaissance Foyer
Meeting Rooms - Meeting Room Level
- 7:00am - 6:30pm **Judges Room Open**
Congressional C
- 7:45am - 9:45am **Networking Breakfast & Plenary Session 2**
Grand Ballroom
- Moderator:**
Sylvia M. James, *Acting Division Director, NSF, HRD*
- Welcome Remarks:**
Alan I. Leshner, *AAAS Chief Executive Officer, Executive Publisher, “Science”*
- Speaker:**
Kristine M. (Tina) Garza, *Executive Director, SACNAS*
- 9:45am - 10:00am **Break**
- 10:00am - 12:15pm **Poster Presentations Session 1**
Renaissance Ballroom and Renaissance Foyer
- Oral Presentations Session 1**
Meeting Rooms - Meeting Room Level
- These include:**
Ecology, Environmental & Earth Sciences Related Research A
Meeting Room 12
- Biological Sciences A**
(Cancer Research and Physiology)
Meeting Room 5
- Chemistry and Material Sciences A**
Meeting Room 13
- Computer Sciences and Information Systems and Computer Engineering A**
Meeting Room 14
- Mathematics and Statistics A**
(Undergraduate and Graduate Students)
Meeting Room 15

Agenda

Physics and Nanoscience A

Meeting Room 16

Technology and Engineering

Meeting Room 11

Concurrent Workshops Session 1

A. Writing Powerful Winning Poster and Presentation Abstracts

Meeting Room 2

Irene Hulede, *Manager Student Programs, American Society for Microbiology (ASM)*

Beronda Montgomery, *Associate Professor, Biochemistry and Molecular Biology, Michigan State University*

B. NSF Graduate Research Fellowship Program

Meeting Room 3

Gisèle Muller-Parker, *NSF, Program Director, Graduate Research Fellowship Programs (GRFP)*

C. Funding Your STEM Education for Undergraduates

Meeting Room 4

Liv Detrick and Chris Cash, *Institute for Broadening Participation, Inc. (IBP)*

12:15pm - 1:30pm

Plenary Session 3

Grand Ballroom

“Lessons Learned about Moving into a Science Media Career”

Moderator:

Richard Weibl, *Director, AAAS Center for Careers in Science and Science, Technology, and Disability*

Speaker:

Aziza Baccouche, *President and Chief Executive Office, Aziza Productions*

1:30pm - 4:00pm

Exhibits Open

Congressional A&B

1:45pm - 4:00pm

Oral and Poster Presentations Session 2 (Set-Up)

Renaissance Ballroom/Renaissance Foyer

4:00pm - 6:30pm

Meeting Rooms - Meeting Room Level

Poster Presentations Session 2

Renaissance Ballroom/Renaissance Foyer

Oral Presentations Session 2

Meeting Rooms - Meeting Room Level

These include:

Cell and Molecular Biology

Meeting Room 5

Chemistry and Material Sciences B

(Undergraduate and Graduate Students)

Meeting Room 12

Computer Sciences and Information Systems and Computer Engineering B

Meeting Room 13

Electrical Engineering

Meeting Room 14

Ecology, Environmental and Earth Sciences Related Research B

(Undergraduate and Graduate Students)

Meeting Room 15

Mathematics and Statistics B

(Undergraduate and Graduate Students)

Meeting Room 16

Concurrent Workshops Session 2

A. Writing Powerful Winning Poster and Presentation Abstracts

Meeting Room 2

Irene Hulede, *Manager Student Programs, American Society for Microbiology (ASM)*

Beronda Montgomery, *Associate Professor, Biochemistry and Molecular Biology, Michigan State University*

B. Preparing for Graduate School and Beyond

Meeting Room 3

Valerie Wilson, *NSF, Deputy Director, Graduate Education*

C. Scientific Computation and Visualizaition for World Changing Science

Meeting Room 4

Linda Akli, SURA

Samuel Moore, Texas Advance Computing Center

Michael Smith, Intel

6:30pm - 8:30pm

Dinner on Your Own

9:00pm - 11:00pm

Talent Show Auditions
Grand Ballroom

Saturday, March 2, 2013

7:00 am

Breakfast on Your Own

7:00am - 2:00pm

Registration
Grand Ballroom Foyer

7:30am - 5:30pm

Judges Room Open
Congressional C

7:30am - 8:00am

Oral and Poster Presentations Session 3 and 4 (Set-Up)
Renaissance Ballroom/Renaissance Foyer
Meeting Rooms - Meeting Room Level

8:00am - 10:30am

Poster Presentation 3
Renaissnace Ballroom/Renaissance Foyer

Oral Presentation 3
Meeting Rooms - Meeting Room Level

These include:
Biological Sciences
(Undergraduate and Graduate Students)
Meeting Room 5

Computer Sciences and Information Systems and Computer Engineering (Graduate Students)
Meeting Room 16

Civil and Environmental Engineering
Meeting Room 15

Plant Research A
Meeting Room 14

Physics and Nanoscience (Graduate Students)
Meeting Room 13

Social Science and Science and Mathematics Education
(Undergraduate and Graduate Students)
Meeting Room 12

9:00am - 1:00pm

Exhibits Open
Congressional A&B

11:00am - 12:30pm

Poster Presentations Session 4
Renaissance Ballroom / Renaissance Ballroom Foyer

Oral Presentations Session 4
Meeting Rooms - Meeting Room Level

This includes:
Plant Research B
Meeting Room 14

Technology and Engineering
(Graduate Students)
Meeting Room 15

Concurrent Workshop Session 3

A. Unpacking the (PhD) Black Box
Meeting Room 2

Robin S. Broughton, AAAS Fellow, Office of Cancer Genomics at the National Cancer Institute

Chiatogu Onyewu, Association of Underrepresented Minority Fellows

B. Writing Powerful Winning Poster and Presentation Abstracts
Meeting Room 3

Irene Hulede, Manager Student Programs, American Society for Microbiology (ASM)

Beronda Montgomery, Associate Professor, Biochemistry and Molecular Biology, Michigan State University

Agenda

C. Funding Your STEM Education for Graduate Students

Meeting Room 4

Liv Detrick and Chris Cash, *Institute for Broadening Participation, Inc. (IBP)*

D. Scientific Computation and Visualization for World Changing Science

Meeting Room 5

Linda Akli, *SURA*

Samuel Moore, *Texas Advance Computing Center*

Michael Smith, *Intel*

12:30pm

Exhibits Close

Congressional A & B

12:30pm - 2:00pm

Plenary Session 4 (Lunch)

Grand Ballroom

“Undergraduate and Graduate Student Networking”

Dione Rossiter, *Project Director, Manager, Mass Media Programs*

Ronke Olabisi, *Assistant Professor, Biomedical Engineering, Rutgers University*

12:30pm - 3:30pm

Judges Meeting and Lunch (Determining Awardees)

Congressional C

2:00pm - 6:00pm

Free time for Tours or Special Meetings

6:00pm - 9:00pm

Plenary Session 5 & Awards Banquet

Grand Ballroom

Moderator :

Shirley M. Malcom, *Director, AAAS, EHR*

Speaker:

Sylvester “Jim” Gates, Jr., *John S. Toll Professor of Physics and Director Center for String and Particle Theory Director, University of Maryland*

Recognition of David and Lucille Packard HBCU Scholars

James Stith, *Vice President Emeritus, American Institute of Physics*

Recognition of the AAAS Policy Fellows and SACNAS Leadership Institute Alumni

Presentation of Oral and Poster Awards:

Shirley M. Malcom, *AAAS and Claudia Rankins*, *NSF*

Presentation of Conference Incentives

AAAS ERN Conference Team

10:00pm - Midnight

Talent Show & Networking

Grand Ballroom

Daniel Akins
The City College of New York

Linda Akli
SURA

Florence Anoruo
Claflin University

Natalie Arnett
Fisk University

Krishna Athreya
Iowa State University

Brittanie Atkinson
University of Oklahoma Health Sciences Center

Diana Azurdia
University of California, Los Angeles

Mufeed Basti
North Carolina A&T State University

Suely Black
Norfolk State University

Charles Bland
Mississippi Valley State University

Gregory Bogin
Colorado School of Mines

Kenneth Boutte
Xavier University of Louisiana

Calvin Briggs
Lawson State Community College

Robin S. Broughton
AAAS Policy Fellow, National Cancer Institute

Travis Brown
Pomona College, Claremont College

Anissa Buckner
University of Arkansas at Pine Bluff

C. Marcel Buford
Institute for Defense Analyses

Cynthia Burroughs
Philander Smith College

Shelvy Campbell
Marshall University Joan C. Edwards School of Medicine

Chris Cash
Institute for Broadening Participation (IBP)

Xuemin Chen
Texas Southern University

Chellu Chetty
Savannah State University

Herve Collin
Kapiolani Community College

Yolanda Comedy
AAAS

Michael Curry
Tuskegee University

Stephanie Dance-Barnes
Winston Salem State University

Abdalla Darwish
Dillard University

Melinda Davis
Fort Valley State University

Carol Davis
Turtle Mountain Band of Chippewa

Agnes Day
Howard University, College of Medicine

Anthony L. DePass
Long Island University

Seema Dhir
Fort Valley State University

Sarwan Dhir
Fort Valley State University

Freddie Dixon
University of the District of Columbia

Aleisha Dobbins
BioMarin

Cyntrica Eaton
Norfolk State University

Lisa Elliot
Rochester Institute of Technology

Yayin Fang
Howard University, College of Medicine

Victoria Freedman
Albert Einstein College of Medicine

Corey Garza
California State University, Monterey Bay

Matthew George
Howard University, College of Medicine

Juan Gilbert
Clemson University

Veronica Godoy-Carter
Northeastern University

Gregory Goins
North Carolina A&T State University

Patrice Gregory
Sandia National Laboratories

Guoqing Tang
North Carolina A&T State University

Marie Hammond
Tennessee State University

Don Harris
BAE Systems

Kelley Harris - Johnson
University of Wisconsin - Madison

Scottie Henderson
Cerritos College

Julia Marcela Hernandez
The Ohio State University

Christine Holler-Dinsmore
Fort Peck Community College

Tiffani Holmes
Fort Valley State University

Tasha Inniss
Spelman College

Kayenda T. Johnson

Judges

Marian Johnson-Thompson
Educational Consultant

Marcus Jones
J. Craig Venter Institute

Tuajuanda Jordan
Lewis & Clark College

Tina King
King Educational Consultants

Bob King
King Educational Consultants

Charla Lambert
Cold Spring Harbor Laboratory

Jonathan Lambright
Savannah State University

Latonia Taliaferro-Smith
Emory School of Medicine

Joslynn Lee
Northeastern University

Mulatu Lemma
Savannah State University

Mary Ann Leung
Krell Institute

Candice Lewis
University of Chicago

Kim Lewis
Rensselaer Polytechnic Institute

Wei Li
Texas Southern University

Liv Detrick
Institute for Broadening Participation (IBP)

Kelly M. Mack
Association of American Colleges and Universities

Arlene Maclin
Morgan State University

Elisa Maldonado
Harvard University

Darlene Martin
Lawson State Community College

Lee Anne Martinez
Colorado State University - Pueblo

Larry Mattix
Norfolk State University

Aliecia McClain
Norfolk State University

James McGee
Elgin College

Tanisha McGlothen
Emory School of Medicine

Camille McKayle
University of The Virgin Islands

Sydika McKissic
Vanderbilt University

Jaruwan Mesit
Grambling State University

Lucas Miller
Haskell Indian Nations University

Hawley Montgomery-Downs
West Virginia University

Beronda Montgomery
Michigan State University

Samuel Moore
University of Texas, Austin

Renee Moore
North Carolina State University

Anthony Morris
Talladega College

Debra Murray
Baylor College of Medicine

Shantisa Norman
Sandia National Laboratories

Joseph Nunez
Schoolcraft College

Babatunde Ojo
Fort Valley State University

Chiatogu Onyewu
Association of Underrepresented Minority Fellows

Colette Patt
University of California

Syed Raza
Talladega College

Karen Redden
University of the District of Columbia

George Robbins
Rensselaer Polytechnic Institute

Dione Rossiter
AAAS

April Savoy
Indiana University

Maureen Scott
Norfolk State University

Carmen Sidbury
Spelman College

Michael Smith
Intel

Rosie Sneed
University of the District of Columbia

Angel Soler-Garcia
US FDA-CFSAN

Julio Soto
San Jose State University

Hattie Spencer
Mississippi Valley State University

James H. Stith
American Institute of Physics (retired)

Illya Tietzel
Southern University at New Orleans

Gregory Triplett
University of Missouri

Rochelle Troyano
Northwest Indian College

Delia Valles-Rosales
New Mexico State University

Kedra Wallace

University of Mississippi Medical Center

Edward Walton

California State Polytechnic Univ

Clytrice Watson

Delaware State University

Richard Weibl

AAAS

Gleneesha Williams

U.S. Department of Defense

Richard Whittington

Tuskegee University

Jim Winter

University of Arkansas at Little Rock

Victor Wyatt

Agricultural Research Service

Katrina Yamazaki

California State University, Los Angeles

Nian Zhang

University of the District of Columbia

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Table 50

AAAS

Center for Careers in STEM

Project on Science, Technology & Disability

1200 New York Avenue NW

Washington, DC 20005

Contact: *Richard Weibl, Rweibl@aaas.org*

AAAS offers many resources in support of aspiring and early career scientists and engineers including internships, fellowships, webinars, profiles of professionals in action, blogs and forums, and much more. Learn about Entry Point Internships for Students with Disabilities, Mass Media Science and Engineering Fellowship, the Science and Technology Policy Fellowship, Science Careers, and more!

Come to our booth to collect your personalized ERN business cards upon arrival!

Table 36

Albert Einstein College of Medicine, Graduate Division of Biomedical Sciences

1300 Morris Park Ave (Belfer 203)

Bronx, NY 10461

Contact: *Victoria Freedman, victoria.freedman@einstein.yu.edu*

Research knows no boundaries' at Einstein, where graduate students grow and learn and are trained in biomedical research in any of more than 200 laboratories in BIOCHEMISTRY, BIOINFORMATICS, BIOPHYSICS, CANCER, CELL & MOLECULAR BIOLOGY, GENETICS, IMMUNOLOGY, INFECTIOUS DISEASES, NEUROSCIENCES, STEM CELL & DEVELOPMENTAL BIOLOGY, SYSTEMS BIOLOGY, EPIDEMIOLOGY, VIROLOGY, and more!

A new PhD track in CLINICAL INVESTIGATION is also offered. All PhD and MD-PhD students receive full tuition remission, stipend, and subsidized housing. For juniors, there is a comprehensive Summer Undergraduate Research Program (SURP) combining full time research and enrichment activities.

Visit the Einstein table to learn about the wonderful PhD, MD-PhD, and summer research opportunities.

<http://www.einstein.yu.edu/phd>

Table 44

Auburn University

Office of Diversity and Multicultural Affairs

101 M White Smith Hall

381 Mell Street

Auburn, AL 36849

Contact: *Chukwudi Chidume, chidugc@auburn.edu*

The Auburn University is one of the few universities to carry the torch as a land, sea and space grant university. Our students can choose from more than 140 degree options in 13 schools and colleges at the undergraduate, graduate and professional levels. Auburn University's Office of Diversity and Multicultural Affairs aims to celebrate diversity - embracing something or someone different from us. We work at creating an environment where you receive kindness and consideration out of respect and receive equal attention based on effort, knowledge, ability, talent and hard work.

Table 6

Carnegie Mellon University

5000 Forbes Ave

533 Warner Hall

Pittsburgh, PA 15213

Contact: *V. Emily Stark, vestark@andrew.cmu.edu*

Carnegie Mellon University is a global research university of more than 12,000 students, and 5,000 faculty and staff. Recognized for its world-class arts and technology programs, collaboration across disciplines and innovative leadership in education, Carnegie Mellon is consistently a top-ranked university. Its real-world impact is visible within our local communities, across the country and around the world. The university consists of seven schools and colleges: Carnegie Institute of Technology, College of Fine Arts, Dietrich College of Humanities and Social Sciences, Heinz College with Schools of Public Policy and Management and Information Systems, Mellon College of Science, School of Computer Science and the Tepper School of Business.

Table 14

Clafin University

400 Magnolia Street

Orangeburg, SC 29115

Contact: *Nankwanga Cherry, ncherry@clafin.edu*

Clafin University is a comprehensive institution of higher education affiliated with the United Methodist Church. A historically black university founded in 1869. Clafin is committed to providing students with access to exemplary educational opportunities in its undergraduate, graduate and continuing education programs. Clafin seeks to foster a rich community comprised of students, faculty, staff, and administrators who work to nurture and develop the skills and character needed for engaged citizenship and visionary and effective leadership.

In its undergraduate programs, Clafin provides students with the essential foundation of a liberal arts education. Emphasizing critical and analytic thinking, independent research, oral and written communication skills, the University invites students to use disciplined study to explore and confront the substantive challenges facing the global society. Clafin's graduate programs

provide opportunities for advanced students to increase their specialization in particular fields of study oriented toward professional enhancement and academic growth. Its continuing education programs provide students with expanded avenues for professional development and personal fulfillment.

Table 25

Columbia University

535 West 116th Street
102 Low Library, MC 4304
New York, NY 10027

Contact: *Barbara Nesmith, bsn2107@columbia.edu*

One of the world's foremost centers of research and teaching, Columbia University offers a distinctive and distinguished learning environment that draws upon the vast resources of New York City. Columbia seeks to attract a diverse and international student body and to support research and teaching that explores issues of global significance. Graduate study at Columbia is centered in the Graduate School of Arts and Sciences (GSAS), which offers M.A. and Ph.D. degrees in the humanities, social sciences, and natural sciences, including programs in the biomedical sciences, as well as dual-degree programs with other schools at Columbia.

In addition to working with the Columbia faculty, which includes some of the world's leading scholars and researchers, GSAS students have the opportunity to conduct research at affiliate institutions, such as the American Museum of Natural History or the Wildlife Conservation Society.

GSAS Ph.D. students typically receive multi-year funding packages that cover tuition, fees, and living expenses. GSAS offers application fee waivers for students who have participated in certain programs (see the GSAS website for a complete list) as well as the Summer Research Program, in which students from groups underrepresented in academia work with Columbia faculty mentors.

For more information about Columbia's M.A. and Ph.D. programs and application procedures, visit our webpage for attendees of the Emerging Researchers National Conference: gsas.columbia.edu/ERN

Table 19

College of Engineering

Cornell University

146 Olin Hall
Ithaca, NY 14853

Contact: *Sara Hernandez, sh267@cornell.edu*

The Cornell University College of Engineering is one of the world's leading engineering and technical institutions, set within

a deliberately broad-based and diverse university. We have a longstanding focus on teaching excellence and groundbreaking research, supported by exceptional laboratories and libraries. Our dynamic culture of innovation and our particular strength in cross-disciplinary collaboration are enhanced by the open, engaging interactions among the members of our community, faculty and students alike.

By earning a graduate degree from Cornell University's College of Engineering, you will find yourself exceptionally well positioned for a rewarding career in research, academia, or industry. In addition to your Cornell credentials and the professional experiences we help you gain, you will have access to expert career management services and a lifelong connection to one of the largest and most active alumni networks in the world.

Table 4

CUNY Graduate Center

365 Fifth Avenue
New York, NY 10016

Contact: *Lorraine Towns, ltowns@gc.cuny.edu*

The Graduate Center of the City University of New York (CUNY) is devoted primarily to doctoral study and awards most of CUNY's doctoral degrees. Over 1950 faculty members are drawn from CUNY's eleven senior colleges and New York City's leading cultural and scientific institutions. Students and faculty pursue a joint enterprise of expanding boundaries of knowledge in over 30 doctoral programs in the humanities, natural and social sciences. Professional development opportunities and financial support for doctoral students in STEM fields are offered through the CUNY NSF Alliances for Graduate Education and the Professoriate (AGEP) Program.

Table 49

DiversityComm/Olive Tree Publishing, Inc.

18 Technology Drive
Suite 170
Irvine, CA 92618

Contact: *Alisia Ortega, events@diversitycomm.net*

As the Proud Publisher of the Black EOE Journal, the Hispanic Network Magazine, the Multicultural Professional WOMAN's Magazine, and U.S. Veterans Magazine DiversityComm has committed itself in providing success-oriented individuals with Print & Online resources that have more than 2,500,000 readers. DiversityComm has 20 years of trusted publishing experience. Our Diversity quartet of publications gives you the best exposure and visibility while providing our viewers with the most current business information, essential career tools and empowering content, the epicenter that connects minorities

Exhibitor Descriptions

with academic, and business and employer opportunities. DiversityComm's successful advertorial and editorials enable you to gain visibility and exposure not only to your Diversity Initiatives, but as well, can help to create key business connections.

DiversityComm is a Media Company based in Irvine, CA. It is sometimes also referred to as Olive Tree Publishing Inc.

Table 29
Florida International University
University Graduate School
11200 SW 8th Street PC 230
Miami, FL 33199

Contact: *Albert Hoyt, III, ahoytiii@fiu.edu*

As a leading public research university, Florida International University focuses on student learning, innovation, and collaboration. It encompasses a nationally and internationally renowned faculty recognized for its outstanding teaching and cutting-edge research. More than 180 baccalaureate, masters and doctoral degree programs are offered in the following: College of Architecture and the Arts, Arts and Sciences, Business Administration, Education, Engineering and Computing, Law, Medicine, Nursing and Health Sciences, Public Health and Social Work, Journalism and Hospitality & Tourism.

Table 39
Florida State University /The Center for Integrating Research & Learning at Florida State University's National High Magnetic Field Lab
1800 E Paul Dirac Drive
Tallahassee, FL 32310

Contact: *Jose Sanchez, sanchez@magnet.fsu.edu*
Jan Jaroszynski, jaroszy@magnet.fsu.edu

Graduate students and postdoctoral fellows who want research experience at the cutting edge of magnetic field, pressure and temperature need look no further than the Magnet Lab. Research at the lab covers many disciplines - physics, biology, chemistry, engineering and all the combinations of each you can imagine.

The state-of-the-art research facilities give students access to tools that exist nowhere else in the world, because lab engineers design and build our magnets, many of which hold world records for strength of field.

The three-campus Magnet Lab is operated by Florida State University in Tallahassee, the University of Florida in Gainesville and Los Alamos National Laboratory in New Mexico, with each site specializing in a different area of high-field research. The

relationship between the campuses presents graduate students and postdocs with myriad opportunities. Features and benefits of graduate study at the Magnet Lab include:

- In 2011, 35 undergraduates, 149 graduate students and 55 postdocs were affiliated with the Magnet Lab.
- Magnet Lab faculty serve on more than 90 graduate committees.
- In 2011, 31 Magnet Lab-affiliated graduate students earned doctoral degrees.
- In 2011, 19 undergraduates participated in mentorships at the Magnet Lab.
- In 2011, about 1,300 scientists conducted research at our facilities in Tallahassee, Gainesville and Los Alamos National Laboratory; many gave open seminars and talks.

Table 13
Georgia Institute of Technology
237 Uncle Heinie Way
Suite 231D
A-French Building
Atlanta, GA 30332-0740

Contact: *Jorge Breton, jorge.breton@vpid.gatech.edu*
Andre Dickens, andre.dickens@omed.gatech.edu

The Georgia Institute of Technology is one of the nation's top research universities, distinguished by its commitment to improving the human condition through advanced science and technology. Georgia Tech is an innovative intellectual environment with more than 900 full-time instructional faculty and more than 21,500 undergraduate and graduate students.

Accredited by the Southern Association of Colleges and Schools, the Institute offers many nationally recognized, top ranked programs. Undergraduate and graduate degrees are offered in the Colleges of Architecture, Computing, Engineering, Management, Sciences, and the Ivan Allen College of Liberal Arts. Georgia Tech is consistently ranked in U.S. News & World Report's top ten public universities in the United States.

Georgia Tech's campus occupies 400 acres in the heart of the city of Atlanta. Year after year, Georgia Tech is consistently the only technological university ranked in U.S. News & World Report's listing of America's top ten public universities. In addition, Georgia Tech's College of Engineering is consistently ranked in the nation's top five by U.S. News. In terms of producing African American engineering graduates, *Diverse: Issues in Higher Education* ranks Tech No. 2 at both the doctoral and bachelor's levels, based on the most recent rankings for 2011. These impressive national rankings reflect the academic prestige long associated with the Georgia Tech curriculum. Georgia Tech now ranks among the top 10 in research expenditures among universities without a medical school. In addition, Georgia Tech has an estimated \$3 billion annual

impact on the metro Atlanta economy, according to a 2011 study.

Table 31

Georgia Institute of Technology

School of Chemistry
901 Atlantic Drive
Atlanta, GA 30332-0400

Contact: *Keith Oden, keith.oden@chemistry.gatech.edu*

The Georgia Institute of Technology is one of the nation's top research universities. Georgia Tech is consistently the only technological university ranked in U.S. News & World Report's listing of America's top ten public universities. In addition, Georgia Tech's College of Engineering is consistently ranked in the nation's top five by U.S. News. In terms of producing African American engineering graduates, Diverse: Issues in Higher Education ranks Tech No. 2 at both the doctoral and bachelor's levels, based on the most recent rankings. These impressive national rankings reflect the academic prestige long associated with the Georgia Tech curriculum. With over 20,000 students enrolled, Georgia Tech offers undergraduate and graduate degrees in the Colleges of Architecture, Computing, Engineering, Sciences, the Scheller College of Business and the Ivan Allen College of Liberal Arts.

Table 22

Institute for Broadening Participation, IBP

PO Box 607
Damariscotta, ME 04543

Contact: *Chris Cash, ccash@ibparticipation.org*

Liv Detrick, ldetrick@ibparticipation.org

The mission of the Institute for Broadening Participation is to increase diversity in the Science, Technology, Engineering and Mathematics (STEM) workforce. We design and implement strategies to increase access to STEM education, funding, and careers, with special emphasis on diverse underrepresented groups. We believe that diversifying the STEM workforce is the best way to ensure our nation's economic vitality and solve global challenges.

Pathways to Science is a project of the Institute for Broadening Participation (IBP). Pathways to Science supports pathways to the STEM fields: science, technology, engineering, and mathematics. We place particular emphasis on connecting underrepresented groups with STEM programs, funding, mentoring and resources.

Use our website, www.pathwaystoscience.org to find programs such as undergraduate summer research opportunities, graduate fellowships, postdoctoral positions, as well as

resources and materials pertaining to recruitment, retention, and mentoring. *(IBP is funded by the National Science Foundation and NASA.)*

Table 27

Keck Graduate Institute of Applied Life Sciences

Office of Admissions
535 Watson Drive
Claremont, CA 91711

Contact: *Anel Rivera-Villa, admissions@kgi.edu*

Keck Graduate Institute (KGI) is a standalone graduate institution that combines applied life sciences, bioengineering, bioethics and business management. KGI offers degree/certificate programs in: Master of Bioscience (MBS), Postdoctoral Professional Masters (PPM), PhD in Applied Life Sciences or Computational Biology, Post-baccalaureate Premedical Certificate, etc. KGI is uniquely positioned to develop leaders who will meet the challenges and opportunities presented by this life sciences industry, by incorporating valuable business training that will prepare students to become successful in their field. KGI is a member of The Claremont Colleges, located in Claremont, California.

Table 9

Marshall University

Joan C. Edwards School of Medicine and School of Pharmacy

Suite 3400
1600 Medical Center Drive
Huntington, WV 25701

Contact: *Shelvy Campbell, Ph.D, campbels@marshall.edu*

At Marshall University, the Joan C. Edwards School of Medicine blends high quality medical education and graduate education with a distinctive hands-on approach to meeting the healthcare needs of West Virginians and others who live in the nation's rural areas. Marshall produces skilled confident graduates who are successful in generalist and sub speciality medicine. In addition to our outstanding School of Medicine, Marshall boasts a newly created School of Pharmacy which welcomed its inaugural class in 2010.

The mission of Marshall University School of Pharmacy (MUSOP) is to advance direct pharmacy patient care by developing innovative practitioners, researchers, and educators. Marshall University offers dozens of healthcare affiliated programs including biomedical sciences, physical therapy and nursing which attract thousands of students each year. We welcome your interest!

Exhibitor Descriptions

Table 26

Massachusetts Institute of Technology

77 Massachusetts Avenue
Building 3-138
Cambridge, MA 2139

Contact: *Catherine Blat*, iblat@mit.edu
Stephen Allsop, sa3@mit.edu

The Massachusetts Institute of Technology (MIT) consists of six schools: Science, Engineering, Architecture and Planning, Humanities, Arts and Social Sciences, Sloan School of Management and the Whitaker College of Health Sciences and Technology. Increasing the representation of African Americans, Hispanic Americans, Native Americans and other underserved and underrepresented segments of the population in the graduate study of science and engineering is critical to the achievement of MIT's mission. This mission includes providing the intellectual stimulation of a diverse campus community for all of our students and serving the nation by contributing to the creation of a diverse pool of highly qualified scientists, engineers and academics.

Table 35

MassNanoTech, University of Massachusetts Amherst

710 N. Pleasant St
LGRT 370
Amherst, MA 01003-9305

Contact: *Michael Westort*, mwestort@research.umass.edu

The MassNanoTech Institute is the University of Massachusetts Amherst's campus-wide initiative for nanoscale science and engineering. The campus has built a strong reputation for innovation in nanoscale research, with breadth across many departments. Ongoing efforts include multiple prestigious NSF awards, licensing of key technology, acquisition of specialized characterization equipment, and the education and training of many talented graduate students working on innovative technologies in individual faculty labs. MassNanoTech provides a single point of contact for students, academic and industrial collaborators.

Table 10

Mississippi Valley State University Bioinformatics Program

MVSU 7308
14000 Hwy 82 West
Itta Bena, MS 38941

Contact: *Charles Bland*, bland.charles@gmail.com

The Bioinformatics Program at Mississippi Valley State University is proud to host its first United States Department of Education sponsored Research for Undergraduates (REU) Program. This

program is designed to give aspiring scientist an opportunity to explore the field of bioinformatics through the integration of mathematics, computer science, and biology/chemistry. The Bioinformatics Summer Institute (BSI) Scholars will be exposed to hands-on computational experiences lead by faculty members of the Bioinformatics Program. Participants will be engaged in topics ranging from scientific ethics to the use of medical data; listening to and conversing with leading scientist in the field; preparing for the GRE; annotating microbial genomes; and learning to use the library and online resources for research.

Table 3

National Science Foundation

Room 815
4201 Wilson Boulevard
Arlington, VA 22230

Contact: *Danielle Kittrell*, dkittrel@nsf.gov

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 'to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense' With an annual budget of about \$6.9 billion (FY 2010), we are the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing.

Table 12

National Science Foundation

East Asia & Pacific Summer Institutes (EAPSI) Program

4201 Wilson Blvd, II-1155
Arlington, VA 22230

Contact: *Elena Hillenburg*, ehillenb@nsf.gov
Amelia Greer, agreer@nsf.gov

The East Asia & Pacific Summer Institutes (EAPSI) program provides U.S. graduate students in science and engineering: 1) first-hand research experience in Australia, China, Japan, Korea, New Zealand, Singapore, or Taiwan; 2) an introduction to the science and science policy infrastructure of the respective location; and 3) orientation to the society, culture and language.

The primary goals of EAPSI are to introduce U.S. students to East Asia and Pacific science and engineering in the context of a research laboratory, and to initiate personal relationships that will better enable them to collaborate with foreign counterparts in the future. The institutes last approximately eight weeks from June to August (10 weeks for Japan).

For more information, please visit www.nsf.gov/eapsi.

Table 2

Norfolk State University Center for Materials Research

700 Park Ave
Norfolk, VA 23504

Contact: *Suely Black, sblack@nsu.edu*

The Center for Materials Research at Norfolk State University conducts cutting-edge research in well-equipped research facilities in the areas of renewable energy, nanotechnology, and photonics in cooperation with other universities, industry, and government laboratories. The Center offers the Ph.D. in Materials Science and Engineering and the M.S. in Materials Science programs. Both are interdisciplinary and accept applications from students with degrees in Chemistry, Physics, Engineering, and related disciplines.

Entering Ph.D students can apply to the prestigious Integrative Graduate Education and Research Training in Magnetic and Nanostructured Materials program (IGERT-MNM) for a unique education experience. IGERT-MNM is a collaboration of Purdue University, Cornell University and Norfolk State University (NSU) with the goal of training students to conduct research that will lead to faster, smaller and more efficient devices and technologies with broad applications, such as information storage, signal detection, and biomedical devices. The project brings together trainees and faculty to build a new, collaborative education model having as its core an iterative assessment-improvement cycle fostered by ongoing critical communication. In support of these goals, IGERT-MNM participants form a cohesive group connected through modular courses, research meetings, and shared planning, management and assessment.

Table 16

North Carolina State University

The Graduate School
Campus Box 7102
Raleigh, NC 27695

Contact: *David Shafer, david_shafer@ncsu.edu*

NC State University is a premier center for graduate study, known nationally for innovative degree programs, a world-renowned faculty, and groundbreaking collaborative research. The Graduate School is responsible for administering over 220 different graduate degrees across all 10 of NC State's academic colleges. Currently, more than 8,000 students from all areas of the U.S. and 100 other countries are pursuing graduate study at NC State. Our outstanding graduate programs emphasize real-world experience through original research opportunities, comprehensive extension and engagement activities, and partnerships with governments, industry, and other universities. Our programs also offer students the advantages of

over 2,500 world-renowned faculty, a global academic perspective, and a respect for diversity. In addition, NC State's Centennial Campus and Centennial Biomedical Campus provide a unique venue for university, government, and industry partners interacting in multidisciplinary programs. Together, these strengths create a uniquely hands-on learning environment that encourages our students to explore cutting-edge issues in their areas of study while building the essential inquiry, communication, and leadership skills they will need to succeed.

Table 23

North Dakota State University College of Science and Mathematics

PO Box 6050
Dept 2715
Fargo, ND 58108-6050

Contact: *Ned Dochtermann, ned.dochtermann@gmail.com*

Through teaching, research, service, and outreach, we provide knowledge, skills, and insight to a world increasingly dependent on science and mathematics. The College of Science and Mathematics prepares NDSU graduates to be part of it all, working in this country and abroad in a wide spectrum of science and mathematics fields. Of the 14,500 students attending NDSU, 1350 undergraduate and 425 graduate students are enrolled in the College of Science and Mathematics. Our graduates today serve in a diversity of fields: top executives in chemical and biotechnology companies, computer scientists for major technology companies (e.g., Microsoft in Fargo), physicists for NASA, physicians and health specialists, and exploration geologists at sites across the Americas. Our nine departments, Biological Sciences, Chemistry and Biochemistry, Coatings and Polymeric Materials, Computer Science, Geosciences, Mathematics, Physics, Psychology, and Statistics, each offer graduate programs.

Table 40

Northeastern University

360 Huntington Ave., 115 RI
Boston, MA 02115

Contact: *Veronica Godoy-Carter, t.westgate@neu.edu
Joslynn Lee, t.westgate@neu.edu*

Northeastern University's signature strengths are grounded in its character as an institution engaged with the world in unique ways that position our students and faculty for success in meeting 21st century challenges. The same focus on engaging the world drives our faculty research. Faculty members of Northeastern, frequently working in collaboration through one of our dozens of interdisciplinary research centers, are motivated by the quest to develop applications that society will

Exhibitor Descriptions

find useful. Our research and academic partnerships with businesses, government agencies, and universities around the world help us advance this agenda. We maximize the potential of fundamental research to translate abstract discoveries into innovative solutions.

Table 20

Ohio State University

Graduate School

230 N. Oval Mall
247 University Hall
Columbus, OH 43210

Contact: *Cyndi Freeman, papio.1@osu.edu*

With more than 90 doctoral and 115 master's programs from which to choose, Ohio State graduate students have access to some of the highest-quality faculty and research experiences in the world. The Graduate School provides strategic leadership for new directions in graduate education and for essential services for graduate students.

Table 8

Pennsylvania State University

5 Henderson Building
215 Henderson Building
University Park, PA 16801

Contact: *Joyce Hopson-King, juh4@psu.edu*
Michael Radis, mwr1@psu.edu

Penn State was one of the largest institutional participants from among 212 universities in the National Research Council Assessment of Research Doctorate Programs, with 69 Ph.D. programs participating (65 ranked) in 51 different primary and 3 emerging fields of study. The study, which assessed more than 5,000 doctoral programs in more than 60 fields, collected a large quantity of data for 20 different characteristics related to research activity of faculty, student support and outcomes, and the diversity of the academic environment. It is the first comprehensive study by the NRC since 1995.

Sixty-five Penn State programs were ranked in the assessment. Links to illustrative figures for each program's overall ranking in comparison to all other programs in the respective field are provided below. Penn State's top ranked programs are: Anthropology, ranked between 1 and 2 in a field of 82, and placed in the company of Harvard (1-5), University of Chicago (1-4), and the University of Michigan (1-5); Plant Biology, ranked 1-4 in a field of 118, along with UC-Davis (1-4) and UC-Berkeley (1-7); Kinesiology, ranked 1-6 of 41, along with University of Massachusetts (1-7), University of Illinois (1-8), University of Georgia (1-8), and the University of Connecticut (1-9);

Spanish, ranked 1-8 of 60, along with Columbia University (1-10), New York University (1-5), and Yale (1-6).

In Penn State's Eberly College of Science, all of the doctoral research programs had exemplar ratings that placed them among the best programs in the nation. These programs are Astronomy and Astrophysics; Biology; Chemistry; Mathematics; Physics; and Statistics.

Penn State's College of the Liberal Arts similarly had many of its programs in the upper range of rankings for their respective fields, including Anthropology, Communication Arts and Sciences, English, Philosophy, Political Science, Spanish, and Sociology.

In addition, a number of Penn State doctoral programs remained highly ranked, including several programs in the following colleges:

- Earth and Mineral Sciences - Geosciences, Meteorology, and Materials Science and Engineering (an intercollege program jointly offered with the College of Engineering and Eberly College of Science);
- Engineering -Environmental Engineering and Electrical Engineering;
- Agricultural Sciences : Entomology;
- Health and Human Development : Human Development and Family Studies and Nutritional Sciences.

A hallmark of research and graduate education at Penn State is the high level of inter- and trans-disciplinarity, with 38 percent of Penn State's programs in the NRC assessment ranked in the top 10 percent of their respective fields for the percentage of interdisciplinary faculty. Of particular significance are the number of Intercollege Graduate Degree Programs (IGDP) (in which faculty participation extends across department and college boundaries) that had notable overall rankings, including Plant Biology, Demography, and Materials Science and Engineering.

Table 7

Rensselaer Polytechnic Institute

110 8th Street
Admissions Office
Troy, NY 12180

Contact: *Jerron Decker, decke72@rpi.edu*

Rensselaer Polytechnic Institute is the nation's oldest technological research university. Located in the Capital District of New York State, Rensselaer offers a broad range of graduate programs from five schools: Engineering, Science, Lally School of Management and Technology, Architecture, and Humanities and Social Sciences. Unique programs include interdisciplinary degrees in information technology, the MFA and Ph.D. in Electronic Arts, and extensive opportunities in biotechnology,

nanotechnology, and energy and the environment. Students also have the opportunity to choose from a number of dual-degree options.

Table 45

Rochester Institute of Technology (RIT)

Part-time and Graduate Enrollment Service
58 Lomb Memorial Drive
A-149 Bausch and Lomb Center
Rochester, NY 14623

Contact: *Sonja Phongsavanh, samadm@rit.edu*

Career-focused. Internationally recognized. Technologically based- RIT offers more than 200 undergraduate programs (BS and BFA) and more than 80 graduate programs (MBA, MFA, MS, MST, ME and PhD degrees). RIT is a privately endowed, coeducational university in upstate New York with branch campuses in Croatia, Kosovo and Dubai and enrolls more than 18,000 students in Sustainability; Art, Design, Crafts, Photography, Film, and Graphic Arts; Engineering and Technology; Business, Communications, Service and Hospitality; Education, Psychology, and Human Resources; Science, Mathematics, Statistics and Imaging Science; Computing and Information Sciences and Technology. Financial assistance is available.

Table 17

Stony Brook University Center for Inclusive Education The Graduate School

Computer Science, Suite 2401
Stony Brook, NY 11794-4422

Contact: *Kathryne Piazzola, Kathryne.Piazzola@stonybrook.edu*
Angel Gonzalez, cie_graduateschool@stonybrook.edu

Stony Brook University's internationally recognized academic programs and collaborative relationships with Brookhaven National Laboratory and Cold Spring Harbor Laboratory make it an ideal choice for students interested in the science research.

The Center for Inclusive Education, a division of the Graduate School, is home to multiple initiatives aimed at increasing the participation of underrepresented students in graduate study and the professoriate: The state funded W. Burghardt Turner Fellowship; the GEM fellowship, the SUNY LSAMP Bridge to the Doctorate, and the the NIH sponsored IRACDA NY-CAPS Post doctoral fellowship. With a combined budget of over two million per year, the CIE provides direct services for 175 students in 38 graduate and professional programs across all disciplines.

The Center's mission is to promote action and knowledge that broadens the participation of disadvantaged Americans in higher education, the scientific work force and the Academy. For information please visit our booth.

Table 46

University of Alabama College of Arts and Sciences

Box 870268
105 Clark Hall
Tuscaloosa, AL 35487

Contact: *Jimmy Williams, jwilliam@bama.ua.edu*

The University of Alabama is a major, comprehensive, student-centered research university, enrolling more than 4,480 graduate students in more than 120 master's, educational specialist, and doctoral programs. The University of Alabama is regularly ranked among the top 100 public universities in *Kiplinger's* annual list of colleges and universities that combine "great academics and affordable tuition." Our distinguished graduate faculty members, as well as visiting endowed professors and research fellows, provide graduate students with an impressive array of opportunities to learn and grow.

The University of Alabama is further enhanced by the diversity of backgrounds and experiences of its graduate students. In 2008, The University of Alabama's Graduate School won the prestigious Council of Graduate Schools/ Peterson's Award for innovation in creating an inclusive graduate student community.

For more information about The University of Alabama's graduate programs, go to <http://graduate.ua.edu>.

Table 18

University of Arizona

PO Box 210066
Tucson, AZ 85721

Contact: *Maria Teresa Velez, cbjerk@grad.arizona.edu*

The University of Arizona offers graduate degrees in more than one hundred fields. Located in the breathtaking Sonoran desert of southern Arizona and within an international border region, UA is consistently ranked as a top public research university and is widely recognized for its cutting-edge research. UA's Graduate Interdisciplinary programs offer innovative and unique opportunities for scholarship.

Exhibitor Descriptions

Table 5

University of Arkansas

346 N Arkansas Ave
STON 50
1 University of Arkansas
Fayetteville, AR 72703

Contact: *Shani Newton, sfarr@uark.edu*

The Office of Graduate Recruitment serves the University of Arkansas by focusing efforts on the Graduate School's most valuable asset, its students. The Office of Graduate Recruitment will recruit quality students and develop relationships with educational and community organizations nationwide that will develop respect for our university. The relationships we create will ensure that culturally/ethnically diverse students have the opportunity to succeed at the University of Arkansas.

Table 47

University of California, Berkeley

College of Letters & Science

Division of Mathematical and Physical Sciences

101 Durant Hall
Berkeley, CA 94720-2920

Contact: *Colette Patt, colette@berkeley.edu*

BSC works to advance students from underrepresented groups into science careers, particularly academic careers, incorporating and also going beyond retention in science majors and completion of degrees. I3-BSC focuses on the mathematical, physical and computer sciences. It targets the transition into graduate school for undergraduates in their junior and senior years and through the first two years of doctoral study.

UPCOMING STUDENT OPPORTUNITIES IN 2013:

EXPLORATIONS IN SCIENCE RESEARCH WORKSHOP invites 24 students to enjoy 7 days in Berkeley learning to do research that can influence policy. In 2013 EISR will focus on the mathematics of the earth. It takes place June 16-27, 2013 at the University of California, Berkeley. *Application deadline: March 1, 2013.*

Applications are available at:

<http://scienceconnections.berkeley.edu>

THE SUMMER RESEARCH OPPORTUNITIES PROGRAM prepares outstanding undergraduates with research experience and preparation for graduate study in the Physical Sciences & Mathematics. Program dates: June 2 – July 27, 2013 *Application deadline: February 22, 2013.*

ERN students see UCB exhibit for more information.

<http://diversity.berkeley.edu/graduate/gdp/srop>

THE BERKELEY EDGE CONFERENCE encourages URM seniors who are competitively eligible for our science and engineering Ph.D. programs, to apply to UC Berkeley.

To apply: <http://ls.berkeley.edu/bep/student-application>

Table 28

University of California, Riverside

Department of Bioengineering

3401 Watkins Dr.
Materials Science & Engineering 217
Riverside, CA 92521

Contact: *Denise Sanders, denise.sanders@ucr.edu*

The Department of Bioengineering, at the University of California, Riverside, is the newest department at the Bourns College of Engineering. Established in 2006 by Distinguished Professor and Member of the National Academy of Engineering, Jerome S. Schultz, the department's mission is to forge future leaders in bioengineering while focusing on solutions to critical themes that impact advanced bioengineering and biomedical engineering research.

The department's interdisciplinary research and educational training effort extends through BIG (Bioengineering Interdepartmental Graduate Program), joining faculty members throughout the University of California, Riverside who are dedicated to this mission.

Now one of the most diverse programs, Bioengineering at UCR is already recognized for its many accomplishments including ranking 3rd in the nation in 2011 for its students receiving NSF Graduate Research Fellowships.

Table 37

University of California at San Diego

Office of Graduate Studies

9500 Gilman Dr. #0003
Student Service Ctr.-4th Floor
9500 Gilman Dr. #0003
La Jolla, CA 92093

Contact: *Veronica Henson-Phillips, vhensonphillips@ucsd.edu*

UC San Diego's rich academic portfolio includes six undergraduate colleges, five academic divisions and five graduate and professional schools. The university's award-winning scholars are experts at the forefront of their fields with an impressive track record for achieving scientific, medical and technological breakthroughs.

Graduate programs at the University of California, San Diego continue to be highly ranked as noted in America's Best Graduate Schools, 2012 Edition released by U.S. News Media Group, publishers of U.S. News & World Report. Each year, U.S. News ranks professional-school programs in business, education, engineering, law and medicine. Of the 25 UC San Diego doctoral programs evaluated by the National Research Council, 60 percent are among the top 20 programs in their fields nationwide. The National Research Council ranks UCSD 10th in the nation in the quality of its faculty and graduate programs. The NRC ranks UC San Diego's oceanography and neurosciences programs first in the nation. We offer a wide variety of academic and professional fields and we welcome talented prospective students from across the nation and around the world. UCSD graduates have gone on to assume prominent roles in academia, industry, government, and the arts and media in California and beyond.

Table 33
University of Chicago
5710 S. Woodlawn Ave
Room 005
Chicago, IL 60637

Contact: *Chinonye "Chi-Chi" Nnakwe, ccnnakwe@uchicago.edu*
Shay McAllister, smcallis@bsd.uchicago.edu

The University of Chicago is one of the world's great intellectual destinations, this is a community of creative, demanding, inspired scholars who debate and collaborate to enrich human life through their work. Located in the community of Hyde Park on Chicago's South Side, just 15 minutes from the city center, the University of Chicago is uniquely positioned to contribute to, and draw from, the strength and diversity of this world-class metropolis. We have also made an indelible mark on the world at large.

Leading in the Sciences

It was at Chicago that REM sleep was discovered and carbon 14 dating was developed. Our scientists laid the mathematical foundations of genetic evolution; executed the first controlled, self-sustaining nuclear chain reaction; conceived the study of black holes; and performed the nation's first living-donor liver transplant. Researchers here have also expanded our understanding of dinosaur evolution; reconstructed the evolution of the early universe in astonishing detail; proved that chromosomal defects can lead to cancer; and pioneered scientific archaeology of the ancient Near East.

Medical Scientist Training Program

The University of Chicago Medical Scientist Training Program (MSTP) was established in 1967 and is one of the longest running physician-scientist training programs in the country. The program is designed for students who seek careers in biomedical research and have a desire to apply both clinical and

research expertise to solve the most pressing problems in medical science. The program has an illustrious history of training students to assume positions of leadership in academic medicine at major research institutions nationwide.

Table 11
University of Cincinnati College of Medicine
231 Albert Sabin Way
Medical Sciences Bldg., Suite 2005
ML 0548
Cincinnati, OH 45267-0548

Contact: *Laura Hildreth, Laura.Hildreth@uc.edu*

Graduate Programs in Biomedical Sciences
www.med.research.uc.edu

Nationally ranked faculty from the University of Cincinnati College of Medicine (UC COM) and Cincinnati Children's Hospital (CCHMC) are preparing the scientists of the 21st Century to make unprecedented forward progress in understanding human health and disease.

Interdisciplinary collaboration is key, as can be seen in the focus on priority research areas that span across departments and divisions within UC COM, especially in the areas of Cancer Biology, Cardiovascular and Pulmonary Biology, Immunobiology, Neuroscience and Neurology, Metabolic Disorders, Gastrointestinal and Epithelial Biology, Developmental and Neonatal Biology, Environmental Health, and Molecular Genetics.

CCHMC is one of the nation's leading pediatric research and teaching institutions. U.S. News & World Report ranked us No. 3 in the nation in the 2013 list of best medical schools for pediatrics.

Programs:

- Summer Undergraduate Research Fellowship (SURF) Programs
- Medical Scientist Training Program (MD/PhD)
- Cancer and Cell Biology (PhD)
- Epidemiology and Biostatistics (MS or PhD)
- Environmental & Industrial Hygiene (MS or PhD)
- Environmental Genetics and Molecular Toxicology (PhD)
- Immunobiology (MS or PhD)
- Medical Physics (DMP)
- Molecular & Developmental Biology (PhD)
- Molecular, Cellular & Biochemical Pharmacology (MS or PhD)
- Molecular Genetics, Biochemistry & Microbiology (PhD)
- Neuroscience (PhD)
- Pathobiology & Molecular Medicine (PhD)
- Systems Biology and Physiology (PhD)
- Master of Public Health (MPH)

Exhibitor Descriptions

- Masters in Clinical and Translational Research (MS)
- Masters in Physiology (MS, a 1-yr MedPrep program)
- Genetic Counseling (MS)

Table 42

University of Illinois at Urbana-Champaign

Graduate College

204 Coble Hall
801 S. Wright Street
Champaign, IL 61820

Contact: *Ave Alvarado, amalvara@illinois.edu*

Jesse Thompson, jthomps5@illinois.edu

The University of Illinois at Urbana-Champaign (Illinois) offers numerous opportunities to students from U.S. populations historically underrepresented in graduate study at Illinois. Summer research experiences, application fee waivers, and funding packages are extended to prospective and current graduate students intended to support their pursuit of an advanced degree. Illinois offers graduate degrees in over 150 disciplines, including the biological sciences, natural sciences, physical sciences, behavioral sciences, and engineering. Numerous interdisciplinary and several joint degree programs, such as the MD/PhD and JD/PhD are granted. Assistantships, traineeships, and fellowships, supplemented with a tuition waiver and stipend are offered to students in all disciplines. The Summer Research Opportunities Program (SROP) and the Summer Pre-Doctoral Institute (SPI) provide participants with an opportunity to conduct research and receive monetary awards and many other benefits.

Please visit our website at: <http://www.grad.illinois.edu/> and <http://www.grad.illinois.edu/diversity> for more information.

Table 32

University of Iowa Graduate College

Graduate College
410 Gilmore Hall
Iowa City, IA 52242

Contact: *Joseph Henry, joseph-henry@uiowa.edu*

Located in Iowa City, The University of Iowa celebrates excellence and diversity, offers choices, and encourages exploration. It is only a 4-5 hour drive from 5 major Midwest cities—Chicago, Kansas City, Minneapolis, Omaha, and St. Louis. In its 2012 America Best Colleges, which examines the overall quality of schools across the country, U.S. News And World Report ranked the UI among the top 30 public national universities. The University of Iowa is home to 11 colleges and enrolled 30, 893 students on a full-time basis for the 2011-2012

academic year. For that year, the Graduate College enrolled 5,617 students across 100 plus programs. Students from underrepresented racial/ethnic groups made up approximately 11.9% of our enrollment.

For more information on our fellowships, tuition scholarships, fee waivers and other opportunities, please contact Joseph Henry at Joseph-Henry@uiowa.edu or by phone at (319) 335-2138. And be sure to learn about a wealth of other programs and resources at our UI Graduate College website at www.grad.uiowa.edu. Thank you for considering graduate education at Iowa!

Table 41

University of Michigan, College of Literature, Science and the Arts

500 S. State Street
College of LSA Dean's Office
Ann Arbor, MI 48109-1382

Contact: *Bob Megginson, ptrail@umich.edu*

The College of Literature, Science, and the Arts at the University of Michigan offers more than 40 graduate programs in the physical and natural sciences, mathematics, humanities, and social sciences. Interdisciplinary study is also encouraged across the university. Many of our graduate programs rank in the top 10 or top 5 in the country. For our doctoral programs, we offer five years of funding including a living stipend, paid tuition, and health care for students and their dependents. Funding is provided through fellowships, teaching, and research assistantships. Our world-class faculty and campus facilities provide training for scholars who are changing every aspect of the world in every corner of the globe. Join us and create your own piece of history.

Table 21

University of Minnesota Graduate School Medical Scientist Training Program MD/PhD

G254 Mayo
420 Delaware Street SE
Minneapolis, MN 55455

Contact: *Jon Gottesman, orbs@umn.edu*

Michelle Corkrum, mcorkrum@umn.edu

Derek Maness, dmaness@umn.edu

The University of Minnesota is one of the most comprehensive public universities in the United States and ranks among the top 10 public institutions in NIH funding & research expenditures in STEM fields.

The Biomedical Sciences Graduate Programs offer PhDs in 6 areas:

- Biochemistry, Molecular Biology & Biophysics
- Integrative Biology & Physiology
- Microbiology, Immunology & Cancer Biology
- Molecular, Cellular, Developmental Biology & Genetics
- Neuroscience
- Pharmacology

The Medical Scientist Training Program at the University of Minnesota (MD/PhD) enables you to train in both clinical medicine and biomedical research, with research fields spanning the full range of biological and physical sciences to include epidemiology. You will prepare for a career in academic medicine with training rooted in strong connections between health care & science. We are located on an urban campus with over 50,000 students, making the U of MN one of the largest, most vibrant educational communities in the United States. Broad opportunities for research exist in the labs of over 110 research preceptors and ten graduate school programs. All students receive full financial support, free tuition and benefits.

On the Web: www.orbs.umn.edu/ERN
www.med.umn.edu/mdphd
www.grad.umn.edu

Table 24
University of Missouri
Graduate Life Sciences Programs
150c Bond Life Sciences Center
1201 Rollins St.
Columbia, MO 65211

Contact: *Debbie Allen, allendebra@missouri.edu*
Brenda Peculis, peculisb@missouri.edu

Experience the Joy of Discovery and Innovation
Graduate Study in the Life Sciences at the University of Missouri
The joy of discovery has propelled the University of Missouri to one of the top-ranked Life Sciences research institutions in the 21st Century, offering doctoral degrees in over 30 life sciences departments and programs.

Our Ph.D. programs emphasize interdisciplinary collaboration and innovation. University of Missouri faculty from diverse disciplines come together to develop cures for human diseases, to improve our nation's food supply, to develop new sources of biofuels and to preserve and protect our environment. The campus is also home to the nation's largest university research reactor. The Colleges of Agriculture, Food & Natural Resources, Arts & Science, Engineering, Veterinary Medicine, and Schools of Medicine, Nursing, and Health Professions compliment MU's research diversity.

Our Ph.D. students use cutting-edge technologies to solve problems. Our research core facilities include state-of-the-art DNA sequencing, proteomics, nanotechnology, microscopy and whole-animal imaging technologies.

We are committed to the success of our graduate students, with strong mentorship programs and career-directed resources. We offer a comprehensive support package including stipend, paid tuition, health insurance and travel funding. Columbia, Missouri is a vibrant, diverse and affordable city with impressive amenities. Consistently ranked as one of the nation's most livable cities, Columbia is conveniently located in the center of the I-70 corridor in Missouri just two hours from St. Louis or Kansas City.

Learn More: <http://www.missouri.edu/research/>
<http://lifesciencesweek.missouri.edu>

Email gradlifesci@missouri.edu

Table 1
University of Pennsylvania/Biomedical Graduate Studies
421 Curie Boulevard
160 BRB II/III
Philadelphia, PA 19104

Contact: *Arnaldo Diaz, diaza@mail.med.upenn.edu*

The University of Pennsylvania School of Medicine is the nation's first, with the Hospital of the University of Pennsylvania being the nation's first built medical school.

Biomedical Graduate Studies was established in 1985 and serves as the academic home students pursuing a PhD in the basic biomedical sciences. BGS is composed of more than 600 faculty members and provides training through seven graduate groups - Biochemistry and Molecular Biophysics, Cell and Molecular Biology, Epidemiology and Biostatistics, Genomics and Computational Biology, Immunology, Neuroscience, and Pharmacology.

In addition to our graduate programs, BGS is pleased to offer research training for individuals at the undergraduate and post-baccalaureate levels.

Table 38
University of South Florida
College of Engineering
University of South Florida
4202 E. Fowler Avenue, ENB 118
Tampa, FL 33620

Contact: *Bernard Batson, bbatson@usf.edu*

The University of South Florida is a high-impact, global research university dedicated to student success. USF is classified by the

Exhibitor Descriptions

Carnegie Foundation for the Advancement of Teaching in the top tier of research universities, a distinction attained by only 2.2 percent of all universities. Signature research areas including Aging and Alzheimers Disease, Bioengineering, Cancer Biology, Computer Vision and Pattern Recognition, Drug Discovery, Environmental Biotechnology, Water Resources, and Sustainability, Nanotechnology and Advanced Materials, Nano-computing, Neuroscience, and Rehabilitative Engineering and Robotics. Graduate funding opportunities for eligible students are available through the McKnight Doctoral Fellowship, USF Graduate Student Success, Alfred P. Sloan Minority Ph.D., and the NSF Louis Stokes Alliance for Minority Participation (LSAMP) Bridge to the Doctorate programs. Summer undergraduate research programs are available in Computer Science, Chemistry, and Interdisciplinary Environmental Science.

Table 15

UT Southwestern Graduate School of Biomedical Sciences: PhD and MD/PhD Programs

5323 Harry Hines Blvd
Dallas, TX 75390-9004

Contact: *Nancy Street*, nancy.street@utsouthwestern.edu

UT Southwestern provides opportunities to prepare for careers in the biomedical sciences through study and research leading to the Ph.D. degree through the Division of Basic Science and the M.D./Ph.D. degree through the Medical Scientist Training Program. Over 340 faculty offer training in genomics, cancer biology, computational biology, developmental biology, biomedical engineering, molecular genetics, structural biology, cell biology, chemical biology, systems biology, pharmacology, microbiology, neurosciences and immunology. Our NIH-sponsored MSTP contains a highly integrated curriculum, premiere teaching hospitals and renowned clinical faculty. The essence of education at UT Southwestern is an exciting research experience in an active, productive and critical scientific environment.

We also have two undergraduate research programs focused on providing world-class research experiences during the summer.

Check them out at www.utsouthwestern.edu/SURF and www.utsouthwestern.edu/qp-surf

Phone: 214-633-1312

URL: www.utsouthwestern.edu/gradschool

Table 48

Vanderbilt Graduate School Fisk-Vanderbilt Bridge Program

2101 West End Ave
Nashville, TN 37240

Contact: *Don Brunson*, don.c.brunson@vanderbilt.edu

Alyce Dobyys, alyce.dobyys@Vanderbilt.Edu

The Vanderbilt University Graduate School's Enhancing Diversity in Graduate Education Office is charged with providing leadership in the identification, recruitment, and retention of talented Ph.D. students from underrepresented groups. Specifically, this means African-American, Hispanic, and Native American students across all fields, women in the science, technology, engineering, and math fields and some students whose background is classified as being both first-generation and low-income. While most of the work is still done at the college and department level, our job is to coordinate, supplement, and expand what faculty are already contributing to Vanderbilt's goal of recruiting and retaining talented young scholars from underrepresented groups.

Table 30

West Virginia University Graduate Education and Life

PO Box 6090
Morgantown, WV 26506

Contact: *Constinia Charbonnette*,
Katie.Gallagher@mail.wvu.edu

Hawley Montgomery-Davis, Katie.Gallagher@mail.wvu.edu

Founded in 1867, West Virginia University is a public, land-grant institution living the mission in the 21st century. Located in Morgantown, WV, consistently named one of the best small cities in country, WVU delivers high-quality education, excels in discovery and innovation, models a culture of diversity and inclusion, promotes health and vitality, and is building pathways for the exchange of knowledge and opportunity between the state, the nation, and the world. Through our land-grant mission we offer our students an affordable, world-class education, focusing on interdisciplinary research and global engagement.

Our faculty includes members of the National Academy of Engineering, Fulbright Scholars, and an Emmy award-winning documentary producer. Our students are National Merit Scholars, have attended the Lindau Meeting of Nobel Laureates, and consistently receive highly-competitive, prestigious fellowships and grants. Their research is funded by over \$175 million annually in grants from numerous federal agencies and private foundations. Our unique Graduate Academy helps students complete their journey with career preparation for positions in universities, business, government, and industry.

West Virginia University offers more than 70 masters and 40 doctoral programs in 14 schools and colleges including a College of Law, as well as schools of Pharmacy, Medicine, Nursing, Public Health, and Dentistry that offer professional degrees. Online graduate degrees and several graduate certificate programs are also available.

Table 34**XSEDE**

1201 New Yor Avenue, NW
Washington, DC 20005

Contact: *Linda Akli, flaus@psc.edu*

Samuel Moore, slmoore@tacc.utexas.edu

The Extreme Science and Engineering Discovery Environment (XSEDE) is the most advanced, powerful, and robust collection of integrated advanced digital resources and services in the world. It is a single virtual system that scientists can use to interactively share computing resources, data, and expertise.

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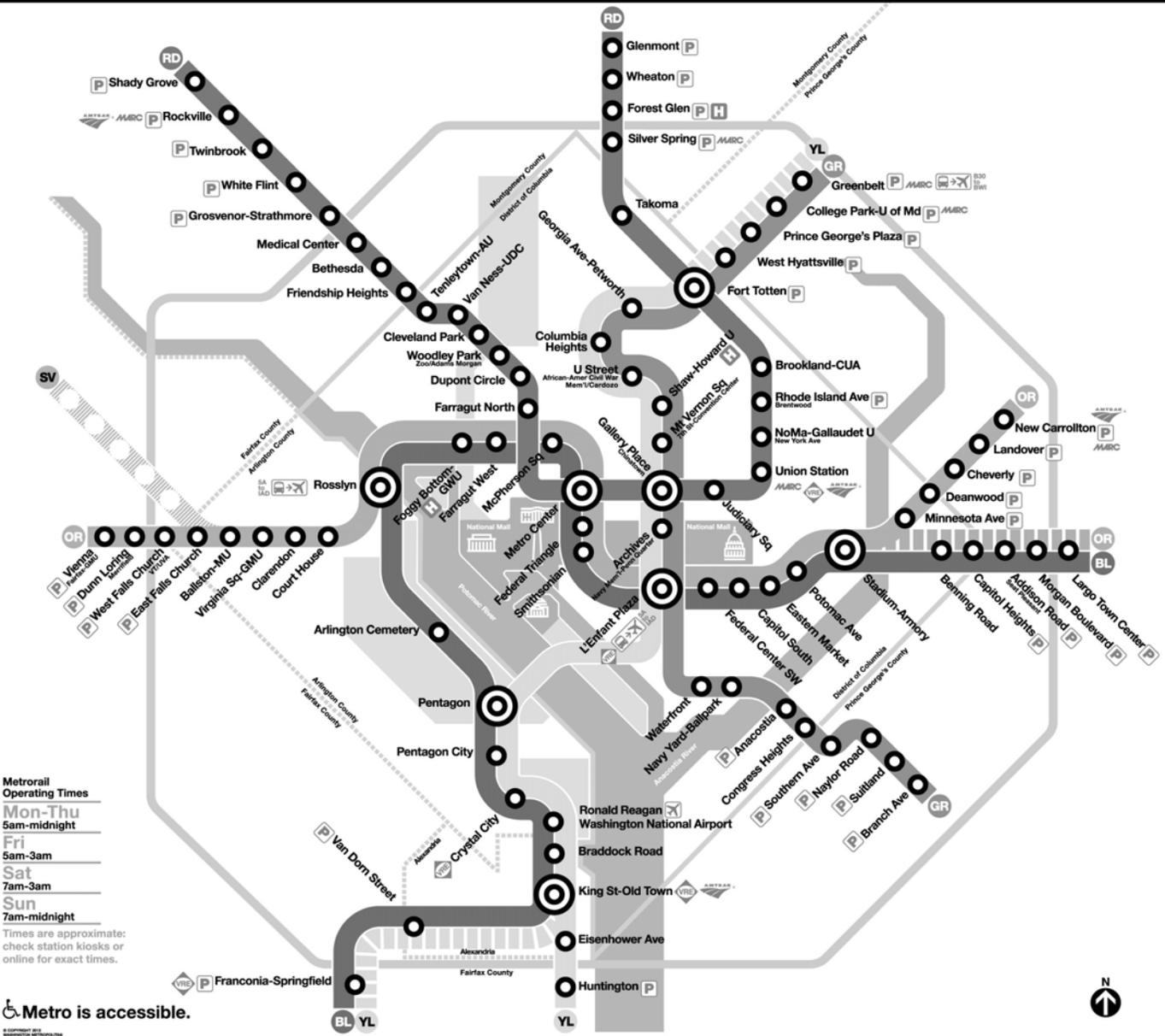
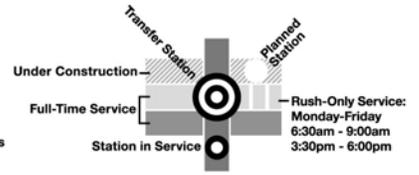
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 - BL** Blue Line • Franconia-Springfield to Largo Town Center
 - GR** Green Line • Branch Ave to Greenbelt
 - YL** Yellow Line • Huntington to Fort Totten
 - SV** Silver Line • Future Dulles Corridor Line

Station Features

- Bus to Airport
- Parking
- Hospital
- Airport

Connecting Rail Systems



Metro
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Mon-Thu
 5am-midnight
Fri
 5am-3am
Sat
 7am-3am
Sun
 7am-midnight
 Times are approximate; check station kiosks or online for exact times.

Metro is accessible.

- No Smoking
- No Eating or Drinking
- No Animals (except service animals)
- No Audio (without earphones)
- No Littering or Spitting
- No Dangerous or Flammable Items

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Undergraduate Abstracts for Oral Presentation

Biological Sciences

OA #1

Subcategory: Microbiology/Immunology/Virology

Determining Reservoirs of HIV-1

Cameron Adams, University of Washington

Richard Fox, Kim Wong, Brendan Larsen, Matthew Pouw, Jennifer Whitehead, Will Slagle, and James I. Mullins, University of Washington

Administration of Anti-Retroviral Therapy slows disease progression and reduces HIV-1 viremia to near undetectable levels. Poor adherence or withdrawal of therapy often results in rapid rebound of viremia with the potential for the establishment of drug resistant variants. HIV is known to establish latency in long-lived central memory T-cells and is often referred to as “the reservoir”. However, we understand that there is both latent and actively replicating HIV-1 that comprises reservoir sites. Using sequence information and computational tools, we can define reservoirs as cells or tissues harboring HIV-1 with genotypic features of reduced temporal structure, high diversity within the population, and low divergence from their most recent common ancestor (MRCA). This is because reservoirs are populated with virus seeded at both early and late periods of infection. If a reservoir is established in a site with reduced drug penetrance, “drug-sanctuaries”, continued viral replication and diversification could occur. This may result in the accumulation of drug resistant variants that lead to therapy failure.

Here we hypothesize that tissue and cellular sites with phenotypes reflective of reservoirs may also be drug restricted, providing a boundary for unrestricted viral replication. To test this hypothesis, we sequenced single genome template derived amplicons of env and pol regions of HIV-1. Presented are data from autopsies from two-subjects. Both S104 and S2 presented with multi-drug resistant genotypes in all tissues sampled. Bioinformatical analysis measuring viral genetic diversity within and divergence from the MRCA of the viral population of S104 demonstrated reservoir phenotypes in tissue virus isolated from lung and large intestine. A lung reservoir phenotype was also observed in subject S2. We continue to expand our characterization of reservoirs and compartments to clearly define sites that must be targeted to eradicate HIV-1 in the host. *[Acknowledgment: National Heart, Lung, Blood Institute (NHLBI) Grant # 5R 25 HL103180 03; Teri Ward, Karlotta Rosbaugh, and Lisa Peterson. NIH, National Institute of Allergy and Infectious Diseases (NIAID), AI086182 (Mullins, PI) University of Washington Center for AIDS Research (CFAR) (P30 AI027757)*

which is supported by the following NIH Institutes and Centers (NIAID, NCI, NIMH, NIDA, NICHD, NHLBI, NIA) (Mullins, PI) amfAR Mathilde Krim Young Investigator Award to Richard Fox (108263-51-RFRL).]

Faculty Advisor: Richard Fox, hivgenomics@gmail.com

OA #2

Subcategory: Genetics

Segregation Patterns of the Ab10 Chromosome in Maize

Margaret Akinhanmi, University of Georgia

Kelly Dawe and Lisa Kanizay, University of Georgia

One of the chromosomes in maize, called abnormal chromosome ten (Ab10), has four different structural variations that each have knobs (long arrays of tandem repeats) of different sizes. The presence of these knobs on Ab10 allows knobs to move towards the spindle poles during cell division. The movement of knobs has been termed neocentromere activity, and it leads to preferential transmission of the knobbed chromosome. This preferential segregation is called meiotic drive and it breaks Mendel’s rules of segregation. Although non-disjunction is not related to meiotic drive, it has been observed to randomly occur with crosses between the different variations of the abnormal chromosome. In order to determine whether this random non-disjunction occurs with Ab10 chromosomes more than normal ten chromosomes, crosses were done between different combinations of Ab10 and N10 chromosomes. These crosses were Ab10 L2/N10, Ab10-I/N10, Ab10-L2/N10, and Ab10-I/Ab10-II heterozygous individuals crossed to N10/N10 individuals. The chromosomes of the progeny from these crosses were viewed using a common laboratory method called fluorescence *in situ* hybridization (FISH). FISH allows the use of fluorescently labeled DNA probes to identify the knobs on the Ab10 chromosomes. From the images of the chromosomes that were taken and the data collected, it was found that these crosses underwent normal segregation. Therefore, the previously observed non-disjunction can still be attributed to random occurrence. *[Acknowledgment: NSF]*

Faculty Advisor: Kelly Dawe, kelly@plantbio.uga.edu

OA #3

Subcategory: Cancer Research

The Effect of G-Protein-Coupled Receptor Kinase 5 on Migration in PC3, DU145, and LNCaP Prostate Cancer Cell Lines

Tamieka Atkinson, Florida A & M University, Tallahassee

Prabir Chakraborty, Zhingzhen Nie, and Yehia Daaka, University of Florida

According to the National Cancer Institute, 1 in 6 men possess a lifetime risk of developing prostate cancer. Within this population of men, there is only a 27.8% 5-year survival rate from prostate cancer metastasis to distant organs. Since there is a high mortality rate in prostate cancer metastasis, understanding the processes that allow prostate cancer cells to metastasize is beneficial in developing diagnostic and/or therapeutic modalities. G protein-coupled receptors (GPCRs) are vital for intracellular signaling, cell-cell communication, and cell-matrix interactions. GPCRs are regulated by two groups of protein, G protein-coupled receptor kinase 5 (GRK5) and arrestins. GRK5 regulates GPCRS via phosphorylation which ultimately leads to the desensitisation of GPCRs. To explore the role of GRK5 and its effect on migration, we utilized the PC3, DU145, and LNCaP prostate cancer (PCa) cell lines.

In our study, three experimental methods were employed to investigate the role of GRK5 in PC3, DU145, and LNCaP cell migration. Initially, the cell lines were maintained through cell culturing techniques. The prostate cancer cell lines PC3, DU145, and LNCaP were grown in F12K (modified Ham's F12), DMEM and RPMI 1640, respectively, supplemented with 10% FBS and 1% penicillin/streptomycin. Also, stable cell lines were generated with GRK5 knockdown using lentiviral approach. Immunoblotting was used to determine the protein expression of moesin within the cell lines. PC3 cells were found to have the highest level of moesin protein. We then employed the method of immunofluorescence in order to acquire visual representation of the effect of GRK5 on moesin and focal adhesion expression in PC3, DU145, and LNCaP cell lines.

Conclusively, the results indicated that a knockdown of GRK5 leads to a significant reduction in moesin, and an increase in the number of focal adhesions. However, overexpression of GRK5 leads to a significant increase in moesin with a decrease in the number of focal adhesions. When compared amongst the PCa cell lines, the level of moesin is highest in PC3 cells as compared to DU145 and LNCaP cell lines, respectively. In future, GRK5 can be employed as a novel biomarker to develop diagnostic and/or therapeutic modalities for prostate cancer patients.

[Acknowledgment: This study was supported, in part, by a grant from the Department of Defense Prostate Cancer Research Program that was granted to Folakemi T. Odedina PhD, Associate Director of Health Disparities, UF Shands Cancer Center, University of Florida.]

Faculty Advisor: Edna Cofield, Ednalou6@yahoo.com

OA #4

Subcategory: Plant Research

Extraction and Characterization of Antioxidants in *Brassica* Species

Natanya Baines, Southern University at New Orleans

Brassica species are known to be high in antioxidants, especially the phenolic compounds which are beneficial to health. Three *Brassica* vegetable varieties (broccoli, Brussels sprouts, and cabbage) were used in this study to develop extraction procedures for fresh vegetables and to characterize the antioxidants present. After testing several solvents for extraction, three solvents (chloroform, ethyl acetate, and petroleum ether) yielded better results with Thin Layer Chromatography (TLC) analysis. Nine extracts (each vegetable per solvent), were prepared and concentrated using a Yamoto Evaporator. Concentrated extracts were analyzed by Infrared (IR) spectroscopy and TLC against eight phenolic standards, tocopherol standard and β -carotene standard. The IR analysis identified several functional groups associated with phenolic compounds in the extracts. The functional groups commonly identified are ester and aliphatic hydrocarbons, suggesting presence of similar antioxidant compounds. TLC analysis of chloroform extracts (all three vegetables) against eight phenolic standards, developed spots that corresponded with four of the eight standards by their Rf values. In addition, ethyl acetate and chloroform extracts had corresponding Rf values to tocopherol and β -carotene standards. The presence of antioxidants was further confirmed by spraying chromatograms with 0.1mM solution of 2, 2-diphenyl-1-picrylhydrazyl (DPPH). After spraying, spots changed from purple to colorless, an indication of antioxidant activity. Further research will be done in characterization of antioxidants using additional *Brassica* species. *[Acknowledgment: This study was supported, in part, by a grant from the NSF awarded to Joe Omojola, Ph.D., E3MaS Program Director, Professor of Math and Physics, Southern University at New Orleans.]*

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OA #5

Subcategory: Microbiology/Immunology/Virology

Disruption of *Pseudomonas aeruginosa* Biofilms Using Probiotics and Chemicals

Michelle Bennett, Southern University at New Orleans
Illya Tietzel, Southern University at New Orleans

Pseudomonas aeruginosa (*P. aeruginosa*) is a rod-shaped, gram-negative, motile bacterium that is an opportunistic pathogen in immune compromised patients. This bacterium has the ability to generate biofilms which makes it multi-resistant to antibiotics. For AIDS patients with *P. aeruginosa* bacteremia, the death rates are high as 60%. Probiotics such as *E.coli*, marine microbes and hexadecane can break down biofilms. It is hypothesized that *E. coli*, *Alcanivorax borkumensis*, and hexadecane can break down the formation of *P. aeruginosa* biofilms. Experimental methods: *P. aeruginosa* was reconstituted and grown on nutrient agar, and one petri dish was left without any microbes as a contamination control. Several staining techniques were

done to identify *P. aeruginosa*. A gram-stain was done to confirm that *P. aeruginosa* is a gram-negative bacterium. Gram-positive *Micrococcus roseus* and gram-negative *E. coli* served as controls. In addition, a negative stain and a simple stain were done to detect the rod shape of the bacterium. In order to determine the amount of bacterium from an original concentration, a 4 fold dilution series and standard plate count was used. In parallel, one test tube with no microbes served as a contamination control. *P. aeruginosa*, *E. coli*, and *A. borkumensis* were grown separately or together, also hexadecane served as a treatment. Triplicates of 0.1mL of *P. aeruginosa* were added to a 96 well plate. The biofilms were fixed with crystal violet and read at an optical density of 590nm. *P. aeruginosa* biofilms were measured alone, serving as a positive control; the growth medium with or without treatments served as a negative control.

The results showed that *P. aeruginosa* was rod-shaped and gram-negative. The bacterial counts ranged from 17×10^6 to 54×10^6 CFU, and the biofilm values ranged from 2.33 to 0.0563. *E. coli* caused biofilms to grow larger in the first experiment and decreased them in the second. Hexadecane decreased biofilms in both experiments, and *A. borkumensis* broke down biofilms in some cases but not in others. In conclusion as hypothesized, hexadecane broke down biofilms. On the contrary, *E. coli* and *A. borkumensis* could break down *P. aeruginosa* biofilms in some cases, but not in the others. Thus, *E. coli* and *A. borkumensis* results were inconclusive. Future studies will show if *E. coli* and *A. borkumensis* can successfully break down biofilms by using higher numbers of CFUs. [Acknowledgment: This work was supported in part by grant fund NSF DBI-1040966 awarded to Dr. Tietzel, principal investigator of the URM grant at SUNO.]

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OA #6

Subcategory: Cell and Molecular Biology

Hyperglycemia Affects IL-6R Function in Skin

Megan Bowlin, Langston University

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Non-healing wounds are a significant problem for health professionals. Diabetic wounds appear to be a self-sustaining inflammatory phase. Interestingly, the inflammatory cytokine IL-6 is necessary for wound healing. While it is known that IL-6 is dysregulated in diabetes, little is known concerning the function of IL-6 or its receptor in diabetic wound healing. Given the association of non-healing diabetic ulcers with inflammation, the altered levels of IL-6 observed during diabetes/hyperglycemia and the close relationship of this cytokine with

skin healing, it seems conceivable that IL-6 and/or its receptor may play important roles in diabetic wound healing.

The goal of this project is to determine how IL-6 and its receptor are involved in diabetic wound healing delay. In doing so, this will provide possible therapeutic modalities to augment diabetic wound healing that are based on manipulation of IL-6 function. Studies began with C57BL/6 diabetic mice subjected to full thickness wounds (4mm); wound tissue was collected up to 13 days post wounding. Primary fibroblasts from IL-6O mice were cultured in collagen conditions I matrices under high (25mM) or normal (5mM) glucose conditions for 5 days and treated with up to 50 ng/ml of rIL-6 for 1 hour. Gene expression was determined by QPCR, Western blot, or ELISA. ERK 1/2 phosphorylation was determined by ELISA. The results revealed IL-6 and IL-6 expression are disparately modulated in wounds from diabetic animals. Hyperglycemia alters IL-6R mediated ERK signaling in fibroblasts while not affecting IL-6R expression. Additionally, diabetes variably alters RAGE expression in wounds. IL-6 itself induces RAGE mRNA expression in fibroblasts dose-dependently up to 50 ng/ml rIL-6 regardless of glycemic state. Conversely, neither RAGE mRNA nor protein is induced by RAW cells cultured in low glucose at >1 ng/ml rIL-6. However, 25 mM glucose exposed RAW cells induce RAGE mRNA and protein less than or greater to 10 ng/ml rIL-6. This data indicated that Hyperglycemia alters the function of the IL-6R while not affecting its expression in skin cells. IL-6 and hyperglycemia can modulate RAGE expression in fibroblast and RAW cells. This interaction may affect IL-6R function in diabetic wounds. [Acknowledgment: This study was supported, in part, by OCAST grant HR10-163, University of Oklahoma Health Science Center, Oklahoma City, Ok, Langston University, LINC, and OK-LSAMP.]

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OA #7

Subcategory: Physiology and Health

The Correlation between Pupillary Unrest with Respiration and Heart Rate

Dwayne Davis, Fort Valley State University

Gang Yao and Ben Davis, University of Missouri

Pupillary unrest, scientifically known as hippus, is the continuous fluctuation, constriction and dilation of the pupil even in steady illumination. The pupil is innervated by the autonomic nervous system, and its oscillation is controlled by the parasympathetic and sympathetic modulation of the iris muscles. A link has been shown between respiratory patterns and pupillary oscillation, as well as heart rate variability. This study examined the connection between the frequencies of breathing rate, heart rate, and pupillary oscillation. During normal, slow and deep breathing, we measured pupil size, breathing rate, and heart rate. Using Fast Fourier Transform, the frequency spectra of

each parameter (pupil size, breathing rate, and heart rate) were analyzed. Pupil size was measured using two high-speed infrared cameras in a binocular pupillogram recording system, and a pressure sensor was used to measure breathing rate. In conclusion, a correlation was observed between breathing rate, heart rate, and pupil oscillation frequency. This effect was more pronounced during the slow deep breathing trial. Further study will focus on the dynamic properties of the pupil measuring Pupillary Light Reflex during controlled breathing.

[Acknowledgment: This study was supported, in part, by grants from NSF HRD HBCU-UP and REU-Site Programs awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, Fort Valley State University.]

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OA #8

Subcategory: Cancer Research

Expression of CK7 Identifies Tumor Heterogeneity in Papillary Renal Cell Carcinoma Type I

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The main intermediate filaments of epithelial cells are keratins. There are about 20 different kinds of these polypeptides which are distributed in a tissue-specific fashion. Malignancies originated from epithelial tissues have been shown to retain specific keratins. These types of monoclonal antibodies are of use in histopathological diagnostics permitting the immunohistochemical distinction between different types of epithelium and carcinomas derived from them. Techniques of immunohistochemistry were applied to Papillary Renal Cell Carcinoma (PRCC) Type I tissue samples in order to demonstrate tumor heterogeneity. Formalin-fixed paraffin-embedded tissue sections from kidney tumors were immune-stained using a monoclonal mouse anti-human antibody for Cytokeratin 7 (CK7) at a dilution of 1:400. Antibody was incubated in a humidified chamber for 1 hour at 37 degrees Celsius. Color was developed by DAB substrate kit for 45 seconds. Upon observation with a light microscope, tissue slides demonstrate cellular differentiation in the same neoplasm. Tumor samples were classified from PRCC to Clear-Cell RCC. CK7 shows positive staining to kidney tumor slides, and tumor heterogeneity is true on PRCC to CCRCC noted by the lack of staining with the same antibody. *[Acknowledgment: This study was supported, in part, by a grant 1T34GM087172-01A1 from NIH/NIGMS awarded to Freddie Dixon Ph.D., Director of MARC U-STAR Program at the University of the District of Columbia. Also, the NIH SIP in Biomedical Research is thankfully acknowledged.]*

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OA #9

Subcategory: Plant Research

The Effect of Induced Stress on Blackberry Flower Timing Under High Tunnel Conditions

Alan Delbridge, Virginia State University

This study examines the effect of induced stress on flower timing of two blackberry cultivars, Tupi and Brazos, grown under high tunnel conditions. These cultivars were chosen due to their short chilling requirement. Early blackberry fruit production means premium prices for farmers. Control blackberry cultivars were used without stress treatment to estimate the time of flower initiation. The varieties utilized in the experiment were stressed chemically and consequently defoliated within 4 weeks. During the late chilling season the walls of the high tunnel were rolled up to stimulate growth. Preliminary findings show that induced stress followed by stimulating growth would not cause an earlier flowering initiation. *[Acknowledgment: NSF HBCU-UP Program]*

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OA #10

Subcategory: Cell and Molecular Biology

Potential of Bacillus and Pseudomonas SPP as a Biological Control Agent for Anthracnose Disease

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Salha Elmahndi, Department of Natural Sciences

Anthracnose is one of the most destructive diseases of chili cultivation that has existed for many years as a mechanism to sustain economic stability in the continent of Asia. The aim of this study is to evaluate antagonistic activity of antagonistic bacteria Bacillus UPM04 and Pseudomonas BMB42 as a biological control of chili anthracnose fungus *Colletotrichum* species. Direct confrontation using dual culture method and crude extract of bacterial isolates Bacillus UPM04 and Pseudomonas BMB42 were performed in this study. UPM04 and Pseudomonas were selected to serve as antagonistic potential by means of a screening method based on antibiotic production and their beneficial morphological and biochemical characteristics. Metabolic activity on the mycelium was observed and resulted, according to Tukey's student test at $P < 0.5$, that the area under growth curve was not significantly different. The highest value of radial growth (PIRG) values were observed with *Colletotrichum capsici* BMB42 using dual culture methods, 0.15mm/day with a regression coefficient of 0.99 R^2 . The minimum radial growth (PIRG) values were observed with *Colletotrichum gleosporoides* UPM04 with

0.06mm/day and a regression coefficient of 0.82 R². UPMO4 with 52% and BMB42 with 55% in the dual culture method exhibited the highest percentage of inhibition when colonized with *Colletotrichum capsici*. Tests to determine the effect of crude extract of metabolites produced by bacterial antagonists on mycelia growth of *Colletotrichum capsici* and *Colletotrichum gleosporoides* were performed. The experiment yielded results of the minimum value with *Colletotrichum capsici* UPMO4 obtaining a mycelium growth rate of 0.01mm/day (0.52R²). Attaining the maximum mycelium growth rate, *Colletotrichum capsici* BMB42 exhibited 0.25mm/day (96R²). Through various experimental approaches, these results exhibit a plethora of conclusive findings. Bacterial antagonists indicate inhibition to mycelia growth of *Colletotrichum gleosporoides* and *C. capsici*. [Acknowledgment: Savannah State University, National Science Foundation, Universiti Putra Malaysia, Kuala Lumpur.]

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OA #11

Subcategory: Plant Research

Development of Transgenic Rice Plants (*Oryza sativa* L.ssp. *japonica* ev. *Nipponbare*)

Cameran Faucette, University of Arkansas at Pine Bluff
Anissa Buckner, Sathish Kumar Ponniah, and Muthusamy Manoharan, University of Arkansas at Pine Bluff

Isoflavones play an important role in human health as a dietary component. Consumption of Isoflavones is associated with health benefits such as decreased risk of heart disease, reduced risk of some hormone related cancers. Rice is one of the most important grains with regard to human nutrition, but it does not naturally produce flavonoids. Synthesis of Isoflavones in rice may enhance its dietary value. Isoflavonoids are synthesized as a part of the phenylpropanoid pathway, and one of the key enzymes in the phenylpropanoid pathway is chalcone synthase (CHS), which catalyzes the formation of the central intermediate, naringenin chalcone. Therefore, our main objective was to transform soybean CHS gene into the rice genome using Agrobacterium-mediated transformation. Sixteen transgenic lines were generated from the callus on hygromycin-containing medium.

The results of the southern blot and PCR analyses showed that the CHS transgene was stably integrated into rice genome and also stably inherited to their progenies. RT-PCR analysis confirmed that CHS was expressed in T2 progenies of each transgenic line. Transgenic plants were normal and fertile. [Acknowledgment: This study was supported, in part, by a grant from the Arkansas Science & Technology Authority ASSET II NSF 11-EPS2-0007 for Plant Powered Production awarded to Dr. Muthasamy Manoharan, Department of Agriculture, University of Arkansas at Pine Bluff.]

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OA #12

Subcategory: Cell and Molecular Biology

Tissue Specific Gene Characterization and Expression in *Stevia rebaudiana*: A Natural Sweetener Plant

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Srinivasa Chaluvadi, University of Georgia

Stevia [*Stevia rebaudiana* (Bertoni); family: *Asteraceae*] is widely grown for its sweet leaves. *Stevia* yields diterpenoid steviol glycosides, which are about 300 times sweeter than sugar. *Stevia* plant organs contain different amounts of steviol glycosides, which decline in the following order: leaves, flower, stems, seeds and roots (Bondarev et al., 2003). Some genes and pathways involved in steviol biosynthesis are already elucidated. Comparison of whole transcriptomes from each of those organs will give us clues into several more genes involved in steviol glycoside production.

In this study, we adapted targeted and non-targeted approaches to assess differential expression of known genes and whole transcriptomes respectively. Towards this goal, we isolated RNA from various tissues such as young shoots, mature shoots, young leaf, mature leaf and roots from *in vitro* and *in vivo* grown plants. Semi quantitative RT-PCR analysis was carried out to find relative accumulation of steviol biosynthesis pathway genes such as SrUGT82C2, SrUGT74G1 and SrUGT76G1. The present study describes RNA isolations, RT-PCR analysis of known genes involved in steviol biosynthesis and methodologies used for RNAseq analysis of whole transcriptomes from various *Stevia* tissues.

This present study, after RNAseq analysis is completed, will help us in identifying novel genes, which are modulated during steviol glycoside biosynthesis. The future study will also place emphasis on identifying EST-SSR markers, to identify superior *S. rebaudiana* genotypes and to aid in *Stevia* breeding program. [Acknowledgment: This study was supported, in part, by a grant from NSF HRD HBCU-UP and DBI REU-Site Programs awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, Fort Valley State University.]

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OA #13*Subcategory: Plant Research***Effect of Maize Mosaic Rhabdovirus on the Behavior of its Vector, *Peregrinus Maudis*****Tiffany Glover, Langston University**

Anna Whitfield and Karen Alviar, Kansas State University

The Maize mosaic rhabdovirus (MMV) reduces and limits corn production. MMV causes chlorosis, withering of leaves, and can result in death of corn plants. The arthropod *Peregrinus maidis* (*P. maidis*) causes this severe damage to corn by feeding on corn's phloem, which is the living tissue that carries nutrients within corn plants. *P. maidis* is the only known vector for MMV. Thus, understanding how MMV affects *P. maidis* is important to determining how to reduce the occurrence of MMV infected corn. The objective of this work was to establish an understanding of the effect of MMV on the behavior of *P. maidis*. Based on the results of other works using different vector-virus systems, we hypothesized that MMV will cause *P. maidis* to be more fecund, to have a decrease in lifespan, and to increase feeding on plant hosts. Two groups were used for each behavioral study, MMV- exposed *P. maidis* and control insects without MMV. A pair of adults was allowed to mate for 3 days. The numbers of eggs, live bodies, and salivary sheaths were counted to measure fecundity, longevity, and feeding, respectively. The two groups showed no significant difference on the number of eggs produced 3 days, 7 days and 14 days after mating. In regards to longevity, MMV-exposed males lived significantly longer than unexposed males. There was no difference on the length of survival between healthy and MMV-exposed females. The feeding experiment revealed that MMV-exposed females produced more salivary sheaths, suggesting more probing behavior compared to unexposed females. The salivary sheaths produced by unexposed and MMV-infected males were not significantly different.

These results partially supported our hypothesis of how MMV affected the feeding behavior of *P. maidis*. Taken together, the results of this work can be used to further understand the interaction of MMV with its host, *P. maidis*. This work may help lead scientists to a method to control this pest and increase corn yield. This data supports that MMV affects male and female *P. maidis* differently. Thus, there are still questions to answer: Are corn plants more likely to be infected with MMV by male *P. maidis*, which live longer with MMV, or female *P. maidis*, which may feed on corn more often when infected with MMV. [Acknowledgment: This work was supported by Kansas State University Graduate School, Summer Undergraduate Research Opportunity Program, Kansas Idea Network of Biological Research Excellence.]

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OA #14*Subcategory: Ecology***Examining Extent of Multiple Paternity in Female Red Flour Beetle, *Tribolium Castaneum*****Shyla Hardwick, Spelman College/Georgia Institute of Technology**

Female Red Flour beetles mate with multiple males during a single fertile period, which often results in enhanced offspring fitness. One intriguing effect of female promiscuity previously documented in red flour beetles, *Tribolium castaneum*, is that females have "sexy sons" with high fitness at the cost of daughters with low fitness. This may be a result of post copulatory paternity-biasing processes. Thus, further paternity testing is necessary to determine which mechanism leads to the variation in fitness patterns between sons and daughters from polyandrous mothers. Paternity analysis of offspring from multiply mated females can reveal the exact number of males that have sired a female's offspring, thus providing insight on the mechanism of opposite fitness effects on sons and daughters due to mothers' multiple matings. Opposite fitness effects may be due to differential paternity of offspring or due to sexually antagonistic genetic variation in traits for fitness. In this study, we conducted paternity analysis of offspring from females exposed to four different males. Polymorphic microsatellite loci were used to investigate paternity of sons and daughters. Preliminary results from examining genotyping data from 4 of 20 families, indicate that extent of multiple paternity is low. Reproductive success of offspring increased when mothers were multiply mated. This project aims to unravel the mechanism behind the unusual fitness tradeoff in sons and daughters in one population of the red flour beetle. The overall project furthers the understanding of evolution and ecology of polyandry. [Acknowledgment: NSF]

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OA #15*Subcategory: Genetics***Molecular Genetic Variation in *Arundo donax* Populations in South Georgia****Shawn Harrison, Fort Valley State University**Seema Dhir, Department of Biology, Fort Valley State University
Srinivasa Chaluvadi, Department of Genetics, University of Georgia

Arundo donax (giant reed) is a potential biofuel feedstock crop, which is distributed throughout the southern half of the United States from California to Maryland. *A. donax* is native to Asia and was initially introduced into North America from the Mediterranean region although subsequent introductions were

from multiple regions. *A. donax* is hypothesized to displace native plants and associated wildlife species as a consequence of the massive stands it forms and subsequently becomes a dominant component of the flora of that region. Invasive species such as *A. donax* are interesting for geneticists because invasive species often evolve rapidly in response to novel abiotic and biotic conditions, and native species evolve in response to the invasion. In the current project, we are interested in understanding local genetic diversity of *A. donax* stands in Houston County and Peach County in Georgia, with the goal to: 1) identify superior genotypes for biofuel production; and 2) understand the potential for colonization and establishment, geographic patterns of invasion and range expansion, and the potential for evolutionary responses to novel environments. In the current study, we analyzed *A. donax* individuals from 12 distinct populations in and around Peach County and Houston County. The poster describes details about DNA isolations from various populations, design of PCR primers to amplify candidate chloroplast and nuclear genes, Sanger sequencing and phylogenetic analysis of sequence data. Further analysis of *A. donax* genome is underway to understand genetic basis of invasiveness and identification of superior genotypes to be promoted as superior biofuel feedstock. *[Acknowledgment: This study was supported, in part, by grants from NSF HRD HBCU-UP and DBI REU-Site Programs awarded to Dr. Sarwan Dhir, Fort Valley State University, GA.]*

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OA #16

Subcategory: Cell and Molecular Biology

Selective Proximal Tubular Mitofusin 2 (MFN2) Deficiency Prevents Oxidant Stress and Promotes Cell Proliferation Following Ischemia Reperfusion (I/R) Injury

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Renal ischemia causes dramatic changes in mitochondrial morphology, a key organelle that regulates cell survival after stress. We hypothesized that MFN2, required for mitochondrial fusion, regulates kidney function by altering mitochondrial injury after ischemic stress. To test this hypothesis, mice with renal structure-specific, conditional MFN2-deficiency (MFN2cKO) were subjected to renal ischemia, and mitochondrial morphology, histologic injury score, oxidant stress, cell proliferation and renal function were quantified. To delete MFN2 in renal proximal tubule epithelial cells, MFN2^{f/f} mice were crossed with Kap2-Cre mice that express Cre-recombinase exclusively in proximal tubules (PT). Acute kidney injury was induced in Cre-positive males (MFN2cKOs) and Cre-negative littermates (control) by renal pedicle occlusion. Blood urea nitrogen (BUN), renal histology, oxidant stress (anti-nitrotyrosine staining), and proliferation (BRDU staining) were

assessed <48 hours after transient ischemia and reperfusion. MFN2cKO caused fragmentation in proximal tubular epithelial cell mitochondria. Despite similar tubular injury scores, MFN2cKO mice exhibited better renal function (lower BUN at 24 and 48 hr post ischemia; P<0.05) and significantly greater survival (86% vs. 28%, P<0.05) compared to control. Cortical nitrotyrosine staining was reduced by 40% (P<0.05) and cortical epithelial cell proliferation estimated by BRDU positive staining was increased by 3.5-fold (P<0.05) in MFN2cKO mice vs. control. Proximal tubule-specific MFN2 deficiency promotes mitochondrial fragmentation and surprisingly, protects organ function and improves animal survival after renal ischemia. These protective effects are partly mediated by decreased PT oxidant stress and enhanced PT cell proliferation, key determinants of post-ischemic organ injury and recovery. We propose that MFN2 is a rational target for modifying ischemic acute kidney injury by regulating mitochondrial dynamics and/or critical injury pathways in the proximal tubule epithelial cell. *[Acknowledgment: NIH MBRS-RISE Grant Award No. GM061325]*

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OA #17

Subcategory: Plant Research

Determination of Optimum Harvest Time of Edamame Grown in Virginia

Bianca Jacques, Virginia State University

Bo Zhang, Virginia State University

Vegetable soybean or Edamame as a cash crop is an ideal substitute for tobacco in Virginia because tobacco is no longer a viable alternative for many small acreage farmers due to the termination of the federal tobacco price support program. As a specialty crop, Edamame has not been fully investigated to support production. Determination of harvest time needs to be explored first to ensure optimal conjunction of high quality products for consumers and great profit for farmers. This study tracked the bean yield and quality change of Virginia State University developed Edamame cultivars and breeding lines in 2011 and 2012, within the harvest window from R6 (full seeds) to R7 (beginning maturity) stage, and concluded the premium harvest time of Edamame. The results showed that total marketable yield and bean pod weight were similar in all harvest dates. However, the bean quality greatly changed at different harvest times: the oil content on the 2nd (21.7%) and 3rd day harvest (21.5%) was significantly higher than that of the other three day harvest; sucrose content on the 3rd day harvest reached the peak of 9%; glucose content on the 4th and 5th days were 0.64 and 0.73%, respectively, higher than the other three day harvest. Therefore, even if the harvest time does not affect yield, harvesting Edamame in the middle of R6 (full seeds) to R7 (beginning maturity) stages will supply better taste and

quality. In addition, total marketable yield or bean quality was similar among all three varieties in the study, but pod weight was significantly different among them. VS03-621 had heavier 100 pod weight than VS10-1069 and Asmara, and VS03-621 and VS10-1069 had more two and three bean pods than Asmara, which means that VS03-621 and VS10-1069 are elite Edamame breeding lines to replace Asmara with more pod weight and similar quality. [Acknowledgment: USDA/ Evens-Allen.]

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OA #18

Subcategory: *Physiology and Health*

Effects of Dietary Cholesterol and Jojoba Seed Oil on High Density Lipoprotein Subclasses in New Zealand White Rabbits

Tarek Karam, California State University, Los Angeles

Atherosclerosis, the accumulation of excess cholesterol in arteries, is the leading cause of cardiovascular disease in America. Atherosclerotic plaque causes blood flow impairments which result in an array of health problems, such as heart attacks. The body's defense against atherosclerosis is the reverse cholesterol transport pathway (RCT). RCT is a multi-step process that results in the net movement of cholesterol, as cholesterol esters, by high-density lipoproteins (HDL) from the peripheral tissues to the liver where it is degraded into bile. In our study of RCT, we have shown that the characteristic decrease of serum HDL concentrations in hypercholesterolemic New Zealand White (NZW) rabbits is hindered by dietary jojoba oil, a liquid wax produced in the seed of the jojoba plant (*Simmondsia chinensis*). We hypothesize that among the two main HDL subfractions, HDL2 and HDL3, the maintained HDL level is due to regulation of HDL2 cholesterol esters (HDL2-CE). NZW rabbits were divided into four experimental groups and placed on either a normal chow diet (N), or a normal diet supplemented with either 3% jojoba seed oil (J), 1% cholesterol (C), or 1% cholesterol + 3% jojoba seed oil (CJ) for one week. The rabbits fed the N diet are the control for those fed the J, C, and CJ diets, and the rabbits fed the C diet are the control for those fed the CJ diet. Serum samples were collected 7 days before and after the diets were administered. Using ultracentrifugation, HDL2 and HDL3 were isolated. HDL2 total cholesterol (TC) and free cholesterol (FC) were quantified enzymatically using a colorimetric method with a linear relationship between the intensity of the color and the concentration of cholesterol. Cholesterol esters were calculated indirectly by subtracting free cholesterol from total cholesterol ($[CE] = [TC] - [FC]$). Using a two-factor ANOVA, at a $P \leq 0.005$, our results show a significant interaction between the HDL2-CE concentrations and total serum HDL concentration in the C- and CJ- diets. This suggests that the effects of jojoba oil on HDL concentrations is due to the regulation of HDL2 and is not an additive effect of HDL2 and HDL3. In future studies, we aim to investigate the histological

effects of jojoba oil on the development of atherosclerotic lesions in the aorta of cholesterol-fed NZW rabbits. We hypothesize that jojoba oil will lessen atherosclerotic lesion development in the CJ-fed rabbits. [Acknowledgment: MORE Program: NIH MBRS RISE Program through grant R25 GM061331; CSU-LSAMP, supported by the National Science Foundation under Grant # HRD-0802628 and the CSU Office of the Chancellor.]

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OA #19

Subcategory: *Physiology and Health*

Developmental Plasticity Effects on Mammalian Physiology

Ian Kim, Auburn University

W. R. Hood and H. Wada, Auburn University

It is well known that a mother's diet consumed during embryogenesis contributes to the phenotype of the young mammal such as glucose/lipid metabolism, heart and renal function, and bone development, with the developmental plasticity playing a major role. Of particular interest in this study is to determine the fitness consequences in phenotype expression from the mammal's varied dietary metabolism. The mammal used for testing is house mice, *Mus musculus*. The selection for this particular species ensures that physiological variability will be seen through maternal diet manipulation, gives us abundant information on the physiology of this species to take from, and offers the ease of reproductive success. The house mice parental generation has been conditioned for 5 weeks with food containing 10% protein and 20% protein, respectively. The retained offspring were then conditioned with diets that matched their parental diet (low/low protein, high/high protein) and that mismatched their parental diet (low/high protein, high/low protein). Diet restriction in maternal proteins have shown physiological changes in offspring such as a reduction in the form and function of the pancreas in the offspring, resulting in a reduction in plasma insulin, which contradicts the norm that exhibits higher plasma glucose levels. In terms of reproductive success, mothers that have been conditioned on a low-protein diet display higher levels of testosterone, longer estrous cycles, and reduced litter sizes than mothers conditioned on a high-protein diet, which indicate early decline in reproductive functions of those conditioned on low-protein diet. Nevertheless, certain animals exhibit greater reproductive success for those that developed from a low food diet and later switched to a high food diet than those that have been on high food diet; this is what we aim to analyze. Diet mismatching has been shown to reveal interesting physiological responses in such species, which led to the principle investigation of this research project. In terms of fitness

consequences of these developmental factors, determining if house mice that develop in diet mismatching really produce phenotypes that result in better fitness cannot only play a role in contributing to ecological and evolutionary processes in biological sciences, but can also contribute to enhancing research in the biomedical world of sciences.

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OA #20

Subcategory: Microbiology/Immunology/Virology

Microbial Load of Mango and Avocado Juice in Bahar Dar

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Neiunna Jones, Howard University
Mengstu Wayau, Bahar Dar University

Juice stands are very widespread in Bahar Dar, a city located in northwestern Ethiopia. These juice stands serve various fresh fruit juices, but many consumers prefer mango and avocado juices. Due to increased consumer consumption, it is important to ensure these fruit juices do not contain pathogenic bacteria. Therefore, the goal of this study was to compare the microbial load of fresh juices served at local juice stands and bottled juices sold at the supermarket. Eleven grams of each sample were collected and mixed in a stomacher machine with 99mL of peptone water. Serial dilutions were then performed for dilutions of 10⁻¹ to 10⁻⁵. These dilutions were then plated on Plate Count Agar (PCA) to evaluate the microbial community and Mannitol Salt Agar (MSA) to screen for the presence of *Staphylococcus aureus*. After an incubation period of 24 hours, it was discovered that the avocado juice had over 300 colonies in PCA in many of the samples collected, while fresh mango and processed juice samples had fewer colonies. The plate count agar for avocado had no countable plates because all of the samples had over 300 colonies; therefore, the plate with a microbial load closest to a countable plate was counted at 5.63x10⁶ CFU/mL. The fresh mango juice had a microbial load of 9.1x10⁶ CFU/mL and the processed juice had a load of 8.3x10⁴ CFU/mL. These results demonstrate fresh avocado juice had a significantly higher microbial load compared to fresh mango and processed juices. The avocado juice also had a higher screening for *Staphylococcus aureus* when using the MSA. The count for the avocado was 2.15x10⁶ CFU/mL, while the count for the mango was 7.8x10³ CF/mL, and the count for the processed juice was 3.2x10³ CFU/mL.

These results give insight on how important it is for juice stands in Bahar Dar to apply proper practices to reduce possible food contamination. In order to further the study, gram stains and

isolations of pathogenic bacteria using biochemical tests could be done to elaborate on the type of bacteria found in the fruits. Also, processed avocado juice or fruit could be examined before they are made into juice to determine the difference in microbial load of fruit before and after they are juiced.

[Acknowledgment: This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.]

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OA #21

Subcategory: Genetics

Genetic Variation in PPAR γ at Nucleotide 1431 Aids Response to Exercise Training

Martell McKinney, Langston University

Obesity is now the second leading cause of death in the United States and is likely to become the first. Exercise can significantly reduce body mass and decrease BMI, a measurement used to determine obesity. However, not all overweight patients respond suitably to exercise. Research supports a "possible" candidate gene that may affect responses to exercise training in obese patients: Peroxisome Proliferator-Activated Receptor Gamma (PPAR γ). PPAR γ activates certain genes in a fat cell, resulting in the storage or burning of fat. The PPAR γ gene polymorphism may have potential functional effects. Thus, we chose to determine whether the C1431T polymorphism influences responses to aerobic exercise training. Following dietary stabilization, healthy, inactive, 50- to 75-year-old obese Caucasian men (n=188) underwent 6 months of aerobic exercise training. Pre-exercise and post-exercise characteristics were measured and compared. Polymerase chain reaction (PCR) was used to amplify only DNA segment with PPAR γ . PCR products were subjected to restriction digestion by HpyCH41V which cleaved nucleotide 1431 at 5'-ACGT-3' and allowed us to recognize PPAR γ nucleotide specific genotypes and polymorphisms via a DNA gel. Results demonstrated significantly lower post-exercise BMI scores for carriers of thymine at PPAR γ nucleotide 1431 in response to exercise training when compared to carriers of cytosine PPAR γ nucleotide 1431. Our data contributes to supporting PPAR γ as a promising candidate gene for therapeutic treatment against obesity. [Acknowledgment: This research experiment was funded by an NIH grant.]

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OA #22Subcategory: *Plant Research***Plant Regeneration and Genetic Transformation in *Arundo donax* Using Particle Bombardment****Michael Melvin, Armstrong Atlantic State University**

Sarwan Dhir, Fort Valley State University

Giant reed (*Arundo donax* L.) is a tall, erect, non-food, warm-season, woody perennial crop plant that has received considerable attention as a potential dedicated biofuel and bioproduct feedstock. Genetic improvement of Giant reed is needed for better cellulosic ethanol production, especially to improve cellulose-to-lignin ratios. Cell suspension cultures offer an *in vitro* system for mutant selection, mass propagation, gene transfer, and cell biology. Toward this end, cell suspension cultures were initiated from embryogenic callus on MS medium supplemented with 2.0 mg/L of 2, 4-D using immature inflorescence and root segments from *in vitro* raised plants. Cultures have been established and characterized with different cell type morphologies: sandy, fine milky and ultrafine cultures. Regular sub-culturing of embryogenic suspension cell and callus on MS media with various concentrations of 2, 4-D (0.5-2.5 mg/L), 3% sucrose and 0.4% gelrite, different developmental stages of embryos including torpedo and cotyledonary stages were observed which later germinated into plantlets. Embryogenic calli, induced, were bombarded with 1.0 μ M gold particles coated with a plasmid DNA vector containing GFP and NPTII genes fused to a 35S constitutive gene promoter. The GFP cultures were observed under UV/blue light. Maximum gene expression was observed after 24 hrs (approximately 600 spots/bombardment) after culture. The effect of different parameters such as types of tissues, distance, varying pressures on stable expression of GFP in embryogenic callus tissues will be discussed. [Acknowledgment: This study was supported, in part, by a grant from NSF DBI REU-Site Programs awarded to Dr. Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA]

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OA #23Subcategory: *Plant Research***Exploring the Utility of Two Plastid Genes, psbA-trnH and matK, in Resolving Species Relationships within *Macrolobium* (*Detarieae*: *Caesalpinioideae*: *Leguminosae*)****Katie Minker, University of the District of Columbia**

Karen Redden, University of the District of Columbia

Leguminosae is the third largest flowering plant family in the world and a dominant component of tropical rainforests. It is divided into three subfamilies, one of these, the

Caesalpinioideae, is not monophyletic. *Detarieae* is the largest tribe within *Caesalpinioideae* and is morphologically very diverse. Unfortunately, due to low taxon sampling of the large genera, the phylogenetic placement of this tribe and its subclades are uncertain. *Macrolobium* is the largest New World genus within the tribe containing 68-81 species and 42 varieties, although no sources agree as to the exact number. The fruits and seeds of the riparian species are a major food source for fishes, birds and mammals and a number of the species are utilized by the local Amerindian communities as food sources, fish poisons, and used to construct houses, fences, paddles, and fish traps. The previous work focused on ascertaining generic relationships based on the combined data (morphology, trnL and ITS) of selected members of *Detarieae* has suggested that *Macrolobium* does not form a monophyletic group. This study surveys the utility of two additional plastid markers, psbA-trnH and matK, for species resolution for 13 *Macrolobium* taxa. DNA was isolated using Qiagen Plant DNeasy. Amplification using polymerase chain reaction and fluorescent sequencing was done following established molecular methods. For herbarium collections, the Phire and Phusion Hot Start DNA polymerase (Finnzymes) methods were utilized. Phylogenetic inference was done using parsimony (NONA and PAUP). We explored, partitioned, and combined morphological and molecular datasets to detect the level of information provided by different types of data and their potential incongruence. We found that the individual psbA-trnH and matK partitions did not provide adequate variation to resolve all species. When the partitions were combined with the ITS and trn-L datasets for the total evidence phylogeny, 30 most parsimonious trees were recovered with 6 nodes having bootstraps greater than 50 percent. This study found that each of the individual plastid genes did not provide enough phylogenetic signal for species-level resolution but in combination with other markers increase the support of internal nodes. Future research will concentrate on increasing taxon sampling of *Macrolobium* and adding an additional low copy nuclear gene, LFY/FLO, to the combined dataset. [Acknowledgment: This study was supported by a grant from NSF/HBCU-UP - HRD-0928444-STEM Center, University of the District of Columbia, Washington, DC.]

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OA #24Subcategory: *Plant Research***Screening of Viruses Infecting Sweet Potato in Arkansas****Jasmon Montgomery, University of Arkansas at Pine Bluff**

Satish Kumar Ponniah, Obadiah Njue, and Muthusamy Manoharan, University of Arkansas at Pine Bluff

Viral diseases are one of the most important diseases affecting sweet potato production causing significant damage to yield. There are several viruses infecting sweet potato but chief

among them are the potyviruses: Sweet potato feathery mottle virus (SPFMV), Sweet potato virus G (SPVG), Ipomoea vein mosaic virus (IVMV), the crinivirus Sweet potato chlorotic stunt virus (SPCSV), and the begomovirus Sweet potato leaf curl virus (SPLCV). In Arkansas, sweet potato production has been steadily growing with a 20% increase in acreage (from 3,000 acres to 3,600 acres) between 2009 and 2011. However, the information on the nature of viruses infecting sweet potato in Arkansas is lacking. We have collected sweet potato samples from different counties in Arkansas such as Jefferson, Ashley, Lee, Cross, Chicot, Monroe and Lonoke to characterize and quantify the level of virus infection. Genomic DNA, total RNA, and proteins were isolated and PCR, Real-time PCR and NCM-ELISA are being conducted for the presence of SPFMV, SPVG, IVMV, SPCSV, and SPLCV in sweet potato. The results will be presented at the conference. *[Acknowledgment: This study was supported, in part, by a grant from the Arkansas Science & Technology Authority ASSET II NSF 11-EPS2-0007 for Plant Powered Production awarded to Dr. Muthasamy Manoharan, Department of Agriculture, University of Arkansas at Pine Bluff.]*

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OA #25

Subcategory: Cell and Molecular Biology

The Identification of Mutations Involved in Zinc Induced Transcription

Andrew Morrison, Savannah State University
Kerry Kornfeld, Washington University

The heavy metal zinc is necessary for all living organisms to survive. It plays many roles in biological systems, such as binding to proteins, promoting specific protein conformations, as well as contributing to the active sites of protease enzymes. Zinc plays a crucial role in human health. Zinc deficiency can cause a wide spectrum of defects in multiple organ systems, such as the integumentary, gastrointestinal, central nervous, immune, skeletal, and reproductive. Excess zinc, which results in zinc toxicity, also proves to have detrimental effects, since it may interfere with other heavy metal binding sites resulting in protein dysfunction. Because both zinc deficiency and excess are deleterious; it is crucial for biological systems to maintain zinc homeostasis. Two families of zinc transporters play a critical role in this maintenance: Zrt-, Irt-like proteins (ZIP) and cation diffusion facilitator proteins (CDF). CDF proteins function in transporting zinc out of the cytoplasm across the lipid bilayer or into intracellular organelles, while inversely ZIP proteins function in transporting zinc into the cytoplasm in the opposite direction. Zinc transporters are known to be transcriptionally regulated by variable zinc exposure. We are interested in identifying the unknown genes responsible for zinc induced

transcription of the *C. elegans* Cdf-2 protein. Utilizing *C. elegans* as our model organism, mutagenic screenings were performed. Mutagenic screening is an unbiased approach, which allows for probing of all genes present in the genome, and may define a novel zinc sensing pathway. Mutants are defined as *C. elegans* that show failure in normal transcriptional response to excess zinc. Determining the genes responsible for zinc induced transcription will lead to better understanding of how an animal responds to environmental cues and maintains zinc homeostasis. *[Acknowledgment: Washington University; NIH/NIMHD RIMI Program]*

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OA #26

Subcategory: Cell and Molecular Biology

Identification and Characterization of Genetic Suppressors of PINK1 Mitochondrial Phenotypes in Drosophila Melanogaster

Mastaneh Nikravesh, San Diego State University

Parkinson's disease (PD) is a devastating progressive neurodegenerative disorder affecting about one percent of individuals over 50. In terms of pathophysiology, PD is associated with the loss of dopaminergic neurons in the *substantia nigra* and neuronal accumulation of intracellular protein aggregates (Lewy bodies). Genes identified in sporadic and familial PD include PINK1, Parkin, DJ-1, alpha-Synuclein, LRRK2, VPS35 and ATP13A2. Studies using animal models confirmed the genetic and the environmental basis of PD. Among the various model organisms, *Drosophila melanogaster* has emerged as an especially effective tool to study PD genes. The complete sequence of the *Drosophila* genome has revealed that 77% of human disease genes are conserved in the fly. Loss of PD genes function in flies leads to DA neuron loss and mitochondrial defects in several tissues, which is reminiscent of the multiple system involvement in PD patients. These features make flies an excellent model system to study PD progression and to identify novel genetic interacting partners to ameliorate PD pathology. In this study, we have focused on screening for genes that can improve PINK1 induced mitochondrial phenotypes. Knockdown of PINK1 in flight muscles of *Drosophila* causes abnormal wing posture, cell death and mitochondrial aggregates due to the accumulation and fusion of dysfunctional mitochondria, which can be easily visualized by a mitochondrial targeted GFP. Rescue of abnormal wing posture in PINK1 mutants is used as primary readout to isolate the candidate genes. The secondary assay includes the dissection of flight muscles and analysis of mito-GFP and cell death markers. The Gal4-UAS binary system in fruit fly allows us to manipulate gene expression in a tissue specific manner. We have isolated few candidate genes in a targeted screen as novel genetic

suppressors of PINK1 mitochondrial phenotypes. The list includes genes involved in autophagy and mitochondrial quality control. We will further characterize these candidates together with Parkin mutants in detail to understand the mechanisms regulating the removal of damaged mitochondria. We will also extend these studies to DA neurons and investigate the role of these genes in mitochondrial transport and dynamics in neurons. In the future, we are planning to validate our fly data in human DA neurons derived from iPS cells obtained from PD patients. *[Acknowledgment: This study, in part, was supported by a Parkinson's grant from NIEHS to Prof. Rolf Bodmer and Sreehari Kalvakuri and LSAMP grant to Dr. Girish Melkani and Mastaneh Nikravesh.]*

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OA #27

Subcategory: Cell and Molecular Biology

Effects of 5-Aminoimidazole-4-Carboxamide Riboside (AICAR) and Rapamycin on Mitochondrial Dysfunction in Mouse Embryonic Fibroblasts (MEFs) Modeling Rapid Aging

Kenyaria Noble, University of South Florida

Mitochondrial dysfunction is associated with aging and most aging-related disorders. To identify compounds that restore mitochondrial function, mouse embryonic fibroblasts (MEFs) containing a D257A mutation in the mtDNA polymerase (Pol- γ ^{D257A}) exonuclease domain, which eliminates its proofreading capability, were used. These cells were isolated from mice that show a premature aging phenotype due to the accumulation of mitochondrial DNA mutations with increasing age. Age related mitochondrial dysfunction is characterized by decreased respiratory rate, increased reactive oxygen species (ROS) production, reduced ATP production, and a decline in mitochondrial membrane potential. Mitochondrial dysfunction may contribute to aging phenotypes and has been implicated in cell death. AMP-activated protein kinase (AMPK) activity also declines with age and activation of AMPK has been shown to stimulate mitochondrial biogenesis. AICAR, an activator of AMPK, has been called "exercise in a pill" because administration to mice stimulated robust increases in running endurance leading to the existence of "marathon mice". Rapamycin, an immunosuppressant used in organ transplantation, inhibits the formation of the mTOR/raptor kinase complex and has been shown to extend the lifespan of mice. Rapamycin has been shown to decrease mitochondrial membrane potential, oxygen consumption, and ATP synthetic capacity in muscle and Jurkat T cells, but increase oxygen consumption in adipose tissue and yeast. Here we demonstrate differential effects of AICAR and rapamycin on mitochondrial function in wild-type (WT) and Pol- γ ^{D257A} mouse embryonic fibroblast cells, under varying glucose and pyruvate concentrations and treatment durations. We found that

rapamycin and AICAR increased ATP production in both WT and Pol- γ ^{D257A} MEFs following 48 hour incubation in low glucose media supplemented with pyruvate. Furthermore, AICAR and rapamycin decreased oxygen consumption in Pol- γ ^{D257A} MEFs and increased oxygen consumption in WT MEFs. Low glucose and the presence of pyruvate promote the use of mitochondria for ATP production rather than the use of the glycolytic pathway as predominately occurs in most cancer cells, an occurrence known as the Warburg effect. Currently, we are performing mitochondrial membrane potential assays and quantification of mitochondrial mass following 24 and 48 hour treatment periods with high and low glucose media with or without pyruvate supplementation to gain a better understanding of the mechanisms by which these compounds affect mitochondrial dysfunction and to determine possible mechanisms behind the tissue-specific effects. *[Acknowledgment: University of South Florida College of Arts & Sciences CMM Biology Department principal investigator startup funds awarded to Dr. Patrick Bradshaw.]*

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OA #28

Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Protein Purification, Crystallization, and Functional Annotations of Essential LysR-type Transcriptional Regulators in *Acinetobacter baylyi* ADP1

Melesse Nune, University of Georgia

There are over forty LysR-type transcriptional regulators (LTTRs) in *Acinetobacter baylyi* ADP1. LysR-type transcriptional regulators (LTTRs) are a family of homologous proteins widely distributed in prokaryotes and important in regulating a variety of metabolic functions such as biosynthesis and catabolism, antibiotic resistance, host-microbe interactions, and virulence. A few of the LTTRs in *A. baylyi* are essential under defined growth conditions. *Acinetobacter baumannii*, a closely related organism to *A. baylyi*, is a multidrug-resistant pathogen that kills tens of thousands of hospital patients each year and is considered an emerging threat. The essential LTTRs in ADP1 are being used as models for *A. baumannii* and thus may represent novel antibiotic targets for drug discovery in the pathogen *A. baumannii*. Also, the DNA-protein interactions of these genes are poorly understood, and we hope our investigations of the genes from this gram negative soil bacterium may give us understanding of the protein/DNA interaction. Bioinformatic analysis (evaluation of shared synteny and multiple sequence alignments) and functional studies (EMSA) are being used to identify the regulated metabolic targets. The functional predictions/annotations assigned based on bioinformatic

analysis has opened doors for functional and structural studies that include successful gel shift assays and gene knockout studies. Structural studies of full-length LTTRs pose serious problems for researchers. Out of over 3900 family of LTTRs, full-length protein crystals with an x-ray diffraction patterns have been reported for less than ten to date. In our study, the genes have been cloned into an expression plasmid that adds a polyhistidine C-terminal purification tag for simple protein purification from *E. coli*. Successful protein purification using metal-chelate and ion exchange chromatography has transitioned to crystallization studies. In our study, determination of the solubility of these essential LTTRS from *A. baylyi* has led to broad protein crystallization trials that resulted in crystallization of two proteins, FinR and CysB. We have solved the structures of FinR and CysB using high-resolution X-ray crystallographic data from Synchrotron. The two structures we have determined are unique additions to the pool of the previously reported Full-Length LTTR structures.

[Acknowledgment: Funding from National Science Foundation to Dr. Cory Momany, Pharmaceutical and Biomedical Sciences, University of Georgia.]

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OA #29

Subcategory: Microbiology/Immunology/Virology

Promoter Methylation and Gene Profile Expression in Systemic Lupus Erythematosus (SLE) Patients

Jarren Oates, University of Arkansas at Pine Bluff

Beverly Word and Beverly Lyn-Cook, National Center for Toxicological Research

Systemic lupus erythematosus is a multifactorial autoimmune disease that affects women at a 9:1 ratio when compared to men. In addition, women of specific ethnic groups, such as African American, Hispanic/Latino, Asian and Native American, have a higher incidence when compared to European American. Pathogenesis of lupus remains unknown, however, emerging data are beginning to show that aberrant epigenetic mechanisms may play a central role in its onset and progression.

Our hypothesis is that specific genes involved in cytokine production will be expressed at higher levels in lupus patients compared to non-lupus patients. Furthermore, the expression profile will be regulated through epigenetic mechanisms. Our laboratory and others have shown global hypomethylation in PMBCs from lupus patients compared to age-matched non-lupus patients, as well as hypermethylation of specific genes.

The method used in this study was real-time PCR using a gene profiler array and a DNA promoter methylation array. Using a cytokine production DNA methylation PCR array, this study

demonstrated that Foxp3 promoter showed an increased methylation profile, while ELANE gene showed a decreased methylation profile in lupus patients compared to age-matched non-lupus patients. The gene profile expression array revealed three genes with significant increase in expression, IL-18 ($p < 0.013$), TNFSF13B (BlyS) ($p < 0.017$) and FASLG ($p < 0.026$). Increased methylation of the Foxp3 gene suggests inactivation of Foxp3. Foxp3 is an essential transcription factor for regulatory T-cells (Tregs) and is considered the guardian of peripheral tolerance. Decreased expression of Foxp3 gene has been noted in another autoimmune disease, rheumatoid arthritis. The ELANE gene promoter showed a decrease in % methylation, indicating activation of that gene. This gene code for a protein called neutrophil elastase and is known to play a role in inflammation. Increased levels of IL-18 and TNFSF13B have been indicated in lupus, but not FASLG. These studies further suggest that epigenetic mechanisms may play an important role in lupus onset and progression. [Acknowledgment: This study was supported, in part, by a grant from the Food and Drug Administration Office of Women's Health, to Dr. Beverly Lyn-Cook, National Center for Toxicological Research, Jefferson, AR.]

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OA #30

Subcategory: Cell and Molecular Biology

Revealing the Components of the Cgi Regulatory System of Complementary Chromatic Acclimation in *Fremyella Diplosiphon*

Terry Phillips, Langston University

Lisa Wiltbank, LaDonna Jones, and David M. Kehoe, Indiana University

As a country, America is heavily dependent on the use of fossil fuels for energy. These fuels are an unreliable source of energy because they are nonrenewable and depleting quickly. Moreover, the use of these fuels causes large release of CO₂ into the atmosphere. Thus, there is a need to find a healthier, more sustainable way to produce energy. Bio solar energy production is one alternative energy source being researched. Knowledge about how photosynthetic organisms capture and use the sun's energy is important to bio solar energy research. The freshwater cyanobacteria, *Fremyella diplosiphon*, has a complex photosynthetic control system that changes specific protein amounts in order to optimally absorb and use the light color in its environment to produce energy for photosynthesis. This process is known as Complementary Chromatic Adaptation (CCA). CCA entails a change in gene expression that was thought to be regulated only by the Rca system, however, in the absence of the Rca system, the levels of the protein PE are upregulated. We hypothesized this upregulation is due to an unidentified component, possibly in the novel system Cgi system.

The aim of this experimentation was to begin to elucidate components of the Cgi system for future investigations. Knowing the components of this regulatory system will allow us to create artificial bacteria with genes capable of harvesting light energy for human resources. We conducted a mutant screen to find components of the Cgi system by using a transposon mutagenesis of cells lacking Rca system. The site of DNA transposon insertion was evaluated from four brown mutants of *F. diplosiphon* to determine the genes responsible for PE regulation. Wild type *F. diplosiphon* was used as a control. Results indicated a possible unknown protein or gene in the Cgi system that represses PE levels. In the future, further research will be conducted with variety of mutant *F. diplosiphon* to determine other components of CGI system and to analyze regulation of the protein identified here. [Acknowledgment: National Science Foundation Grant #MCB-1029414]

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OA #31

Subcategory: *Physiology and Health*

A Rat Model of Type II Diabetes

Denzel Pugh, Langston University

Rong Ma and Bing Shu, University of Texas Health Science Center

Chronic kidney disease (CKD) affects over 31 million Americans and no therapeutic means can cure this disease presently. Diabetes is significantly linked to CKD; diabetic nephropathy occurs in about 40% of all diabetics and is a leading cause of end stage renal disease in America. The aim of this study was to generate an animal model to be used to analyze the effectiveness of a novel potential CKD treatment this lab has developed. We hypothesized that high fat diet fed and streptozotocin exposed rats will develop signs of type II diabetes and CKD to aid us in testing our potential treatment. This study used male Sprague-Dawley rats at an age of ~6 weeks. The rats were randomly divided into two groups, low fat diet (LFD) and high fat diet (HFD) groups. All HFD rats were injected with streptozotocin (STZ) at 35 mg/kg via tail vein 5 weeks after starting the diet. Body weight, blood glucose level, plasma insulin, triglyceride, cholesterol, 24 h urine output and urine protein concentration were monitored for all rats every 5 weeks to determine the development of diabetes.

The major findings include: 1) the levels of blood glucose, plasma triglycerides, and urinary albumin excretion were significantly elevated from the 5th week after STZ injection in HFD/STZ rats; 2) a significant increase in the level of plasma insulin occurred in the rats with 5 week HFD (before STZ injection) and was maintained throughout the entire study; 3) a significant increase in the plasma cholesterol level did not occur until 19 weeks after HFD. These results suggest that rats injected

with STZ and fed a HFD manifest phenotypes indicative of type II diabetes and may be used as an animal model to investigate treatment against type II diabetes and CKD. We have begun using this animal model to assess the effects and efficacy of our potential CKD treatment to obtain FDA approval.

[Acknowledgment: This study was supported in part by NSF and an NIH RO1 grant awarded to Dr. Rong Ma, OK-Louis Stokes Alliance for Minority Participation, and Langston's Integrated Network College.]

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OA #32

Subcategory: *Biochemistry (not Cell and Molecular Biology and Genetics)*

The Toxicity of Tire Leachates to *Girardia tigrina* is Due to Zinc Content

Elliot Rice, University of the District of Columbia

The practice of recycling old tires into various outdoor structures such as playground surfaces and landfill liners poses the risk of tire components moving into local watersheds and possibly affecting aquatic organisms. In this study we tested the hypothesis that the zinc content of tire leachate is a significant factor in its toxicity to *Girardia tigrina* (Girard, 1850), a freshwater planarian common to North American waterways. Planarians were cultured in tire leachate containing either 49.5 mg/L of zinc (BALT) or 0.13 mg/L (FRESH) of zinc or a control of extraction medium (EM) over a time period of 24 hours. All planarians in the BALT group died within 24 hours while no planarians died in either the FRESH or EM groups.

To verify that zinc was the causative agent in the observed toxicity, planarians were maintained in a solution containing an equivalent amount of zinc (from zinc sulfate) for 24 hours. To rule out the role of sulfate, a control group of *G. tigrina* was cultured in magnesium sulfate with sulfate levels equal to that of zinc sulfate. The survival rate of planarians in the zinc sulfate-treated group was not significantly different from the survival rate observed in the BALT group. There was no mortality in animals treated with magnesium sulfate. These data strongly indicate zinc as the toxic agent. In addition to the lethality demonstrated by both high-zinc solutions, planarians displayed signs of distress indicated by increased activity, writhing, and loss of motor coordination prior to death when compared to controls, suggesting that neurotoxicity may be the mechanism of action.

Future studies will examine the dose-response relationship of zinc toxicity in *G. tigrina* as well as evidence of neurotoxicity. [Acknowledgment: This study was supported by the NSF-funded STEM Center for Research and Development and the NIGMS-

funded MARC U*STAR Honors Program at the University of the District of Columbia]

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OA #33

Subcategory: Mathematics and Statistics

Regulation of the G1/S transition Simulation and Investigation

Taylor Rosemond, North Carolina Agricultural and Technical State University

Liping Liu, North Carolina Agricultural and Technical State University

The cell cycle consists of four stages: G1, S, G2, and M. During the G1 (or Gap 1) phase, the cell grows, makes proteins and organelles, and checks its environment to ensure it has the proper conditions to continue to the S phase. The S (or Synthesis) phase of the cell cycle is where nuclear DNA replication occurs. Next the cell goes through a second gap or growth phase, G2, before it undergoes Mitosis (M phase). As the cell progresses through the cell cycle, it completes two irreversible transitions. The first transition, the one we focus on, is the G1/S transition. In yeast this transition is known as the start point—the point at which the cell commits to replicating its DNA and is no longer dependent on extracellular signals. In the past researchers developed a model that focuses on the regulation of this transition and cell growth in budding yeast.

In order to investigate the dynamics of the G1/S transition, we use a simplified version of that model (shown below). We begin by conducting a numerical simulation of the model in MATLAB using Runge-Kutta 4th order scheme, and then compare our numerical solutions with the results in the previous study. Next, we conduct a mathematical analysis on the solution behavior by solving the differential equations analytically as much as possible. Finally, we conduct a stability analysis on the system of ordinary differential equations. The results obtained from the qualitative analysis compared with the solutions from numerical simulations and the experimental data in the literature provide some insights for the accurate modeling of the G1/S transition. For our future work we will investigate mammalian cell bistability. [Acknowledgment: I would like to thank Talent 21, iBlend, Dr. Liping Lui, Dr. Ricardo Gonzalez, and Dr. Gregory Goins for all their support and mentorship.]

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OA #34

Subcategory: Ecology

***Biomphalaria glabrata*: Gene silencing of Cathepsin B in Resistant Strains Leading to Susceptibility to Schistosome Parasite**

Michael Smith, University of the District of Columbia

Biomphalaria glabrata is the intermediate snail host of the parasitic trematode, *Schistosoma mansoni*, which is the causative agent of the devastating tropical disease schistosomiasis. These snails are known to display a wide range of susceptibility phenotypes depending on the genetics of both the snail and the invading parasite. Recent studies have shown that by using double stranded RNA (dsRNA) with the non-viral inert cationic delivery agent, polyethyleneimine (PEI), successful gene silencing in the snail host can be achieved. Since high basal levels and early expression of Cathepsin B was found to correlate with resistance to *S. mansoni* in the resistant BS-90 snail host, we hypothesized that knock down of the most seen with Cathepsin B (Cath B) gene. Using the corresponding CathB dsRNA and PEI delivery method in this snail will suppress the expression of CathB, thereby reduce /prevent the early destruction of the parasite normally seen in these snails. Twelve snails were soaked for 48 hours with dsRNA/ PEI nanoparticle complexes before exposure to the parasite. At 6 weeks post-exposure, experimental and control snails were monitored for cercaria shedding. RT-PCR with CathB gene specific primers was used to validate the successful knockdown of the CathB gene in dsRNA/PEI transfected snails, done in parallel using control mock myoglobin dsRNA/PEI transfected snails. Change in qualitative expression of CathB was determined relative to the housekeeping actin gene. The knockdown of cath B allowed the miricidia to enter into the snail and continue its life cycle from mother to daughter sporocyst into multiple pre-emerging cercariae. [Acknowledgment: Supported by NIH/NCI-5R25CA129035 and NSF/HBCU-up-HRD-0928444]

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OA #35

Subcategory: Cell and Molecular Biology

Understanding the genetic diversity for nutritional properties among selected brown and white rice varieties

Renee Smith, Savannah State University

R. Valarmathi and Tamil Nadu Agricultural University, Coimbatore, India

Rice is an essential food source that feeds more than half of the world's population. It is a primary source of food in countries like Asia, India, and many others. It grows in wet environments, without the need to rotate crops. Rice is exported around the

world and provides significant nutrition to overall health. There are more than 112,000 different types of rice. Of the different varieties of rice, brown rice and white rice are popular and widely consumed. Some varieties of rice have been linked to serve nutritional value while also contributing to various lifestyle disorders throughout the world specifically in countries where rice is a major component in every meal. The purpose of this study is a biochemical analysis of nutritional components in selected traditional brown rice and white rice varieties and characterization of bioactive compounds in the selected brown and white rice varieties using the high performance liquid chromatography (HPLC). This study also calculates an estimation of total soluble sugars (free sugars), total starch, amount of amylose in selected traditional and commercial rice varieties. As the maximum world population consuming rice as staple food, developing therapeutic rice varieties with increased nutritive value will have greater impact on preventing various life style disorders. Effective use in breeding programs to improve the nutritional quality of rice grains will further advances in nutritional markers for breeding programs. *[Acknowledgment: National Science Foundation-MAGEC-STEM Plus Program]*

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OA #36

Subcategory: Physiology and Health

Comparison of the Functionality of High Density Lipoprotein Cholesterol in Overweight Youth Before and After an Exercise Trial

Britani Vann, Langston University

High density lipoprotein (HDL) cholesterol is the form of cholesterol that is thought to play a protective role in cardiovascular health. HDL-cholesterol is primarily known for its role in reverse cholesterol transport, removing lipid deposits from blood vessels and helping to prevent cardiovascular disease. However, HDL-cholesterol also plays a protective role as an antioxidant. The goal of this project is to establish a cell-free assay to measure the anti-oxidative properties of HDL-cholesterol and to test whether this property changes in response to a short-term exercise program performed by overweight sedentary adolescents. The fluorescence assay we set up is performed in a 96 well plate and uses dihydrorhodamine 123 (DHR), which will spontaneously oxidize.

The goal of the assay is to measure how effective the HDL-cholesterol samples are at slowing that oxidation. We measured the increase in fluorescence of DHR with and without HDL-cholesterol every 2 minutes for one hour. First, we expected to observe that the presence of HDL-cholesterol would reduce the oxidation rate of DHR compared to DHR alone. Second, we predicted that the oxidation rate will be decreased following the

exercise program compared to the baseline. We observed that over a time period of one hour the oxidation rate of DHR alone in buffer solution is linear and reproducible. Adding HDL-cholesterol significantly reduced the oxidation rate. Participants in the exercise study improved their aerobic fitness but did not lose weight. Their HDL-cholesterol concentration did not change.

At the time of this abstract, we processed samples from the exercise study for the DHR assay but had not completed the data analyses. So far we have shown that the assay is reliable and can be used to study human samples with only a small volume. If our hypothesis correct, we will show that although short-term exercise training does not significantly alter body weight or cholesterol concentration, it could promote an improvement in health by increasing HDL functionality as shown by increased antioxidant capacity. *[Acknowledgment: National Science Foundation NARCH Program]*

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OA #37

Subcategory: Cancer Research

Cancer Epigenetics: Combining LSD1 and DNA Methylation Inhibitors for Targeted Breast Cancer Treatment

Britney M. White, Claflin University

Breast cancer is one of the most common cancers among women after lung cancer. There are many factors to that affect the outrageous growth of breast cancer cells. Ethnicity, mutations, diet, and lifestyle habits all contribute to the diagnosis of breast cancer. Incidence rates show that Caucasian women have a higher rate than African-American women, but mortality rates show the converse. To treat breast cancer, many drugs are being developed to combat the breast cancer cells from growing uncontrollably. The study is if changes in gene expression are essentially how epigenetics is defined.

Modifications in the binding sites of the proteins in genes are what control the regulation of normal and disease process. The particular gene that is being disturbed in these modifications is the tumor suppressor genes. LSD1, or lysine specific demethylase 1, was found to be the enzyme that silences tumor suppressor genes. By combining all this information, drugs were created to test and see if these genes can essentially be "turned back on". The LSD1 inhibitors were then created to decrease the growth of cancer cells in breast cancer. Two different cancer lines were used, MCF7 and MDA-MB-231. Two drugs were also used, BP-107-15 and 5-Azacitidine.

Using six 96 well plates, concentrations of each of the drugs were tested on the cell lines, as well as two combinations of the two drugs together. In total, there were four treatments. Each

treatment had 10 concentrations. To check if the drugs were decreasing cell growth, an MTS assay was conducted. Cell growth was inhibited in the presence of the LSD1 inhibitor, as well as in the DNA methylation inhibitor. In the combination plates, specifically for the MDA-MB-231 cells, a great decrease was shown. The MCF7 cells, however, did not have the same trend; there was a higher decrease in cell growth in the BP-107-15 drug alone versus the cells containing both drugs. There is little to no change in 5-AC aspect. The results show us, also, that all cell lines are different. MCF7 are ER+ and the MDA-MB-231 is ER-; in this case the results are great due to the fact the MDA-MB-231 cells are more tumorigenic. [Acknowledgment: HBCU-UP]

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Chemistry & Chemical Sciences

OA #38

Subcategory: Chemistry (not Biochemistry)

Determination of Moisture Content of Pharmaceuticals Using Karl Fischer Titration

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Sayo O. Fakayode, Winston-Salem State University

High moisture contents may promote harmful microbial activity, resulting in rapid degradation of pharmaceutical products [1, 2]. The conventional methods of moisture content determinations in samples such as thermogravimetry and near-infrared spectroscopy have major drawbacks including, lengthy analysis time, poor accuracy and sensitivity, precluding their utility for moisture content determination at trace or ultra-trace levels. Consequently, Karl Fischer titration (KFT) method is often preferred for the determination of moisture content in pharmaceuticals [3, 4].

This study investigated use of KFT for the determination of moisture contents of pharmaceuticals (BC Powder, Goody's Powder, Prenatal Vitamins, Allergy Relief, Acid Controller, Aspirin, and Children's Chewable Vitamins). The average moisture content of $0.87 \pm 0.04\%$, $0.86 \pm 0.09\%$, $4.14 \pm 0.36\%$, $6.91 \pm 0.61\%$, $6.52 \pm 6.36\%$ were obtained in BC powder, Goody's Powder, Prenatal Vitamins, Allergy Relief, Acid Controller, Aspirin, and Children's Chewable Vitamin, respectively. Overall, the percentage of moisture content determined in the pharmaceuticals were very low, highly reproducible, and within the recommended moisture content in pharmaceuticals. Future study includes the determination of moisture content in more pharmaceuticals and dried food products. References: 1. Wu, C.; McGinity, J. W. *European Journal of Pharmaceutics and Biopharmaceutics*, 2000, 50, 277-284. 2. Maggi, L.; Bruni, R.; Conte, U. *International Journal of*

Pharmaceutics, 1999, 177, 83-91. 3. Lam, P.; Nariman, M. *Pharmaceutical Technology*, 2009, 33, 52-60. 4. Isengard, H.; Haschka, E.; Merkh, G. *Food Chemistry*, 2012, 132, 1660-1663. [Acknowledgment: This study was financially supported by the National Science Foundation HBCU-UP Award #HRD-0927905, US Department of Education, Title III grant to Winston Salem State University.]

Faculty Advisor: Sayo Fakayode, fakayodesa@wssu.edu

OA #39

Subcategory: Chemistry (not Biochemistry)

Biodiesel from Algae Oil (from Dandora Waste Water Treatment Plant)

Nadjitade Badje, Howard University and University of Nairobi

In the context of climatic changes and soaring prices per barrel of petroleum, renewable carbon neutral transport fuels are needed to displace petroleum derived transport fuel, which contribute to global warming and are of limited availability. Biodiesel derived from an algae oil crop is a potential renewable and carbon neutral alternative to petroleum fuel. Examination of the potential of algae from Dandora wastewater treatment plant for production of biodiesel is thus the subject of this research. The algae collected from the wastewater ponds was dewatered, grounded and bio-oil was extracted using hexane through cold extraction and soxhlet extraction method. Then diesel was synthesized via trans-esterification of the algae oil. The calorific value of the biodiesel was determined to ascertain the feasibility of the algae in wastewater ponds to produce biodiesel. 129g of dry algae produced on average 51.065g of oil, hence 39.595g of biodiesel. This is an indication that algae from Dandora wastewater ponds can be harnessed for production of biodiesel. [Acknowledgment: We would like to give special thanks to the following individuals and organization for making our journey a success: University of Nairobi, Howard University, Dandora Waste water treatment plant, The GEAR-UP team and staff, and the National Science Foundation.]

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OA #40

Subcategory: Materials Science

Synthesis and Characterization of Titania Supported Silver Phosphate

Saluta Banks, University of Arkansas at Pine Bluff

Erum Qayyum and John Kuhn, University of South Florida

An *in situ* precipitation method used to place Ag₃PO₄ nanoparticles onto the surface area of TiO₂ is developed to form

a photocatalyst active under visible light spectra. The synthesis of Ag₃PO₄/TiO₂ forms a heterostructured photocatalyst. X-ray diffraction patterns, Physisorption method on the Brunauer-Emmett-Teller surface area, UV-Vis diffusion reflectance spectra and Transmission electron microscopy were characterizations used to investigate the structure and properties of Ag₃PO₄ of TiO₂. To enhance the activity of Ag₃PO₄/TiO₂, heterostructured photocatalyst degradation of methyl orange under visible light irradiation were executed to confirm decomposition. TiO₂ is a photocatalyst that has ability to create an electron hole pair as a result to exposure to the ultraviolet radiation. Therefore, depositing Ag₃PO₄ onto the surface TiO₂ will cause electron-hole separation leading to photocatalytic activity. Qualitatively, the more Ag₃PO₄/TiO₂ concentration in the reaction, the better the decreasing of decomposing organics. *[Acknowledgment: This study was supported, in part, by an NSF REU in the Department of Chemical and Biomedical Engineering, University of South Florida.]*

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OA #41

Subcategory: Chemistry (not Biochemistry)

Nelfinavir (Viracept®) and its Silicon Analogue as HIV-1 Protease Inhibitors: Synthesis and Evaluation

Chynna Blaker, Norfolk State University

HIV is a progressively fatal virus that destroys the human immune system. No cure has been discovered to stop the progress, or eliminate the virus; only a cocktail of drugs is administered to patients, including inhibitors targeting multiple point of the virus's life cycle and also medication to ease the serious side effects of the inhibitors. Due to these inefficiencies, this study has chosen a nucleoside reverse transcriptase inhibitor known as Nelfinavir as an initial point. The study aims to improve the performance of the drug by altering the molecular structure, primarily inserting a silanediol and varying amino acids attached to the structure. These changes and alterations provided 100 different structures to be tested.

Through the use of SYBYL software and Surflex-Dock (addition to SYBYL), construction and theoretical docking to the HIV-1 protease was tested and protein/ligand docking measurements were recorded. Each of the 100 structures obtained a greater docking value to the HIV-1 protease than the Nelfinavir drug itself (2.68 protein/ ligand). After analysis of the collected measurements, there were seven structures scoring over 7.00 protein/ ligand, the highest being structure 3 with Arginine at 8.70 protein/ ligand. In deduction, the silanediol replacement proved to be a structural enhancement, with other alterations providing small changes in outcome compared to each other, however improving all around compared with Nelfinavir.

[Acknowledgment: A thankful acknowledgment directed toward the financial support of the National Science Foundation grant number 0714930, and the Center for Biotechnology and Biomedical Sciences for providing the facility.]

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OA #42

Subcategory: Chemistry (not Biochemistry)

Synthesis and Structure Characterization of an Ionic Tributyltin Complex with Oxalic Acid

Andrei Callejas, University of the District of Columbia

Xueqing Song, Dain Thorpe, and Woldegebriel Yeibyo, University of the District of Columbia

There is a large need for the development of novel metal-based anticancer agents due to the low solubility and high organ toxicity of metal-based compounds such as cisplatin and its analogues. Triorganotin have been well established as having various biological activities including anticancer activity. However, their low solubilities in water may have limited their effectiveness. On the other hand, ionic triorganotin complexes may have improved solubilities due to their partially ionic characteristics. Our hypothesis is that ionic triorganotin derivatives will have better solubility and better activity as potential anticancer agents with reduced toxicity. Synthesis of the ionic tributyltin complexes involve the reaction of oxalic acid, a diprotic carboxylic acid, with bis(tributyltin) oxide in the presence of dibutylamine. One carboxyl group in oxalic acid forms a tributyltin ester with bis(tributyltin) oxide by removing a water molecule through a condensation reaction, while the other carboxyl group reacts with the diamine to form an ammonium salt of the carboxylate. A polymeric ionic tributyltin complex with four Tin nuclei in the repeating monomeric unit was obtained from the synthesis with dibutylamine.

The structure of this complex was characterized by infrared and ¹H/¹³C/¹¹⁹Sn NMR spectroscopies. There are three oxalate groups involved in the coordination to four tributyltin groups. The ionic complex consists of two anionic moieties and two dibutylammonium as the counterions. All tin atoms in the complex have the common trans-trigonal bipyramidal geometry with three butyl groups in the equatorial plane and two O atoms at axial position. Both short and long tin-oxygen distances are observed for all tin atoms in the complexes.

The results indicate ionic tributyltin complexes can be successfully obtained in a condensation reaction of bis(tributyltin) oxide with a diprotic oxalic acid in the presence of an organic amine. Future studies will be focused on a relationship between aqueous solubility and biological activity. *[Acknowledgment: This study was supported by a grant from*

NIH/NIGMS: grant# 1T34GM087172-01A1 - awarded to the MARC U*STAR program, University of the District of Columbia, Washington, DC 20008.]

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OA #43

Subcategory: Materials Science

Preparation of Injectable Therapeutic Microgels to Treat Spinal Cord Injury

Kristopher Crawford, Morehouse College

Juana Mendenhall, Morehouse College

Spinal cord injuries (SCIs) present an overwhelming challenge to persons with limited mobility, agility, and elevated paralysis. These traumatic injuries affect the regions of the spinal cord which house the central nervous systems (CNS) and a vertebral body that includes individual intervertebral discs. Acute SCIs arise when the CNS is injured and produces lipid peroxidase, which initiates free radicals catalyzed by iron in blood in the presence of low pH or oxygen radicals. If SCIs are left untreated, lipid peroxidation (LP) migrates to cells and weakens healthy cell growth and proliferation. Pathophysiology investigations have determined that protection against oxygen radicals can be controlled effectively by employing lipid antioxidants to inhibit LP. In the experimental models of SCIs, lipid antioxidants provide a protection against oxygen radical degradation and LP. To circumvent the oxygen radicals produced from LP in SCIs, we have prepared injectable therapeutic microgels (ITM). These ITM are comprised of two components: a temperature-responsive biomaterial (poly(n-vinylcaprolactam [PVCL]) and an antioxidant. PVCL is a temperature-responsive polymer that can release the antioxidant upon temperature change. ITM were prepared in buffer solutions at 37°C, and the efficacy of the ITM was tested using the FRAP assay and assessed the lipid peroxidase activity. Using the FRAP assay, the ITM reduced iron concentration and increased lipid peroxidase under low oxygen conditions. These are the initial stages towards preparing ITM for spinal cord injuries. [Acknowledgment: NSF (HBCU-UP)]

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OA #44

Subcategory: Chemistry (not Biochemistry)

Photodegradation of Methylene Blue using MPA-capped Cu-doped ZnSe(S) Quantum Dots

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Luis Alamo-Nole, Pontifical Catholic University of Puerto Rico
Sonia Bailón-Ruiz and Oscar Perales-Pérez, University of Puerto Rico, Mayagüez

The photodegradation of organic contaminants in water bodies has become a promising treatment strategy that can be applied to eliminate dyes in effluents of textile industries. Furthermore, using quantum dots (QDs), or semiconductor nanoparticles, as photodegradation catalysts have attracted attention due to their capacity of generating an electron-hole pair, and subsequently producing Reactive Oxygen Species (ROS). The photocatalytic capacity of UV irradiated Cu-doped Zn-based QDs to photodegrade methylene blue (MB) in aqueous phase was studied. Fluorescent QDs with a size of 4 nm were synthesized under the microwave irradiation technique. The QDs at two concentrations (500 mg/L and 1000 mg/L) were used to photodegrade 10 µM solution of MB. The solutions were maintained under agitation at 20 rpm and irradiated at 302 nm using an 8-Watt UV-lamp with 30-minutes intervals for a total of 6 hours. The photodegradation of MB was monitored at 660 nm using a 1200 Agilent High Performance Liquid Chromatography equipped with a diode array detector. An Eclipse XBD-C18 column (pore size of 5 µm) and a mobile phase of 72% deionized water/28% Acetonitrile with a flow rate of 1.0 ml/min were used for the analysis. The MB photodegradation was dependent of the quantum dots concentration and the UV irradiation time. The MB photodegradation efficiency was 39% and 50% using 500 and 1000 mg/L, respectively, of QD. The chromatograms showed the presence of photodegradation products. The results suggest the formation of ROS responsible of the photodegradation mechanism. Accordingly, the QDs could be used as efficient catalysts to degrade organic contaminants in wastewater. [Acknowledgment: This work was financially supported by the National Science Foundation under Grant No. HRD 0833112 (CREST program).]

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OA #45

Subcategory: Chemistry (not Biochemistry)

Extraction of Oil and Polyphenols from Camellia Oleifera Shell and Seed

Angelique Gumbs, Savannah State University

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Green chemistry is the fastest growing alternative processes being produced today. Environmentally friendly substances such as CO₂ have been discovered to be able to replace the harmful solvents used in the extraction process. The problem facing many chemists is the toxicity of the solvents currently used such as hexane and ether. With the use of CO₂, the harmful gas is eliminated, but the yield is lower. The task at hand is to be able to produce more without using organic solvents but instead using CO₂. We hypothesized that the super critical carbon dioxide can increase the quality of oil. It is easy to operate, and

it eliminates the toxicity during the process. The extraction of polyphenols with the assistance of ultrasonic will enhance the yield of polyphenols. We conducted the experiment with traditional solvent extraction and super critical carbon dioxide extraction. Four solvents were used in the organic solvent extraction--ethanol, acetate, ether, and hexane to be compared with the super critical extraction. The shells of the tea oil seed were more useful ground up than the shell pieces in the polyphenol extraction. The powder was used for the extraction, and the time was changed for the purpose of the ultrasonic enhancement. Three different time frames--10 minutes, 20 minutes, and 30 minutes were used with the ultrasonic enhancement to compare the influence of ultrasonic.

Our results showed that the appearance of the oil was lighter when compared with the organic solvent extraction. There was also a difference in the smell of the two. The super critical oil smelled like oil and the solvent extraction smelled like the solvent that was being used. The yield was not as good as the solvent extraction, but by changing the conditions of the super critical extraction such as the temperature and pressure, the yield will be enhanced. The time used for the solvent extraction was approximately 12 hours which explains the higher yield as opposed to the super critical extraction that lasts approximately 3 hours.

With the results from the polyphenol analysis that we have obtained so far, it shows the presence of ultrasonic had a greater effect than without it. In conclusion, we were able to perform a successful extraction of oil using the Super Critical CO₂ extraction method. With future analysis, we know we can change the conditions of the process to produce a higher yield using the super critical method. The ultrasonic also proved to be more effective with less time. *[Acknowledgment: National Science Foundation-MAGEC-STEM Plus Program]*

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OA #46

Subcategory: Astronomy and Astrophysics

Soil Conductivity Analysis of the Formation and Detection of Perchlorate Brines on Mars

Kayla Love, Langston University

Vincent Chevrier and Laura Fernandez University of Arkansas

The Phoenix Mars Lander performed chemical analysis and detected perchlorates on Mars that are most likely to exist as magnesium perchlorate (Mg(ClO₄)₂) and sodium perchlorate (NaClO₄). Mg(ClO₄)₂ and NaClO₄ perchlorates have different hydration degrees and two water phases. These perchlorates are readily soluble in water and lower the freezing point of water. This deliquescent property of these perchlorates may

play a role in controlling Martian soil and atmosphere's water content. Moreover, research supports ambient air moisture contributes to the formation of liquid water on Mars's surface. Deliquescence of perchlorates is dependent on both relative humidity and temperature.

My goal was to develop a technique to enhance detectability of perchlorate brines on Mars. To achieve this, we focused on electric conductivity of perchlorate brines during the liquid phase where both liquid water and perchlorate are stable indicating the deliquescence limit. Palaganite Soil (JSC Mars 1), which is most similar to regolith found on Mars, was used with either 1%, 10% or 20% of Mg(ClO₄)₂. JSC Mars 1 samples were in closed environments surrounded with water to ensure 100% relative humidity and kept at approximately 73°C. Copper electrodes, attached to a micrometer, were inserted into samples. Samples were kept in closed environments surrounded with water to ensure one hundred percent relative humidity and kept at approximately 73°C. To observe conductivity of samples, the amount of resistance was recorded over time.

Results illustrated that recorded resistance and concentration of (MgClO₄)₂ were inversely proportional. Our technique of measuring conductivity of soil may be used to indicate perchlorate brines on Mars. Learning more about the behaviors of perchlorates in a Martian environment will expand research on the past conditions, current conditions, potential for biological life, and preparations for human explorations on Mars. We will use a Mars Simulation Chamber to vary the relative humidity and conduct experiments at lower temperatures with a CO₂ atmosphere to investigate the capability of conductivity in a Martian environment.

[Acknowledgment: This funding was supported by the National Aeronautics Space Administration Grant No. NNX10AN81G, Oklahoma-Louis Stokes Alliance for Minority Participation (OK-LSAMP), Langston Integrated Network College, University Of Arkansas Space and Planetary Science and the National Science Foundation Grant No. 1157002.]

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OA #47

Subcategory: Chemistry (not Biochemistry)

Characterizing the Safety and Efficacy of Fluoride Dental Varnish with Applications for Standards Development and Clinical Relevance

Richard North, Texas Southern University

Fluoride dental varnishes were analyzed to validate a standard method for measuring the total fluoride content of fluoride-releasing varnishes. The purpose of the varnish is to stop cavities from continual growth or to completely

reverse formation. There are wide varieties of fluoride-releasing compounds in a dental varnish. They may contain sodium fluoride (NaF), sodium monofluorophosphate (MPF), amine fluoride (NH₃-F), stannous fluoride (SnF₂), or any combinations of these fluoride compounds. The evaluation method must be capable of analyzing any fluoride present. This validation method is part of a multi-lab International Standards Organization (ISO) standard drafting process. The ISO method needs to accurately determine the quantity of total fluoride in any fluoride varnish as dispensed from the commercial container in an accurate and preferably simple manner. Fluoride measurements were performed by ion selective electrode (ISE) properly diluted within total ionic strength adjustment buffer II (TISAB II). Fluoride ISEs are constructed from single-crystal sections of rare earth fluorides and respond to fluoride ion activity over five orders of magnitude while showing a high selectivity for fluoride over other common anions. Results from the study show that the digestion and measurement techniques proposed are repeatable and suitable for ISO method adoption. The methods were also adapted for the measurement of fluoride varnish release and fluoride uptake into a hydroxyapatite disk (the mineral form of dental enamel). *[Acknowledgment: National Institution of Standards & Technology American Dental Association Foundation]*

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OA #48

Subcategory: Chemistry (not Biochemistry)

Cu-Doped Zeolites for the Oxidative Carbonylation of Ethanol (Methanol)

Ekundayo Platt, Savannah State University

Professor Xinbin Ma and Shouying Huang, Tianjin University, Tianjin, P. R. China

The green chemistry initiative is gaining momentum in the People's Republic of China. Green chemistry or sustainable chemistry is the study and design of chemicals and synthesis processes that reduce or eliminate the use or generation of hazardous substances. Environmentally friendly alkylcarbonates such as dimethylcarbonate (DMC) and diethylcarbonate (DEC) have been discovered to be able to replace the harmful phosgene reagent in the industrial synthesis of polycarbonates and isocyanates. DMC and DEC can also be used as fuel additive, decreasing soot particle release by 10-30% when 5 wt. % of the chemical compound is added to fuel.

The problem facing chemical engineers is the design of an environmentally friendly catalyst that can effectively promote gas phase oxidative carbonylation of ethanol (process that produces DEC) complete with high catalytic activity and selectivity. Zeolites have been discovered as catalytic agents

which promote the oxidative carbonylation of ethanol in the gas phase. Zeolites offer several advantages when compared to other catalyst supports (i.e. activated carbon). The avoidance of chlorine makes Cu-doped zeolites maintain a much longer activity than activated carbon catalysts and will not corrode machinery. The ability of Y zeolite to stabilize Cu⁺ ions through solid state ion exchange has offered a unique field of research in which copper doped zeolites are synthesized for study of their effectiveness in promoting the gas phase production of DMC and DEC.

This project largely focused on the processes for the synthesis and characterization of CuY zeolite with some attention paid to inner workings of the machines used during the synthesis and characterization. We hypothesized that CuY zeolite could be synthesized from the reaction of the protonated form of Y zeolite with CuCl producing CuY and HCl. Experiments performed included the synthesis of the protonated Y zeolite from NaY zeolite and the synthesis of Cu-doped zeolite from the protonated zeolite. It was also necessary to purify CuCl before it could be used as a reagent in the synthesis of CuY. XRD results indicated that all of Cu species were well dispersed. XPS characterization method was used to verify the state of Cu located in zeolite. Pyridine adsorption IR was also used to determine the concentration of Bronsted and Lewis acid sites. Our results showed that all protons from the protonated zeolite had been replaced by Cu⁺ ions. In conclusion, we were able to perform a successful synthesis of CuY zeolite to use for the gas phase production of DEC and DMC.

Future studies would focus on enhancing CuY zeolite to produce optimum catalytic activity and selectivity. Enhancement of CuY zeolite may include increasing the number of Bronsted acid sites to supply more sites for ion exchange with Cu⁺ ions. The mechanism of the solid state ion exchange between HY and CuCl may also be studied to guide the design of the catalyst. *[Acknowledgment: National Science Foundation-MAGEC-STEM Plus Program]*

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OA #49

Subcategory: Chemistry (not Biochemistry)

Regiospecific Lithium-Mediated Sn₂ Benzylolation of a Natural Anthraquinonoid Dye: Producing Eco-friendly Dye for Eco-friendly Fabric

Rajah Singh, Langston University

Julian Silverman and George John, City College of New York

Polylactic acid (PLA) fiber is an attractive newly developed sustainable ecological fiber. In addition to being thermoplastic, producible in less time, and produced from annually renewable

resources, PLA shows mechanical behavior comparable to conventional Polyester and Nylon fibers. Research shows that dyes containing additional -OR groups (R = methyl, alkyl or phenyl) have better sorption onto certain fabrics. Other fabrics, like PLA, do not retain these dyes significantly. The anthraquinonoid purpurin is a natural more polar red dye not retained on PLA. As the sorption of hydrophobic dyes onto biodegradable synthetic fabrics can be improved by substituting non-polar groups for more polar groups, it is possible to develop simple and specific reactions to synthesize natural dye derivatives to replace artificial dyes.

In this study, we aimed to achieve efficient production of a mono di-ether purpurin product. We hypothesized that a general reaction mixture with lithium will produce a regiospecific product, an ether linkage solely on the 2-position. The product from our designed reaction was extracted, dried, and concentrated *in vacuo*. The product was recrystallized in ethylacetate to afford a dark red solid and compared to the general reaction without lithium that served as our control. TLC and ¹H NMR spectroscopy confirmed an ether linkage solely on the 2-position, creating a mono-product with decreased polarity. Results support that our reaction efficiently produced the preferred mono di-ether purpurin product.

In future studies, the sorption of this product on to PLA and other fabrics will need to be assessed and other natural anthraquinonoids & halides maybe be analyzed using our lithium-mediated reaction. [Acknowledgment: National Science Foundation via CENSES REU at CCNY, OK-Louis Stokes Alliance for Minority Participation, and Langston's Integrated Network College at LU.]

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OA #50

Subcategory: Chemistry (not Biochemistry)

Investigation of the Binding of 1-(9-anthryl)-2,2,2-trifluoroethanol with Human Serum Albumin Using Analytical Spectroscopy

Austria Taylor, Winston-Salem State University

Richard Gray and Sayo O. Fakayode, Winston-Salem State University

Accurate understanding of the binding mechanism of chiral drugs on biological samples, including human serum albumin (HSA) is required for effective drug design, drug metabolism and drug delivery to the targets [1-4]. We hypothesized that enantiomers of 1-(9-anthryl)-2,2,2-trifluoroethanol (TFA), a potential chiral drug will bind differently with HSA protein, resulting in enantiomeric drug discrimination. This study investigated the binding of 1-(9-anthryl)-2,2,2-trifluoroethanol (TFA) enantiomer with HSA using Fourier transform infrared

(FTIR), UV-visible, and fluorescence spectroscopy. In addition, the potential utility of fluorescence spectroscopy in conjunction with multivariate regression analysis for the determination of enantiomeric composition of TFA in HSA samples was also explored. The enantiomers of TFA bind differently with HSA, resulting in the formation of diastereomeric complexes of different absorption and emission properties. The developed multivariate regression models from the emission spectra data of HSA-TFA complexes were able to predict the enantiomeric composition of TFA in HSA samples with good accuracy of root-mean-square-relative-error of 5.62%. Future study includes the investigation of the binding of more chiral drugs such as propranolol and Excedrin on HSA samples using analytical spectroscopy. References: 1. Lenz W (1988) *Teratology* 38: 203-215; 2. Jamali F, Mehvar R, Pasutto F (1989) *J Pharm Sci* 78: 695-715; 3. Armstrong DW, Han SH (1988) *CRC Crit Rev Anal Chem* 19: 175-224; 4. Caldwell J (1996) *J Chromatogr A* 719: 3-13. [Acknowledgment: This study was financially supported by the National Science Foundation HBCU-UP Award #HRD-0927905, US Department of Education, Title III grant to Winston Salem State University]

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OA #51

Subcategory: Cell and Molecular Biology

Low Resource Extraction of mRNA using Surface Tension Valves

Lana Thomas, Savannah State University

Nicholas Adams, Rick Haselton, and David Wright, Vanderbilt University

Detection of pathogens can be conducted using nucleic acid-based diagnostics which are specific and highly sensitive. Today, these diagnostics can be performed by using commercially available Rapid Diagnostic Tests (RDT). RDT kits require sample preparation procedures prior to analysis to eliminate potential interferences. However, the procedures often require the use of specialized instrumentation and trained technicians. In a low resource environment, specialized instrumentation and trained technicians are not readily accessible.

Therefore, we utilized a previously developed self-contained nucleic acid extraction cassette suitable for a low resource environment. The cassette contains preloaded solutions separated by air gaps within a continuous length of 1.6 mm inner diameter Tygon tubing. The mRNA binds to the dT sequence of the Dynabeads® Oligo (dT) 25. The beads are then transferred into each pre-loaded chamber of the Tygon tube using an external magnet to wash and elute into the final solution. The efficiency of the cassette extraction was evaluated by quantitatively measuring the mRNA recovery. mRNA was recovered from Lysis Binding Buffer using RNase-free tubes and

the Tygon tubing with 62.75 and 88.00 % efficiency, respectively. Extractions performed using HEP-2 cells shows that mRNA can be extracted from complex backgrounds.

[Acknowledgment: Vanderbilt University, Nashville, TN]

Faculty Advisor: Kenneth B. Williams Jr,
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OA #52

Subcategory: *Biochemistry (not Cell and Molecular Biology and Genetics)*

Characterization of Na⁺-Dependent Dicarboxylate Transporter (NaDC) in Bovine Brain Microvessel Endothelial Cells

Trenton Ware, University of Arkansas at Pine Bluff

Antonie H. Rice, University of Arkansas at Pine Bluff

The delivery of therapeutic drugs to the brain continues to be a challenge for the pharmaceutical industry. The blood-brain barrier (BBB) regulates the influx and efflux of a wide variety of substances, and remains the major obstacle in the delivery of drugs to the central nervous system (CNS). Various strategies have been devised to circumvent the BBB in order to increase drug delivery to CNS. The purpose of this work was to assess the potential mechanistic pathways present at the BBB in bovine brain microvessel endothelial cells (BBMECs) and to demonstrate that active transporters exist at the BBB that may provide alternative routes for delivering therapeutics to the brain that may exhibit poor brain/CNS bioavailability. Previously, we demonstrated the functionality of the following transporters in the BBMEC cell culture system: a) the monocarboxylic acid transporter, and b) the organic anion transporter.

The following work demonstrates the presence and activity of Na⁺-dependent dicarboxylate transporter (NaDC) in BBMEC cell culture system. To characterize the functionality of the NaDC transporter, typical substrates were selected to perform uptake and transport experiments. The NaDC substrates selected were succinate, glutarate, fumarate, α -ketoglutarate, and maleate. Results of competitive inhibitions studies using each of the substrates demonstrate that the transporter is present and functional in BBMECs. Bidirectional transport was assessed and the permeability coefficients were determined in the presence and absence of inhibitors. Future studies will be to determine the specific active isoforms of NaDC transporter and other active transporters in the BBB. [Acknowledgment: NIH Grant Number P20 RR-16460 INBRE Program]

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OA #53

Subcategory: *Chemistry (not Biochemistry)*

Phosphorus Removal From Waste Water: Dandora Waste Water Treatment Plant

Brooke Williams, Howard University

Wastewater contains phosphorus which exists in the following forms; orthophosphates, triphosphates, pyrophosphates and organic phosphates. Phosphorus is a major nutrient for plant growth but excess supply causes eutrophication. The main source of phosphate materials in wastewater is domestic water unlike industrial waters with excreta and detergents being the major source. There are several methods employed in phosphorus removal which include chemical precipitation, enhanced biological phosphorus removal, ion exchange, ultrasonic technology and adsorption. It is hypothesized that these methods will effectively remove phosphorus from wastewater with different levels of efficiencies. This work mainly concerns the employment of chemical precipitation and EBPR where calcium hydroxide, aluminum sulphate and ferric chloride were used. Green discharged waste water and sludge from anaerobic ponds were used as samples. UV spectrophotometer was used for phosphorus level analysis.

This work proposed the need for wastewater phosphorus removal before the wastewater is discharged for agricultural activities and livestock usage. Calcium hydroxide precipitated phosphorus materials faster and more effectively than ferric and alum. This is because as green water was added to the known amount of calcium, it cleared instantly. The levels of phosphorus in the discharged wastewater should be monitored and removed daily before the wastewater is discharged to the river. [Acknowledgment: This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.]
Faculty Advisor: Tiffany Lathan, tlathan@Howard.edu

Computer Sciences and Information Management

OA #54

Subcategory: *Computer Engineering*

Controlling a Robotic Hand Using a Non-Invasive Brain-Computer Interface

Adegboyega Akinsiku, Howard University

The hand is a very important body part. Many daily activities are accomplished via the use of the hands. Unfortunately, some

people do not have use of their hands due to birth defects, illness or amputation. To help people regain the functionality of hands, prosthetic and later robotic arms and hands were developed. The focus of this thesis is the latter: the development of robotic arms and hands. At present, commercial robotic arms and hands usually require the implanting of electrodes in the user's brain to allow them to control the appendage. This method is not only very expensive, but it can also be very dangerous as it can cause infections in parts of the subject's brain. The goal of this study is to build and control a robotic arm and hand using a non-invasive brain-computer interface. We want to find out if this method of controlling a robotic hand is possible and whether it would be efficient. We intend to achieve these goals with the use of two brain-computer interfaces; the OCZ Neural-Impulse (NIA) and the Affectiva Q Sensor 2.0. The project is an ongoing project and results are being updated periodically. *[Acknowledgment: Global Education, Awareness and Research Undergraduate Program (HBCU-UP)]*

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OA #55

Subcategory: Computer Science & Information Systems

Enhancing Node Cooperation in Mobile Ad Hoc Networks

Keenan Bonds, Norfolk State University/Lamar University

Mobile Ad Hoc Networks (MANET) has been a research interest over the past few years; yet, node cooperation has continually been a recognized issue for computer scientists. Because of their lack of infrastructure, MANETs depend on the cooperation of intermediate nodes to forward or send packets to other nodes in the network. If there is no payoff for forwarding packets, the nodes may start to refrain from forwarding the packets of others in order to save their battery life. The main objective is to label the issues of selfish nodes and introduce an algorithm which encourages nodes to evenly distribute their resources, leading to a functional network. The Community Enforcement Mechanism has recently been used to force the cooperation among the nodes and reduce their misbehavior. It only considers a node to be misbehaving if it does not cooperate in the forwarding of packets. If a node is defected, or misbehaving, it defects the other nodes in its vicinity, causing a network breakdown. However, a node may not cooperate because of its early battery depletion; hence, it should not be considered as defected. Therefore, I proposed an algorithm, the Moderate Defection strategy, which is developed with the attention on the level of battery depletion of each node. With this algorithm it is considered that each node has an initial battery power, X , and the energy that it spends to forward one packet is Y . A node can only forward packets for other nodes if it contains enough battery power. Therefore, a threshold value, Z , is set for the battery power of a node. A node can send/forward

packets as long as the battery power of a node does not fall below the threshold value Z . If the battery power falls below the threshold Z , then the node will not be included in the forwarding of packets. Using the Network Simulator 3, I tested and compared the Moderate Defection Strategy against the Community Enforcement Mechanism, using eighty nodes for each algorithm. The results showed that within a 15 second time span, all eighty nodes of the Community Enforcement Mechanism are defected. Only twenty four nodes are defected using the Moderate Defection Strategy. My approach assumes to extend the lifetime of a network, and based on the results from our simulation, this algorithm defects fewer nodes in the same amount of time as the community enforcement mechanism. For future studies, I plan to test the Moderate Defection Strategy using multiple threshold values for each node battery. *[Acknowledgment: This research was supported by a grant from NSF awarded to Kami Makki Ph.D., Director of Computer Science Undergraduate Research, Lamar University, Beaumont, TX.]*

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OA #56

Subcategory: Computer Science & Information Systems

Using Snort Network Intrusion Detection System to Monitor Network Traffic for Predefined Suspicious Activity or Patterns on a Secured and Unsecured Network

Jonnetta Bratcher, Ateneo De Manila / Howard University
LaKeasha Williams, Howard University

Monitoring networks is vital when maintaining solidity with a network. Watching over the entire network allows you to detect hacking attempts, virus infections, configuration problems, hardware problems and a host of other things. Snort is an open source Network Intrusion Detection System (NIDS) that can analyze the traffic and packet logging of an IP Network. Using Snort, we monitored a university's network and a USB Bongle's network to watch for inappropriate traffic. Keeping the NIDS the same, the two networks that were being monitored differed in levels of security. The levels of security on each network altered the amount of activity we encountered. We then use the bait and switch technique which will attempt to draw exploiters in and then redirect them to another host (a honeynet). Given this tool we were able to detect hackers and common exploits and a tactic against them.

We have found that in order to successfully get a hit on a network while using Snort, there are a few factors that we must consider. One, the type of networks that we are connecting the server to makes all the difference, due to the different levels of security. This is vital to the success of your security because it would be redundant to run Snort and the "bait and switch" system on a network that is fully secured. You will receive zero

exploits, similarly to when we ran Snort on the university's network. Second, the amount of servers that are connected to the network increases the availability of the data that is trying to be accessed. If there is only one server connected to the network, it is unlikely that server will receive a hit. What are the chances of one server being exploited out of one-hundred servers? Third, the accessibility of the network that the server is connected to. A hacker will not attempt to gain the data from your server if the longevity of the time connected to the server is not consistent. The hacker will need idle time when trying to get into a server, therefore, an ample amount of connection time will suffice. Lastly, the bait and switch technique offers a simple solution to redirect the exploits away from your system and into another host where you can identify the information of the hacker.

This study was limited in time and servers connected to our network. This project would have produced more results if we had designed a honeynet that emulated web servers in a computer lab and ran our Snort for at least a month's time. *[Acknowledgment: This material is based upon work supported by National Science Foundation (NSF) Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.]*

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OA #57

Subcategory: Computer Science & Information Systems

Morphing Using Particle System in Computer Graphics

Orlando Elias, Grambling State University

Khalid Al-Nafisah, Grambling State University

In this research we present an implementation of morphing which is a special effect technique used for graphics in motion pictures and animations. Morphing consists of gradually transforming one image into another image through a seamless transition (from metamorphosis). In our research, the main goal is to provide detailed instructions on how the morphing works by using particle system in computer graphics. Our research incorporates three processes. The first one involves distorting one image at the same time that it fades into another. The second one marks corresponding particles and vectors on the 'before' and 'after' images. In the last one, both images must have the same number of polygons or triangles to allow correspondence between the particles in source and destination models.

For the approach used in this research, we use Shape morphing in our implementation to explain how morphing works using particle system. Before we can begin morphing, we must load the list of the particles of our objects from an external file.

Afterwards we can perform the morphing of our objects which use three variables: helper, source, and destination objects. The helper object is used to modify the source object into the destination object. When morphing from the current object, it immediately begins to form the helper object and it modifies the particles to match the particles of the destination object. To show the morphing from one object to another, we implement the two methods PARTICLE CALCULATE (int i), which calculates the new position of the particles from the source object to the destination object by performing the calculation of $(\text{source} - \text{destination}) / \text{time steps}$, and PARTICLE TRACE(int i), which traces the particles as it is moving from its current position to its destination position.

We have experimented in seven source and destination models. These models are a sphere, gengen (similar to a pentagon), cube, torus knot, pyramid, random particles and a teapot. The result of this implementation was the successful morphing of objects made of colored particles positions. Future work includes attempting to turn these objects into solid objects, apply more complicated solid objects for source-destination models, and successfully morph those objects. In addition, after morphing using particles, surface reconstruction can be added to form the solid source-destination models. Along with turning the objects into solid objects, we also intend to apply textures. *[Acknowledgment: LSAMP]*

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OA #58

Subcategory: Computer Science & Information Systems

Simulating the Cognitive Networks Using Cloud to Solve Hidden Terminal Problems

Stephen Ellis, Grambling State University

The cognitive radio (CR) is a promising technique to detect and utilize the spectrum holes efficiently. The process includes spectrum sensing, spectrum management, spectrum sharing, and spectrum mobility. In spectrum sensing, the CR must detect primary (licensed) user through sensing methods including matched filter detection, energy detection, and feature detection. The spectrum management includes characterization, selection, and reconfiguration of the spectrum. The spectrum mobility deals with the handoff in CR networks. Hidden terminal problem (HTP) is one of the well-known problems when a node is visible from the access point, but cannot communicate through it. The HTP can be solved using the cloud with cognitive radio networks. In this paper we proposed a method to solve the hidden terminal problem through cloud computing. The idea is that the cloud can store the status of cognitive network, compute, reorganize, and make available the current state of cognitive networks for future decisions. The role of HTP and solution using cloud was discussed in Reddy[1]. The CRN

structure proposed by Reddy [1] was implemented through simulations.

In our simulations, the interface was connected to CRN nodes and CRN cloud (CRNC) black board. The controller receives messages from CRN nodes, schedules messages, and executes needed actions. The hidden node problem and dynamic spectrum allocation are very important in cognitive radio networks. The hidden node problem is eliminated by using cloud, since the CRNC board has current status of CRN nodes. Further, the changes will be triggered automatically using the blackboard structure. The simulations were conducted using 10 cognitive nodes and transferring the packets from one node to any other node. The simulations are visual. The status of each cognitive node and nodes at cloud are updated on real-time. The best path was calculated and appropriate paths were locked to transfer the packets. Since the actions are taken at cloud, the hidden terminal problem is eliminated automatically and clearly seen. The cloud simulation helps to eliminate IEEE RTS/CTS (request to send /clear to send) creation in IEEE 802.11 protocol. The future simulations involve the sudden entry of primary user and cloud security aspects. [1] Y. B. Reddy., *Solving Hidden Terminal Problem in Cognitive Networks Using Cloud*, SENSORCOMM 2012, August 19 - 24, 2012 - Rome, Italy. [Acknowledgment: LSLAMP and CMAST (HBCU-UP)]

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OA #59

Subcategory: *Computer Science & Information Systems*

Computer Simulation of the Side-Load on the Rocket Nozzle

Akima Huggins, Alabama A&M University

The objective of this project is to use computer software tools to simulate and analyze the side-load on the rocket nozzle. Within the past several years the subject of flow separation in supersonic convergent and divergent nozzles has been extremely important research. Today's research has absolutely grown with the interest of rockets, missiles, and other aerospace applications. Flow separation in the nozzle is portrayed as a complex fluid-dynamics happening in the combustion chamber. This results in a shock formation interaction surrounded by the nozzle. Past tests on rocket engines have shown structural damages that have been caused by the transient nozzle side-loads. The most severe side-loads take place during the engine startup and shutdown transient processes as the location of the nozzle flow separation moves from the throat region to the end of the nozzle. It has been found that the side-load on the nozzle may cause system malfunctions and is therefore considered to be a high-risk factor. Even though this is a hardware problem with the root of the side-loads, it is acknowledged that it can be understood and

fixed with the help of computer software tools. To get a better understanding of the situation, it is necessary to understand the physics behind the phenomena and to properly calculate the pressure and its impact on the nozzle in the design phase. Executing this before testing can help resolve the problem by saving money and time. Our current work is designing a Graphical User Interface for a software tool. Future efforts will be using a software program to model and simulate the side-load on the rocket nozzle. This will help understand the side-loads of how they function and how it will affect the nozzle design. [Acknowledgment: This research has been supported in part by the National Science Foundation, Historically Black College Universities-Undergraduate Program, grant #HRD0928904.]

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OA #60

Subcategory: *Computer Science & Information Systems*

Establishing Guidelines for Accessibility of Online STEM Resources

Wade Kellard, Rochester Institute of Technology

Persons with diverse access and communication needs include individuals who are deaf and hard-of-hearing, blind and low vision, and mobility impaired. This presentation will focus on the identification of guidelines for finding accessible websites designed specifically to accommodate persons with access needs. Individuals cannot always access STEM resources on the Web, because resources are often not designed with access in mind. Our solution is building our own online community and curating a STEM media library of resources accessible for persons with diverse access and communication needs. In order to develop this online community, it is necessary to identify what makes online resource media fully accessible. Ultimately, the challenge is to make learning and communication easy for people who access STEM resources online with a website design that incorporates all of the necessary tools and resources to meet accessibility requirements. Other challenges include: how to identify tools to efficiently evaluate websites for accessibility; how to shorten this process, yet keep it efficient and how to find and build websites that are accessible for both deaf and hard-of-hearing as well as blind and low vision users. Our team is conducting a literature review to identify qualities of accessible and credible websites. Following specific rules and criteria, as well as adhering to the W3C 2.0 Web accessibility standards, we have created and established a rubric for the evaluation of websites. This presentation will describe Internet access needs for diverse groups of users, development of our accessible website to date, and examples of accessible STEM resources. Documentation of required guidelines is being created for future team members to follow in the next 4 - 5 years. The process of researching and developing this online STEM media library is

ongoing. In order for a website to be fully accessible, it must receive a "AAA" rating, in accordance to W3C 2.0 standards. Based on the rubric, approximately 40 websites have been rated; 9 of which fail accessibility tests completely, and only 3 of which are fully accessible. The outcome of this research project will create an online community that can benefit anyone with diverse access and communication requirements.

[Acknowledgment: This study was supported, in part, by the Office of the Dean, Rochester Institute of Technology/National Technical Institute for the Deaf, and a grant from NSF (Deaf STEM Community Alliance), HRD-1127955]

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OA #61

Subcategory: Computer Science & Information Systems

Course Curriculum Module for Multidimensional Array and Linked List using Gaming Approach

Antoine Lathon, Bowie State University

The goal of this project is to create course curriculum modules for computer science and mathematics students. Engineering and Mathematic courses are typically considered as difficult by college students and exhibit high failure rate. Through the use of this course curriculum module, students will be able to learn the concepts of multidimensional arrays and linked list better and lead them to better success in the computer science field. The aim is to create Virtual Reality course educational curriculum modules with more inquiry based problem-solving activities and hand-on experiences. The Course Curriculum Module will help students learn new and exciting subjects through the use of trial and error games and demonstrations. Some students like to read material and can easily comprehend the subject matter. There are others who are visual learners and need to see how a process is done in order to fully comprehend a subject. Through the use of the Course Curriculum Module in Virtual Reality, students will be able to utilize tutorials in various subjects in computer science and look through videos and demonstrations that will help them learn in an efficient way.

Our hypothesis is that the use of curriculum modules using gaming approach will lead to better student learning outcomes. We propose to conduct user studies after the gaming modules are created to prove our hypothesis. Our proposed curriculum module use a gaming approach in demonstrating the concepts of Multidimensional Arrays and Linked List. Multidimensional arrays deal with accessing array elements such as removing, inserting and swapping elements, dealing with bound errors, understanding partially filled arrays and other subjects that make up how arrays work (Sorting algorithm and Binary search, copying, sum and average). Linked List will deal with stacks and queues, insertion dealing with the head and the null endpoints of a linked list, inserting new nodes and dealing with an empty

list. Through the use of this gaming approach, it is possible for students to learn in a new, exciting way and become educated in these subjects. We will be conducting user studies to find out if the module will lead to a better learning outcome and if students will be able to grasp the concepts that are presented to them and utilize these concepts in the classroom.

[Acknowledgment: The authors would like to thank the National Science Foundation for supporting the project. This work is funded by the Grant number HRD-1137541 and HRD-1238784.]

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OA #62

Subcategory: Computer Science & Information Systems

Study Data Dissemination Protocol in Wireless Sensor Network Using Motelab

Jonathan McMillon, Virginia State University

Ju Wang, Virginia State University

Wireless sensor networks (WSN) are widely used in military battlefield surveillance, industrial and civilian areas, healthcare applications, traffic control, habitat monitoring, homeland security, and energy management. An important network protocol for WSN is the data dissemination protocol, which is a protocol designed to send a piece of information to the entire network. The research issue is to disseminate the data with minimum waste of transmission. A second goal is to achieve complete coverage within a short period of time. The performance of such protocol need to be studied. This project will evaluate the DHV protocol by both simulation and experiment. The simulation is done through a TOSSIM software package. The TOSSIM simulator compiles directly from TinyOS code, simulating complete programs from application level logic to the network at a bit level. Also Motelab is used to evaluate the same protocol. MoteLab is a web-based sensor network testbed. Our investigation shows that the DHV protocol is more easily controlled with small network size. However as the size of the network exceeds 100, the efficiency decreases significantly. *[Acknowledgment: NSF]*

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OA #63

Subcategory: Computer Science & Information Systems

Virtual Reality Classroom

Jeff Ruffin Jr., Bowie State University

What if there was a way to add more substance to an online class setting? Currently students log in to a school website and read messages left by their teachers and also conduct

discussions and submit assignments with very little interaction. Personally I feel that it is dull and doesn't provide enough interaction between teachers and students that is needed more today. Virtual reality is the answer. It takes advantage of the human senses in a way that allows more interaction which results in more opportunities. The purpose of this project is to use a virtual reality classroom setting as a learning tool for students who are enrolled in online classes. Through the presentation of WorldViz Vizard, students will be able to interact with fellow students and teachers through a server/client feature. On the server side, the entire environment will be displayed in a bird's eye view as well as the position of everyone in the environment. The environment will consist of 8 classrooms with two student lounges with distinct individual textures. On the client side, the user will be able to log into the server as an avatar of choice through a drop box provided to the user. Once logged in, the user will actually be in the environment and view the environment in first person view. They will also see the avatars of fellow students and teachers logged in the environment with a name label popup when their avatar is in view. Gesture action will be implemented for quick visual interaction as well as a chat feature for verbal interaction. So far the results of this project have been promising. The client/server works just as it should as well as the gestures for the avatars. The environment has been put together well and the avatar gestures work as well. Chat features are working properly and are transferred from one screen to another properly. Some problems are the refresh rates of both the server and client while running together and developing a way to conduct gesturing and stop gesturing in an ample amount of time. In closing, research will continue on completing and updating this project for future use of online classes. A richer visual viewing and more interaction using a multi-user virtual environment would be an asset for students to learn and communicate more effectively and provide more opportunities that students on a campus environment would have.

[Acknowledgment: I would like to thank the NSF Division of Human Resource Development for this and future opportunities to present my work.]

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OA #64

Subcategory: Computer Science & Information Systems

Gaming Approach to Learn Arrays In C++

Kim Ta, Bowie State University

Recent studies have observed that humans learn faster from video games than from traditional studies due to the interactivity with the games. Our goal is to create a three-dimensional environment, with a user-controlled instructor that teaches the user how to visually create arrays, and how to practically implement them in C++. This research approach is

innovative because students get more involved in learning via playing a video game. Our approach makes learning more intuitive, easier, and faster than traditional learning methods. While playing the game, the user learns how to create arrays via the 3D environment. The user has two options: tutorial mode and live mode. Tutorial mode demonstrates to users the concept and mechanics of the game while live mode scores the user based on how well they play the game and the amount of times they have been successful on a particular level in the game. The game is scored via how much time it takes to complete the objective, and how many successive objectives have been completed.

The first level of our proposed game teaches how to incorporate the initial components of an array by asking the user to collect the components that make up an array. Upon five successive completions of the objective, the module allows the user to proceed to the next level. The second level teaches how to declare, initialize an array, and how to write information statically inside an array. After the users successively complete the objective five times, the module allows the users to proceed to the next level. The third level teaches how to add elements in an array in a certain position. After the player has successfully completed the level, the next one encompasses out of bound errors in an array. The users are presented with an array, and they have to fill it with the correct out of bound items and data types. Once the users succeed fulfilling the objective five times, they are able to move to the next level. The sixth level in the game incorporates the creation and implementation of character arrays and parallel arrays. *[Acknowledgment: The authors would like to thank the National Science Foundation for supporting the project. This work is funded by grants HRD-1137541 and HRD-1238784.]*

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OA #65

Subcategory: Computer Science & Information Systems

Network Traffic Analysis on Hadoop-based Cloud Computing System

Waled Tayib, Tennessee State University

The increased amount of inter-networked and online services such as text, chat, email, and social networking produce an increased amount of user-generated content and metadata. These data are far too numerous for people working for companies and government agencies to examine and find trends therein. Instead, these organizations rely on analysis of these data by executing data processing tasks on a single-server. The single-server approach is not scalable during analysis of large volume of data at once or managing a few tera or peta-byte network traces simultaneously. Recent advances in cloud computing platforms have expanded the applications

distributed parallel computing. The MapReduce programming model is a software framework that supports distributed computing via implementation of map and reduce functions on large data sets in Hadoop, an open-source cloud computing platform.

Though MapReduce-based Hadoop systems can process petabytes of data, they provide insufficient analytical functionality. In this project, we focus on analysis of network traffic using the MapReduce programming model on Hadoop platform. Network traffic generated in cloud computing platforms contain a lot of information on performance and security of the cloud. In order to provide fast and reliable analysis of network traffic, I have developed a MapReduce program on the Hadoop framework to extract network level features which provides insight into the number of cloud users and amount of traffic generated by each cloud user. Experimental results show that the network traffic analysis on Hadoop can extract information from massive network trace files in the order of few minutes. We also found that the number of nodes on the cluster had a linear effect on the time it took to run the MapReduce program. [Acknowledgment: This study was funded by the NSF Research Initiation Award awarded to Dr. Sachin Shetty, Assistant Professor, Electrical and Computer Engineering, Tennessee State University]

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OA #66

Subcategory: Computer Science & Information Systems

3D Simulated Emergency Subway Evacuation

Titus Thomas, Bowie State University

People catch the train to get around the city for many reasons, and with so many people using subway trains, emergencies are bound to occur. What is important is how prepared everyone is for an emergency situation. The Metro Rail System in the Washington Metropolitan Area has emergency train evacuation procedure posted inside every train. While this does give a general description to passengers how they should evacuate the train, it may not accurately describe the correct way to react in different types of emergencies. One way Metro (or any Train Company) could improve their evacuation information would be to take a group of test subjects, place them in an emergency train scenario, and observe their reaction to find possible design flaws in train structure and procedure. Of course it would be very costly and unethical to subject others to hazardous conditions; however, that would not be the case if the tests were done in a Virtual Environment. With a virtual environment many people can safely participate in a variety of cost-free tests that would give very helpful results to train companies. This research project is done using the Unity 3d Game Engine.

Multiple players can connect to a host server which allows groups of testers to interact with each other as opposed to only having computer controlled players. There are also computer controlled characters that will be evacuating with the players, this will help simulate crowded subway stations. When the evacuation starts, all players and bots will have 90 seconds to evacuate the area. Once the 90 seconds are up, the event will be over and the total number of casualties and escaped will be finalized. Additionally, there will be different test environments that include but are not limited to, a gunman, an earthquake, a bomb, and a gas leak. This application will provide Subway Rail systems with a convenient and useful method to test possible emergencies in their station without putting anyone in actual danger. The 3D Environment combined with real-time events and statistics provide the tools necessary to test the safety of their system.

The project is not yet complete, however, the overall structure and objectives are clear and ready to be implemented. The exciting thing about this type of project is its flexibility and portability. It can be run from different operating systems and scenarios can be added without much effort such as a train collision, a fire, or even flooding. [Acknowledgment: The authors would like to thank the National Science Foundation for supporting the project. This work is funded by grants HRD-1137541 and HRD-1238784.]

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OA #67

Subcategory: Computer Science & Information Systems

Using Ubuntu Operating System and Snort Intrusion Detection System to Monitor Network Traffic for Predefined Suspicious Activity on Secured and Unsecured Networks

Lakeasha Williams, Howard University

Jonetta Bratcher, Howard University

Network intrusion detection systems are an important part of any network architecture. They help monitor network traffic, detect for any suspicious activity and report it back to the system administrator. Ubuntu, which was used in this research, is a Linux based computer operating system. Ubuntu is composed of many software packages, and the majority of them are distributed under a free software license. The Snort Intrusion Detection System (IDS), which was installed onto Ubuntu, is an open source network intrusion prevention and detection system. It has the ability to perform real-time traffic analysis and packet logging on Internet Protocol networks. As Snort is run, packets of information come into a network's router from the Internet, and later go through the IDS. The IDS then looks through every little piece of information in each packet and finds any type of attack information, or signatures. If

the IDS finds any, it will set up a flag and log the information into an alert file, which can then alert the network administrator of the attack. However, it does not block the attack, that is what firewalls are for.

In this research project, Snort was installed on two Ubuntu operating systems. One system was run under a Philippine Internet Service Provider, Globe Telecoms dongle, which is an unsecured network. The other was run under the Ateneo de Manila University network, which is a secured network. The Snort on each system was configured with the maximum sensitivity level. The unsecured network used a Point-to-Point Protocol network interface while the secured network used an Ethernet network interface, which was indicated in each file. Snort began running, and all activity was being logged into a syslog file and any attacks to the networks were flagged and logged into the alert file. Snort was run on both networks for four days. After the IDS was stopped, the results were examined, allowing the ability of comparing the activity being logged in both. The majority of Philippine networks, whether private or public, are behind a type of Network Address Translation (NAT).

As a result, the security of the computers within the networks is substantially improved as shown by the low hits detected by Snort. Therefore, there were no hits detected by Snort. Other networks that are not behind NAT would encounter a larger amount of attacks. This is a classic performance versus security penalty. No further research will be done on this experiment. *[Acknowledgment: This material is based upon work supported by the National Science Foundation under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.]*

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Ecology, Environmental and Earth Sciences

OA #68

Subcategory: Astronomy and Astrophysics

Improving the Prediction of Geomagnetic Storms with WSA-Enlil

Tasha Adams, Norfolk State University

NOAA's goal of creating a "Weather-Ready Nation" means addressing a wide variety of weather problems like storms over land, water, and in outer-space. The Space Weather Prediction Center (SWPC) provides 24/7 surveillance for geomagnetic and solar radiation storms, as well as radio blackouts. These storms

can cause wide spread damage like power systems blackouts, communications outages, spacecraft operations disturbance and damage, and pipeline corrosion. Recently SWPC started to use WSA-Enlil to better improve the prediction of geomagnetic storms. This is used to model the propagation of Coronal Mass Ejections (CMEs) and create a 3D forecast for its arrival at Earth. These CMEs can take up to 4 days to reach Earth and are the cause of the most significant geomagnetic storms. It is for this reason that CMEs are the main subjects of this study. In this project we are working on "Improving the Prediction of Geomagnetic Storms with WSA-Enlil."

Through this study, recent CME events will be analyzed by observing a WSA-Enlil model run, real-time ACE satellite data, and global Kp data. These three different data sets will provide information on the predicted impact of the event at ACE (WSA-Enlil), the actual impact of the event at ACE (ACE satellite's SWEPAM and MAG instruments), and the resulting geomagnetic deviation from the normal daily activity at Earth (global Kp data). For each event, key data will be observed to see if there is a correlation between WSA-Enlil predictions and the geomagnetic activity at earth. There was a small relationship found between the prediction and the storm intensity.

As a result, further investigation will be done to identify how WSA-Enlil can be used to predict storm intensity and duration. This is important because since this model is in its early stages of use, it is only being used to predict storms arrival times. However, NOAA customers would also like to know how to prepare for the expected storm. Some CME events are small enough to not cause any damages to property; however, larger events can cause damages like those found on March 13, 1989 that caused the massive blackout in Quebec, Canada. If people could know the strength (or intensity) of the storm and the length (or the duration) of the storm, they can be better prepared for the storm. As a result, this project fulfills the requirements for helping NOAA with its goal of having a "Weather-Ready Nation." *[Acknowledgment: Educational Partnership Program - National Oceanic and Atmospheric Administration (NOAA); Space Weather Prediction Center-NOAA.]*

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OA #69

Subcategory: Water

Photooxidation of Hg(0) in East Fork Poplar Creek, Oak Ridge, TN

Marian Alicea, Southern Polytechnic State University /Oak Ridge National Laboratory

Mercury (Hg) is a global contaminant resulting from various industrial and mining activities, which can bioaccumulate in aquatic and terrestrial foodwebs. A unique Hg contamination problem occurs in Oak Ridge, TN, in association with the production of materials used in thermonuclear fusion weapons 50 to 60 years ago. Understanding the biogeochemical cycling of Hg in the environment is of particular interest to investigators at Oak Ridge National Laboratory (ORNL). The phototransformation of Hg is a major pathway of Hg cycling in the environment. Photooxidation of Hg(0), which has been largely ignored in the past, plays an important role in Hg cycling in East Fork Poplar Creek (EFPC) near ORNL. Our research examines the photooxidation of Hg(0) in EFPC, because this process contributes to production of Hg(II), a form of Hg that microbes can easily convert to methylmercury. Methylmercury, unfortunately, is the most toxic form of Hg, because it can readily cross the blood-brain barrier in the human nervous system. To study the photooxidation of Hg(0), we exposed artificial and creek water samples to simulated sunlight after they had been spiked with Hg(0). The EFPC water was collected from two locations in the stream. The concentrations of Hg(0) and total Hg were measured through time using a Lumex mercury analyzer. We found that Hg(0) photooxidation followed pseudo-first-order kinetics, with a half-life of 1.1 h. To probe the reaction mechanism, we treated the creek water samples with 0.1% propanol (a hydroxyl radical quencher), 0.2M sodium azide (a singlet oxygen quencher), and by lowering the concentration of dissolved oxygen to near zero. Both hydroxyl radicals and singlet oxygen seemed to contribute to Hg(0) photooxidation. By understanding Hg photooxidation, researchers can better characterize the Hg cycle in the EFPC system, and likely provide insights for future remediation of contaminated streams. *[Acknowledgment: This research is sponsored by the U.S. Department of Energy (DOE) Office of Science, Biological and Environmental Research, Subsurface Biochemical Research Program. ORNL is managed by UT-Battelle, LLC for US DOE under contract DE-AC05-00OR22725.]*

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OA #70

Subcategory: Plant Research

Analysis of Lipid Biosynthetic Enzymes in Tobacco Using Bimolecular Fluorescence Complementation (BiFC) Assay

Jamil Baskett, Fort Valley State University, Center for Biotechnology

Shin Gene Kang, Jan Jaworski, and Donald Danforth Plant Science Center, St. Louis, MO

Proteins are involved in almost all biological functions in cells. While many proteins accomplish their functions autonomously, most must interact with other proteins to carry out their role. To

identify protein-protein interactions, we used Bimolecular Fluorescence Complementation (BiFC) assay, which is based on the association of two fragments of a fluorescent protein that are fused to interacting proteins. When proteins interact with each other, a complex is formed that leads to the association of the two fluorescence fragments. Recently, we tested a series of *Arabidopsis* homologues of lipid biosynthetic enzymes from developing seeds of *Ricinus communis* (Rc) by membrane-based yeast two hybrid (Y2H) assay (Kang et al. unpublished data). To validate the interaction in plants, BiFC analysis was used; however, several positive interactions found in Y2H could not be confirmed by BiFC analysis. We hypothesize that some protein-protein interactions may be time-dependent.

Therefore, we designed a time course experiment to observe protein complex expressions in tobacco leaves over four days after infiltration and determined protein interactions using confocal microscopy. Our results suggest that RcOLE interacts with either RcPDAT or RcDGAT with weak Yellow Fluorescent Protein (YFP) expression only in the early stage after infiltration. This data suggest that the expression of reconstituted YFP may be reduced due to destabilization and degradation of these proteins over time. *[Acknowledgment: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA 31030.]*

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OA #71

Subcategory: Climate Change

Investigation of Causes of the Severity of the 2011 Thailand Floods

Ahna Beruk, Howard University

Thailand, among the top five flood-affected countries in Asia, has the highest rate of increase in flood frequency when compared to its neighboring countries. From July 2011 until January 2012, Thailand endured its most devastating floods. Records show that Thailand's tropical wet and dry and tropical monsoon climate predisposes the region to flooding. This investigation revealed that in addition to a dramatic increase in rainfall in June 2011, other factors contributed to the long-term inundation of the country. The causes can be divided into initial reasons for flooding: land development without drainage capabilities, lack of preparation and factors that prolonged the floods community conflicts, and slow decision making. Regulation of construction and proper management of current water management facilities will minimize or prevent devastation of future flooding. *[Acknowledgment: This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this*

material are those of the author(s) and do not necessarily reflect the views of NSF.]

Faculty Advisor: Tiffany Lathan, tlathan@Howard.edu

OA #72

Subcategory: Environmental Engineering

Optimization of Anaerobic Digestion under Mesophilic and Thermophilic Conditions

Joshua Brown, Howard University

The world in the 21st century faces problems due to growing energy consumption and diminishing fossil fuel supplies. It is necessary that we begin to consider innovative resources. Methane is a naturally renewable and economical source of energy. The gas shows much promise as alternative energy, hence the need for its optimization which can be utilized at Waste Water Treatment Plants. The main objective of this study was to optimize the anaerobic digestion of waste water and determine which variation of inoculum, temperature, and substrate/inoculum ratio would enhance the biogas production. Biogas production was evaluated at mesophilic (37°C) and thermophilic conditions (55°C).

The substrate (sewage wastewater) was mixed in a 500 ml flask with an inoculum (sludge or rumen fluid) in the substrate/inoculum ratios 1:1, 1:3 and 3:1 (volume by weight or volume by volume). The 1:1 ratio at mesophilic conditions was used as the constant of our experiment. Nitrogen was bubbled through the mixture to create anaerobic conditions. They were connected to a 100 ml syringe used for gas collection. Flasks were set in a water bath for twenty four hours with agitation at two-hour intervals (flasks remained un-agitated in the night time). The gas collected was noted after each agitation. The pH of the mixtures was measured before and after the digestion to ascertain if there was any inhibition due to pH. At mesophilic conditions, the 3:1 ratio for both inocula produced the most biogas in the period of 24 hours and the 1:1 ratio produced the least biogas. This could be explained by the fact that the bacteria had enough food in the short-term digestion. When the rumen fluid was used the 3:1 ratio produced a volume of 20 ml, higher than when sludge was used in the same ratio. At thermophilic conditions the sludge using 3:1 substrate/inoculum ratio had the highest biogas produced (58 ml), whereas rumen fluid at 1:3 ratio had the most biogas produced (66 ml).

In the objective to optimize anaerobic digestion, it can be said that further trials needs to be conducted on the use of Rumen fluid at a 1:3 substrate/inoculum ratio at Thermophilic conditions. These conditions should be recreated and applied to a large scale/long term design. *[Acknowledgment: This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions,*

findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.]

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OA #73

Subcategory: Plant Research

Ethnoveterinary Treatment of Horses by the Great Sioux Nation

Sunshine Claymore, Sitting Bull College

Karen Walker, Missouri Botanical Garden, St. Louis, MO

Through the observations of the natural world around them, many Native American societies have accumulated an immense knowledge of how to utilize their surrounding fauna and flora for food, medicine, shelter and clothing. Not only did these societies use native plants for themselves, but for their domesticated animals as well. This study focused on the native plants used in ethnoveterinary treatments of horses by the Lakota (Sioux) People of the Standing Rock Indian Reservation located in South and North Dakota. No known ethnoveterinarian study of this nature has previously been conducted on the Standing Rock Indian Reservation.

This research project had three main goals: 1) to discover and document native plant preparations of ethnoveterinary treatments used for horses through a literature review and interviews from elders and other community members, 2) to collect and voucher the native plants discussed in the literature review and interviews, and 3) to make this body of knowledge accessible to the community. In the 18th century, horses were introduced to the Sioux People by the Cheyenne. Horses quickly became adopted into the Sioux society as they realized the horse's capability for transportation as well as being able to cover long distances. Owning horses allowed this great nation to span across a greater region, following the buffalo into the Great Plains during summer hunts. The use of the horse revolutionized the economy of the Sioux People. Although the Lakota People no longer use horses as they once did, they continue to play a valuable role in their society as they are used on ranches, memorial rides, and most recently as a therapeutic tool to assist behavioral and mental disorders.

During the summer of 2012, we conducted a literature review to access available knowledge of native plants used in ethnoveterinary treatment of horses as well as interviews of enrolled tribal members about how native plants were used in this process, i.e. identification of plant, parts of the plants used, and how they were administered. Sixteen plants were documented from the literature review and interviews as being used by the Lakota People to treat horses for distemper, wounds, sore muscles, urinary tract infections and other

ailments. All plants documented from the literature review as well. [Acknowledgment: National Science Foundation, Missouri Botanical Garden, Sitting Bull College]

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OA #74

Subcategory: Geosciences and Earth Sciences

Data Analysis of Tybee Island's Beach Profiles

Jennifer Colley, Savannah State University

Beaches will display certain characteristics depending on the season or time of year because beach sediments are being constantly moved by currents and breaking waves. It is important to note how the shore is changing by observing the typical patterns of a beach for each season, by comparing it to previous years, and by studying the beach profile which is a cross section of the beach along a line that is perpendicular to the shoreline. In this study, the three Tybee beach profiles are observed in January, February, April 2012. After data is collected and documented, the coefficient of determination equation and the correlation coefficient equation are used to determine if there is a correlation between each data set. The major finding of this study is that Tybee Island does show typical storm and swell profiles as hypothesized. For the future study, we need to collect the data in January, February, April 2013 to see any changes in time series. [Acknowledgment: National Science Foundation]

Faculty Advisor: Sujin Kim, kims@savannahstate.edu

OA #75

Subcategory: Pollution/Toxic Substances/Waste

Inoculates and Their Effects on Anaerobic Biogas Production at Dandora Wastewater Treatment Plant

Kinyata Cooper, Howard University

Anaerobic digestion has played an important role in wastewater treatment for its ability to transform organic matter into biogas (most importantly methane gas). At the Ruai Wastewater Treatment Plant in Kenya this technology is found in the form of anaerobic ponds. In this study, we will try to improve Ruai's method by researching the sustainability issues that occur when constructing a functional anaerobic digester on a large scale. Here, wastewater will undergo anaerobic digestion using two inoculums--sludge and rumen fluid--to test which has a higher yield of biogas production. Using the batch process, two 210L anaerobic digesters were designed and connected to two 100L drums in order for more feed to be added in long term use. In

the duration of three days the tanks were agitated and monitored at mesophilic conditions to determine the how much biogas was formed.

In this study, the Rumen fluid produced more boigas than the sludge as predicted; rumen fluid produced .617 g biogas and sludge produced .229g. [Acknowledgment: This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.]

Faculty Advisor: Tiffany Lathan, tlathan@howard.edu

OA #76

Subcategory: Plant Research

Testing and Analyzing Tomato Flavors for Commercial Production

Kareem Council, Fort Valley State University

Harry Klee, Horticultural Sciences Department, University of Florida

Sugars, acids, and volatiles with texture, taste, and favor play an important role in the flavor of tomatoes. When talking about taste, the type of tomato is important. The best tomato for commercial use must have the right size, roundness, color and grow well in the field. Previous research has determined the biochemicals important for good flavor. The hard problem with finding the best tasting tomato is that every person has their own opinion on taste. To try to get a spectrum on different peoples taste, a series of taste panels were done. These taste panels were rated from -100 to 100. During these taste panels, one can analyze how people rate the different types of tomatoes. We worked on 22 different varieties of tomatoes. We tested the sugars, acids, and volatiles of the tomatoes to find the best tasting one. When looking for a good tasting tomato, the amount of sugars and acids in the tomato has a huge impact on taste. To find the best tasting tomato, we harvested them and measured the sugars, acids, and volatiles. We found the best tasting tomato for commercial use.

In conclusion, we found three out of the twenty-two tomato varieties with high sugars, acids, and volatiles. These varieties also had large fruit and grew well in the field. These three varieties was the Flora-Dade x Wisconsin 55 progeny 13 (FW13), Wisconsin 55 x Flora-Dade progeny 46 (WF46), and Wisconsin 55 x Flora-Dade progeny 6 (WF6). Further studies will be done on the agronomic properties and taste of the tomatoes. [Acknowledgment: This study was supported by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Director for the Center for Biotechnology, Fort Valley State University, Fort Valley, GA 31030.]

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OA #77

Subcategory: Chemistry (not Biochemistry)

Investigating Termite Behavior and Digestion of Cellulose-Based Nanofibers to Determine Cellulase Activity

Arishaun Donald, Morehouse College

Termites provide a model system for illustrating how wood cellulose degrades throughout its gut. The analysis of the digestive process of termites can be used as a potentially cost and energy efficient model for the large scale manufacturing of bio-ethanol from cellulose. Our research entails feeding reticulitermes species worker termites a combination of cellulose and temperature-responsive fibers, known as poly (N-vinyl caprolactam)[PVCL]-cell, labeled with the fluorescent tag dichlorotriazinyl aminofluorescein (DTAF) which helps detect cellulase enzyme activity. Specifically, it involves exploring the difference between two different combinations of PVCL/cellulose used to map digestion and sample preference in termites. We hypothesized that the termites used in our study would consume the samples and have a preference for one over the other.

The procedure for this experiment consisted of four phases: hydrolyzing cellulose acetate fiber into a cellulose fiber, conjugating DTAF to PVCL/cell sample, conducting the feeding experiment, and fluorescent microscope imaging. Data was collected based upon preference and consumption by weighing the termites at three, six, and every twenty-four hours following their exposure to the PVCL/cell samples until experimentation ended, as well as the recording of the toxicity (mortality rate) of the PVCL samples in correlation to the number of termites that died during experimenting. The consumption and preference of the termites were detected through fluorescent microscope imaging to compare DTAF intensity in the termite gut for both PVCL-cell fibers. DTAF fluorescent imaging showed cellulase activity was easily detected within the mid- and hind portion of the abdomen after 30 hours of consumption. PVCL-2 yielded the lowest change in weight and PVCL-2 yielded the lowest mortality rate.

This study suggests that termites preferred PVCL-2 versus the other samples. Our future experiments consist of determining the cellulase digestion in the gut at various temperature changes. [Acknowledgment: This work is funded by the Morehouse Wide Initiative for Sustainable Energy (HBCU-UP/ACE 1043330) and the Howard Hughes Medical Institute.]

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OA #78

Subcategory: Ecology

Converse of Bergmann's rule supported in Male Slevin's Bunchgrass Lizards, *Sceloporus slevini*, from Southeastern Arizona

Brooke Ellison, Virginia State University

Ivan V. Monagan and Christian A. d'Orgeix, Virginia State University

Bergmann (1847) proposed that populations living in cooler climates should show an increase in body size when compared with conspecifics in warmer climates. This phenomenon has been labeled Bergmann's rule and applies to widespread species at higher elevations or more northerly latitudes. The logic behind the rule is that larger animals have a smaller surface area in relation to volume which increases their ability to retain heat and maintain homeostasis. There is widespread support for this rule in endotherms, animals which are able to thermoregulate without the assistance of external temperatures; however, its application to ectotherms, animals which thermoregulate by external temperatures, remains controversial. We hypothesized that ectotherms should show the converse to Bergmann's rule because a small surface to volume ratio hinders assimilation of heat necessary for an ectotherm to carry out its metabolic activities.

To test this hypothesis we measured variations in the body size of male Slevin's bunchgrass lizard, *Sceloporus slevini*, from high, mid and low elevation populations in southeastern Arizona. Data on individual snout-vent length (mm), site location, GPS location, and sex of lizards were taken. We found statistically significant differences in size between high, 2750 m above sea level, and low, 1450 m above sea level, elevation populations. Low elevation populations showed larger body size in comparison to their high elevation conspecifics. We conclude that the converse of Bergmann's rule is supported by male *S. slevini*. The most parsimonious explanation for this support is the physiological basis for heat assimilation in ectotherms.

Future research will focus on the rule's applicability to female *S. slevini* which have the added confounding variable of large body size being associated with an increase in fecundity.

[Acknowledgment: We thank the National Science Foundation HBCU UP program for supporting this research. K. Johnson and T. Mathies assisted in the field and provided valuable discussion.]

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OA #79

Subcategory: Ecology

Solar Farm Effects on Eastern Box Turtles (*Terrapene carolina carolina*) Home Range

Jasmin Jenkins, Southern University at New Orleans

Timothy Green, Brookhaven National Laboratory, NY

Eastern box turtles (*Terrapene carolina carolina*), one the most common terrestrial reptiles in the eastern United States, are a k-selected species with a conservation status of vulnerable. According to the IUCN (International Union for Conservation of Nature) red list "eastern box turtles have an ongoing decline that exceeds 30% over three generations." One of the many causes of their decline is habitat destruction. At Brookhaven National Laboratory, 200 acres of land, which is home to box turtles, was converted to a solar energy farm. As part of a preliminary study, box turtles were captured inside the solar farm to study the effects it may have on their home range. It is expected that the turtles will not make great use of the solar farm, they will leave the farm to the forest areas surrounding it. Using 6 turtles from a previous study and 20 new turtles, their home range was studied using radio telemetry equipment, a global positioning system unit and Arc GIS software.

Observations showed the 6 turtles from the previous study had an average home range between 0.3-1.7 hectares. Of the 14 turtles initially caught inside the solar farm, only 1 move backed into the area. This may be due to the lack of vegetation, cover and food available to them. The turtles traveled in the forest surrounding the solar farm. This being the first year of a multi-year project, further research will be conducted to gain detailed information on the turtle's use of the solar farm. This research is important, because it gives insight in how the solar farm construction impacted habitat in wildlife. [Acknowledgment: This study was supported, in part, by the Office of Educational Programs at Brookhaven National Laboratory, Department of Energy.]

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OA #80

Subcategory: Geosciences and Earth Sciences

Sources of Environmental Risk to Human Populations Across the Caribbean: Potential Use of Remote Sensing

Milica Jevtic, New York City College of Technology, The City College of New York (CUNY)

Charles Vorosmarty, CUNY

To support the well-being of the society, people rely on the environment for wide variety of resources and services, among

which are those that provide protection from climate extremes and other natural hazards. Degraded ecosystems and loss of such services can have catastrophic effects on humanity. In order to prevent damage and loss, timely response is necessary when extreme weather and hazardous events occur, and, therefore, reliable monitoring, early warning, and strategic planning systems are needed. To do so requires first an identification of the critical geophysical and socioeconomic sources of environmental risk to human populations. In our study, we focus on the Caribbean region and analyze more than 80 variables over the period from 1968 to 2011. Systematic linear and multiple linear regression analyses have shown that a combination of both physical and social science variables results in the highest risk and that areas where ecosystems are stressed are subject to higher threats. We have identified the critical components of risk: population density, GDP, forest area, permanent cropland and average yearly precipitation as the best indicators of potential damage. These variables hold the potential for being monitored through high resolution satellite imagery and data, and we explore its potential use in the strategic planning context of weather-related hazards reduction. [Acknowledgment: This study was supported by the National Oceanic and Atmospheric Administration Cooperative Remote Sensing and Technology Center (CREST) under the grant #NA11SEC4810004 and the National Science Foundation CREST Research Experience for Undergraduates grant: AGS-1062934.]

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OA #81

Subcategory: Ecology

Pattern Polymorphism Expressed in Slevin's Bunchgrass Lizard, *Sceloporus slevini*, in Southeastern Arizona

Kelsey L. Johnson, Virginia State University

Color or pattern polymorphism, the occurrence of two phenotypic morphs in a species, is hypothesized to be important in species' range expansion, resistance to extinction, co-evolution of multiple traits, as well as reproductive isolation and speciation. *Sceloporus slevini*, Slevin's Bunchgrass lizard, is one of the few lizard species to exhibit pattern polymorphism. This small lizard is restricted to the Sky Islands and adjacent plains of Arizona and New Mexico in the United States, and in the Sierra Madre Mountains of northern Mexico. In this species one morph displays a 'normal pattern' with black dorsal markings and a rarer 'unicolor' morph lacks this dorsal pattern. Although previous studies have documented the existence of pattern polymorphism in this species (Anderson 1972, VanDevender and Lowe 1977), small sample size and variable results have resulted in a lack of clarity on the universality of this phenomenon. We test the hypothesis that pattern polymorphism should be displayed throughout populations of this species in Arizona.

Understanding the occurrence and role of polymorphism within a species is important because of a lack of information of this phenomenon.

To test this hypothesis, we sampled individuals from three high elevation populations in the Huachuca and Chiricahua mountains and two low elevation populations in the San Rafael Valley and Sonoita Plain in Arizona. Data collected included: site, GPS location, lizard sex, snout-vent length and morph pattern (normal or unicolor). We collected data from lizards in five populations. We found that the three mountain populations contained both morphological patterns; however, the two low elevation populations lacked individuals displaying the unicolor morph. Of the 225 lizards from populations displaying both morphs, approximately 20% were unicolor. Our data agree with previous studies (Anderson 1972, VanDevender and Lowe 1977) documenting the occurrence of the unicolor morph constituting 14-20% of the population. We conclude pattern polymorphism is widespread, but not universal in populations of *S. slevini*. These findings enable us to more specifically address the role and genetic or environmental basis of this polymorphism in future research. [Acknowledgment: We thank I. Monagan, B. Ellison, T. Young and T. Mathies for help in the field. L. Kennedy and the Audubon Appleton-Whittell Research Ranch provided logistic support. This study was supported in part, by a grant from NSF/HBCU UP, to Dr. Christian d'Orgeix, Department of Biology, Virginia State University, Petersburg, VA.]

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OA #82

Subcategory: Microbiology/Immunology/Virology

Impact of BP Oil Spill 2010 on Atlantic Croaker and the Intestinal Microbes

Gawain Kiffin, Southern University at New Orleans

Illya Tietzel, Department of Natural Sciences, Southern University at New Orleans

Natural as well as man-made oil spills are catastrophic for marine environments, significantly for fish. The Atlantic Croaker lives in the Gulf of Mexico where the spill occurred. As a bottom feeder fish, it might be exposed to both dispersed oil and oil deposited at the sea bed. Ingested oil and oil microbes are influential on the intestinal microbes of the Croaker.

Alcanivorax borkumensis can metabolize oil and was found at spill sites. Thus, it is hypothesized that transfer of oil degrading alkB1 gene from oil spill microbes to intestinal microbes of fish occurred after the BP oil spill. In an effort to study this hypothesis techniques such as cultivating microbes, Real Time PCR, Microbial DNA isolation and Analytical Gel electrophoresis were done. The oil spill microbe *Alcanivorax borkumensis* was grown *in vitro* and PCR was used to detect presence of alkB1

gene using a fecal DNA isolation Kit and a Microbial DNA isolation kit. Primers designed specifically for the alkB1 gene was used to perform the Real Time PCR. The specimens captured in September 2010 were dissected and their feces removed. *Alcanivorax borkumensis* was placed in feces to establish the detection limits of the PCR. The DNA isolation kits were used to isolate the microbial DNA from the feces. PCR with primers specific for alkB2, another gene responsible for the catabolism of oil (present in *Alcanivorax borkumensis* and other oil microbes), along with Analytical gel electrophoresis, showed positive indication for the presence of alkB2 in feces which was not artificially introduced to oil microbes.

Future research will investigate the testing specimens from October and November of 2010 for the alkB1 gene. Primers for alkB1 will be redesigned to give PCR products of 200bp. Inverse PCR followed by the sequencing of the alkB1 gene as well as TA cloning will be done. [Acknowledgment: The research was sponsored by NSF MCB-1051237.]

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OA #83

Subcategory: Ecology

Identifying and Developing Sustainable Local Strains of *Apis mellifera* for the Urban Mid-Atlantic Region.

Sean McKenzie, University of District of Columbia

Mohamed A. Elhelu, University of the District of Columbia

Antoinette Burnham, Maryland State Beekeepers Association

Losses of the honey bee *Apis mellifera* colonies in North America have reached catastrophic levels in recent years. Between 2006 and 2011 an average of 33% of managed colonies have failed. This has severe impact on human food supplies and the viability of non-agricultural green space. To ensure the presence of the pollinators necessary for the health of urban habitats, the present study attempts to explore how we can develop bees that are more adapted to densely populated green space in the Mid-Atlantic region. Previous studies indicate that desirable genetic Varroa mite resistance characteristics can be increased in the overall honey bee populations through the introduction of queens which freely mate with unselected drones. It is of interest to investigate whether we can increase the overall viability of local bee populations by identifying queens with a track record of good local adaptation, free-mating their daughter queens and developing managed colonies with these characteristics. Queen bees were acquired from local feral and commercial sources. Local feral strains were acquired by removal from multi-year colonies in buildings and tree cavities as well as from swarms. These represent strains that have survived over numerous seasonal cycles with minimal or no human intervention. Initial results indicate that locally sourced queen bees enjoyed a higher winter survival rate (100%) than their

commercial counterparts (40%). The small sample size and limited duration of the project makes these results preliminary. The performance of the daughter queens is essential in determining the persistence of the desirable traits that allowed the feral bees to survive with no human intervention. The objective of our study is to examine the survival rate of the commercial and feral strains and compare them with crowd-sourced survival and management data. [Acknowledgment: HBCU-UP STEM Center]

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OA #84

Subcategory: Genetics

Genetic Transformation in Valeria (*Valeriana officinalis* L) using Agrobacterium

Adriana Mejia, Universidad Metropolitana, San Juan

Seema Dhir, Department of Biology, Fort Valley State University

Valeria (*Valeriana officinalis* L.) is a hardy, perennial, flowering plant used as an herbal medicine. The roots contain a compound, Valerian, an excellent remedy for anxiety, nervous tension and insomnia. Tissue culture and molecular engineering have provided rapid methods to develop desirable varieties of cultivated plant species. Transient expression has a wide range of applications in molecular biology. The goal of this work was to establish an optimal transient expression system using Agrobacterium for T-DNA gene delivery into different explants from which the whole plantlets can be regenerated.

Leaf explants derived from one-month-old seedlings of in-vitro-grown *Valeria* plants were infected by *A. tumefaciens* carrying a binary vector that harbors a *gusA* gene and an *nptII* gene. The infected leaf explants were incubated for three days before they were subjected to *gusA* histochemical assay. The transformability was determined as the percentage of leaf explants expressing the *gusA* gene and as the intensity of *gusA* expression per responsive leaf explant. Parameters tested in this study included - different acetosyringone, Silver Nitrate (AgNO_3) and Calcium Chloride (CaCl_2) concentrations used during the incubation period, the length of the pre-culture period of explants prior to infection, different bacterial density (OD) and duration of immersion periods.

The results based on transient *gusA* gene expression of explants suggested that one-month old leaf explants inoculated for 60 minutes with 0.4 OD and 150 μm acetosyringone, 60 μm AgNO_3 , and 0.25 μm CaCl_2 showed 80-90 % transformation efficiency. Therefore, the investigation of factors that influence T-DNA delivery is an important first step in the utilization of Agrobacterium in the transformation of *Valeria* tissue.

[Acknowledgment: This study was supported, in part, by a grant

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OA #85

Subcategory: Ecology

Assessment of Genetic Endemism of Burrowing Crustaceans on the US Pacific Coast

Danielle Perryman, San Jose State University

Burrowing shrimp are critical organisms in estuaries, recycling nutrients into the environment. Shrimp habitats are heavily modified by humans through collection for bait and use of pesticides. The goal of this study was to reconstruct evolutionary relationships amongst species of burrowing shrimp genera, *Neotrypaea* and *Upogebia*, endemic to the western United States using mitochondrial DNA nucleotide comparison. DNA sequencing is the most accurate way to identify different species of burrowing shrimp as they are morphologically very similar. As compared to nuclear coding genes, mitochondrial DNA has a higher mutation rate favoring distinction of closely related species.

The following hypotheses were considered: (i) If genetic variation is limited on either side of a potential phylogeographic barrier, Point Conception, then human interference/geographic barriers are a factor in dispersal; (ii) If a population of shrimp is clearly divergent, then a "cryptic", non-interbreeding, species may exist. Shrimp were collected at sites between Santa Catalina Island, CA and Skokomish Estuary, WA. Tissue was extracted from the leg muscle of each shrimp, emulsified, and incubated in CTAB buffer. Extracted DNA was amplified using PCR and measured using electrophoresis. Samples with bands visible during gel imaging were sequenced and analyzed using Chromas and MEGA 4.0. The COI sequence alignment yielded a cladogram that had six distinct clades (bootstrap support > 85%). The largest clade is identified as *Neotrypaea californiensis*, and haplotype lineages were widely dispersed. This may indicate a recent introduction of the species to a new area or that Point Conception does not act as a barrier for *N. californiensis* (i). The sixth clade included 21 samples from below Point Conception and near Santa Catalina Island. The shrimp representing these taxa were reexamined and were in fact morphologically very similar to *N. californiensis*. The limited range of organisms in this clade, as well as the neighbor joining tree's support of the clade being divergent, provides two significant findings. The 21 samples in clade six were misidentified as *N. californiensis* (ii), and species in this area are not transported North of Point Conception or are unable to travel beyond it (i). There was a net nucleotide divergence between Santa Catalina Island and northern-coastal *U. pugettensis* of 13%, a significant level which

also supports Point Conception as a possible barrier.

[Acknowledgment: COAST, NSF, RISE]

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OA #86

Subcategory: Civil/Mechanical/Manufacturing Engineering

Automatic Sun Tracker

William S. Person, III, Virginia State University

This paper's focus is on the optimization of the electric energy by photovoltaic cells through the development of an intelligent sun tracking system. Since the angle at which solar radiation strikes a surface dramatically affects the amount of energy received by the surface, longitudinal rotation of the cells may increase power generation. An automatic position control system has been designed for controlling the azimuth angle of a solar panel to maximize solar radiation energy received by panel. [Acknowledgment: HBCU UP]

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OA #87

Subcategory: Geosciences and Earth Sciences

Comparing the Organic Production of Short-day and Day-neutral Strawberry Varieties Under Haygrove Structure in Southern Virginia

Gernice Richardson, Virginia State University

Strawberry is considered one of the most important berry crops in the United States in terms of production and consumption. The United States produced 1.3 million metric tons in 2010, this accounted for 30% of the total world strawberry production. The annual per capita consumption of strawberries is 4.85 pounds. Growing strawberries early in the season can help farmers obtain premium prices. This is possible by growing strawberries in a protected structure called "Haygrove." Haygrove is a simple and inexpensive structure that provides protection to the crop from rain, pests, and extreme temperatures. It is possible to produce strawberries in a Haygrove structure up to two weeks earlier than the field grown crop.

Another important factor that can extend the strawberry production season is to plant day-neutral varieties. Most commercially grown strawberry plants are short-day varieties, meaning that the fruit production occurs only during the short days of March to May in Virginia. However it is possible to plant day-neutral varieties that allow growers to harvest fruits beyond

the month of May, possibly even to July. Currently, there is no research information available under the Southern Virginia conditions that can be used by growers to decide if growing day-neutral strawberry varieties in a Haygrove structure can be profitable. Therefore, an experiment was conducted to evaluate the following: If there are significant differences in the marketable yield and harvest period between Chandler, a short-day variety and Albion a day-neutral strawberry variety grown under Haygrove conditions at Randolph Farm, Virginia State University, Petersburg, VA.

This experiment was planted in September 15, 2012, under a Haygrove structure at Randolph Farm. The production management is to apply organic pesticides and fertilizers and to provide a drip irrigation system. Both of these varieties will be evaluated for fruit quality, marketable yield and the harvest period (date from the first harvest to the date of the last harvest). These results will be collected, analyzed and presented. [Acknowledgment: NSF HBCU-UP]

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OA #88

Subcategory: Plant Research

Manipulating the Vibrational Communication of Asian Citrus Psyllids (*Diaphorina citri* Kuwayama)

Barukh Rohde, Hunter College, City University of New York / USDA-ARS-CMAVE

The Asian Citrus Psyllid, *Diaphorina citri*, the vector of the citrus greening disease Huanglongbing, has in previous work been found to communicate using plant-borne vibrations. This form of communication is used by the psyllids to facilitate mating. In nature, the male emits a vibrational "call", and the female responds with a vibrational "response" call, which elicits the male to move toward the female. Our hypothesis is that this vibrational communication may be manipulated, letting scientists "communicate" with the psyllids using recorded vibrations. 3-9 day old virgin adult *Diaphorina citri* were used in this experiment. All recordings of psyllid calls and all testing of calls on psyllids were done in a noise-controlled anechoic chamber.

To test female responses to recorded calls, recordings of calls were played to the female. There was a significant difference between response to the male calls versus the white noise ($p < .01$) played to females, proving that female psyllids will respond to played-back recordings of male calls. Female calls were played back to a target virgin male psyllid. Whenever the male would emit a call, a technician would hear it and press "play", causing a recorded female call to be played onto the plant. The male's calling frequency increased, and the male

moved toward the source of the vibration, interrupted by occasional pauses to call and wait for a response, to which the technician would again play the female call recording. 10 male psyllids crawled from a distance of at least 5 cm to within 1 cm of the vibration exciter while participating in normal duetting with the vibration exciter. Of the ten male psyllids tested that started calling, all ten participated in duetting with the recorded female calls, and all ten eventually moved to the source of the calls. As a control, 10 male psyllids were placed upon a vibration-less tree, and in ~2 hours of observation, only 1 male crawled the required distance. Given the success of this experiment, it is possible that an automated trap can be developed. An automated trap that replies to calls of searching males could be attractive from distances on the plant in the tree canopy, enabling more efficient targeting and control of incipient infestations of psyllids than is currently available. Potentially, such a trap could be a tool also for exploration of psyllid behavior and biology, and for development of vibration-based methods that interfere with mating behavior.

[Acknowledgment: Citrus Research Development Fund US Department of Agriculture, Agricultural Research Service, Center for Medical, Agricultural, and Veterinary Entomology, Lab of Richard Mankin]

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OA #89

Subcategory: Plant Research

The Effects of Light on Eelgrass (*Zostera marina*) Growth Rates in Sequim Bay, WA

Alexandra Simpson, Portland State University

Seagrasses, flowering marine plants, form meadows that provide many ecological services ranging from supplying food and habitat for economically important species to sediment stabilization. Yet, seagrasses are experiencing worldwide decline largely driven by anthropogenic stressors. Increased turbidity is one major stressor contributing in their decline and remains a major concern in seagrass restoration. Seagrasses demand higher levels of light to support their growth and survival than other marine plants such as seaweeds. Here, I focus on the connection between the net primary productivity (NPP) of eelgrass (*Zostera marina*) populations at Sequim Bay and the corresponding light levels over a two-week growing period at three sites within the bay (Washington Harbor, on the beach, off the laboratory dock). To do so, I measured irradiance and the growth rate to determine approximately how much growth occurred during certain light levels. The extremely high levels of light recorded resulted in little correlation between light and primary productivity.

These results will aid in the restoration and management of eelgrass in the Washington Harbor restoration site, and add to

the knowledge regarding the issue of the effects of reduction of light caused by increasing turbidity in coastal systems.

[Acknowledgment: This study was supported by the Science Undergraduate Laboratory Internship Program through the U.S. Department of Energy under the guidance of Dr. Ron Thom, Pacific Northwest National Laboratory, Marine Sciences Laboratory, Sequim, WA.]

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OA #90

Subcategory: Environmental Engineering

An Evaluation of Sustainable Production of Non-food Crop Feedstock for Biofuel

Darius A. Stanton II, Claflin University

Biofuels are fuels produced from renewable resources, especially plant biomass, vegetable oils, and treated municipal and industrial wastes. The biomass from plants used for biofuel production (feedstock) could subsequently be converted into bioethanol, biobutanol, and biodiesel. The objective of this project is establish/evaluate the most bio-energy producing, cost efficient feedstock for biofuel production using eco-sensitive farming methods. Three non-food feedstock (Sorghum, Sugarcane, and Miscanthus) were grown on approximately twenty acres of land in a rural town (Eastover) in South Carolina. The feedstock was grown under irrigated and non-irrigated conditions. Sucrose content which translates to biofuel production potential of each of the two varieties of Sorghum (ES 5201 and ES 5105) was evaluated. Additionally, weeds, pests, and diseases endemic to all three feedstock were evaluated.

Results indicated higher sucrose content in both varieties of Sorghum ES 5201 and ES 5105 grown under non-irrigated conditions compared to those grown on irrigated fields. Furthermore, the diseased and pest infested Sorghum (ES 5201 and ES 5105) varieties grown under non-irrigated field had higher sucrose content compared to the healthy plants (ES 5201-irrigated-healthy 4.6, diseased 5.2, pest infested 5.4, ES 5201-non-irrigated healthy 6.7, diseased 8.8, pest infested 8.0; ES 5105-irrigated healthy 5.2, diseased 5.5, pest infested 3.8, ES 5105, non-irrigated healthy 6.0, diseased 7.7, and pest infested 5.5 Brix respectively). Miscanthus and Sugarcane feedstock are under evaluation. *[Acknowledgment: USDA]*

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OA #91

Subcategory: Plant Research

Measuring and Comparing Pigments in Leaves Based on Spectra

Ellen Tisdale, Tuskegee University

All life depends on photosynthesis. Photosynthetic pigments in plants fill multiple roles from increasing the range of energy captured for photosynthesis to protective functions. The amounts of chlorophyll or carotenoids in a leaf can determine the overall health of a tree, and ultimately a forest. In this experiment, chlorophyll and carotenoids were extracted from leaves and the spectra were measured to determine the changes in concentration from the beginning to the peak of the season. It was expected that chlorophyll levels would be higher than carotenoids and that lower level leaves would have more chlorophyll a than upper level leaves. Chlorophyll was extracted from red maple, red oak, and yellow birch leaves collected from Harvard Forest in Massachusetts. A spectrophotometer was used to determine the absorption at various wavelengths.

These data were used to calculate the levels of chlorophyll a, chlorophyll b, and carotenoids in the leaves. Leaves were collected from above and below the tree canopy at different times within the season. It was found that chlorophyll b levels were always lower than chlorophyll a levels. The highest pigment concentrations generally occurred in June instead of in the peak of the season (July). Lower level leaves of yellow birch peaked in July and did not follow the same pattern as the other species. Carotenoids did not vary much. With this information, the health of trees can be predicted by determining the spectra, eventually through remote sensing. *[Acknowledgment: This study was supported by the Woods Hole Partnership Education Program.]*

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OA #92

Subcategory: Pollution/Toxic Substances/Waste

Acute Toxicology: Effects of Cu on Grass Shrimp (*Palaemonetes pugio* L.)

Van Vu, Southern University at New Orleans

Murty Kambhampati, Southern University at New Orleans

Acute toxicity of copper on grass shrimp (*Palaemonetes pugio* L.) at varying concentrations of salinities was investigated. Studies were conducted due to unavailable literature on Cu toxicity to *Palaemonetes pugio* and to test the hypothesis that the majority of test subjects would survive at higher salinity

levels when exposed to known concentrations of Cu. Water in aquaria was stabilized in order to maintain test subjects. Test subjects were acclimated in aquaria of 5, 10, and 20 ppt salinity levels for 10 days before toxicity tests were initiated. Test subjects were treated with 0.25, 0.50, 1.0, 2.0, and 4.0 ppm Cu to determine LC50 in replicates of 4. Water quality for dissolved oxygen, pH, temperature, salinity, and ammonia nitrogen were measured in aquaria at weekly intervals throughout the studies. Data collection for mortality rates were taken at 3, 6, 9, 12, 24, 48, 72, and 96 h. Lethal median concentration (LC50) values were determined at the end of each set of experiments. Morphological effects of Cu were documented with specific focus on the abnormalities of the head, abdomen, and tail. At 20 ppt salinity, the mortality rate was lower compared to 5 and 10 ppt salinity; the toxicity test at 20 ppt salinity failed to reach LC50. In contrast to 20 ppt salinity, experiments at 5 ppt yielded more LC50 values along with a faster rate of mortality. Lower levels of salinity gave more potency to toxins used in research; higher levels salinity decreased potency of a toxin.

[Acknowledgment: I express my deep sense of gratitude to the National Science Foundation (HRD-0928797) for financial support to carry out this research project.]

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OA #93

Subcategory: Environmental Engineering

The Design and Microproduction of Bioethanol from *Brassica napobrassica*

Aurellia Whitmore, Southern University at New Orleans

Carl P. Johnson, Southern University at New Orleans

Biofuel is widely evolving throughout the world with maize being the main source of bioethanol. *Brassica napobrassica* also known as Rutabaga has similar characteristic to that of maize, but is not a high demand food crop. The focus of this research is the design, micro-production and characterization of bioethanol from *Brassica napobrassica*. The biosynthesis was based on a well-known fermentation method to produce ethanol from rutabaga on a small scale. The ethanol was tested and categorized by infrared spectroscopy. Based on preliminary studies and recent research results, *Brassica napobrassica* is a great candidate for bioethanol and will one day substitute corn, sugar cane and other competitive food crops in the conversion to bioethanol. *[Acknowledgment: Summer Undergraduate Research Experience Program (SURE), Dr. Carl P. Johnson, and Southern University at New Orleans.]*

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OA #94

Subcategory: Genetics

Agrobacterium-Mediated Genetic Transformation in Stevia (Stevia rebaudiana)

Derrick Williams, Jr., Saint Augustine's University, Raleigh, NC
Seema Dhir, Department of Biology, Fort Valley State University

Stevia rebaudiana is used as a sugar substitute because of its crystalline glycoside, stevioside, which makes the plant 250-300 times sweeter than sucrose. Research has been done on this glycoside because of the effects it has on humans. The human body does not possess enzymes needed to digest stevioside. Scientists are trying to mass produce this sweetener because of its use as a sugar substitute in weight loss programs and by diabetics. A principal goal of genetic transformation is to improve crop plants by introducing genes from other organisms into them.

The objective of this project was to optimize parameters for genetic transformation in *Stevia* explants using *A. tumefaciens* carrying a binary vector (pSU- GUS) that harbors *gusA* gene and a *nptII* gene. The infected leaf explants were incubated for three days before they were subjected to *gusA* histochemical assay. The transformability was determined as the percentage of leaf explants expressing the *gusA* gene and as the intensity of *gusA* gene expression per responsive leaf explants. Parameters tested in this study included: different acetosyringone (0-250 μ M) and silver nitrate (AgNO₃; 0-120 μ M) concentrations used during the incubation period, different wounding methods, different explants types, different bacterial density (OD; 0-1.0 at 600 nm) and duration of immersion periods (0-90 mins).

Based on the results obtained in this study we concluded that optimal parameters for *Stevia* transformation include – addition of 150 μ M of acetosyringone and 60 μ M of AgNO₃ in the culture media, bacteria with OD of 0.6 at 600 nm, a 30 minute immersion period and no wounding of the explants. Therefore, the investigation of factors that influence T-DNA delivery is an important first step in the utilization of *Agrobacterium* in the transformation of *Stevia* tissue. [Acknowledgment: This research was supported by a grant from the National Science Foundation (DBI#1004764) at Fort Valley State University, Fort Valley, GA 31030.]

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Mathematics and Statistics

OA #95

Subcategory: Mathematics and Statistics

Modeling with Exponential Functions: The Malthus Model

LaQunia Banks, Southern University at New Orleans

Population plays a vital role in urban planning and development. Lack of this knowledge can be detrimental to planning for the future. In order for a society or organization to run well, we must have dependable population projections. Proper population projection will ensure that we have sufficient resources for the society under consideration. In this research we demonstrated that the Malthus model is one of the simplest, yet accurate forms of growth models to use for a limited time interval. We also showed that once this model is modified, it works for any population over a limited period of time. For the Malthus Model, we mainly look at the population of humans, bacteria, and other biological species. The Malthus growth model produces an ever growing function which makes the model unreasonable as time increases. The Logistics model is one attempt to improve the Malthus model. In this model the rate of population increase may be limited, i.e., it depends on population density. We surveyed different population growth models and concluded that the logistic growth model can help modify our Malthus model. We investigated the dynamics of the populations of two countries (China, India) and the World so as to determine the parameters of the Malthus and Logistics models for these populations. We were able to predict the World's population growth for the future and determine when and where the World's population will reach its equilibrium point by using the logistic growth model to modify the Malthus model. [Acknowledgment: National Science Foundation: HRD - 0928797]

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OA #96

Subcategory: Mathematics and Statistics

A Perturbation Analysis of the Behavior of Vesicles in Cell Desiccation

Joel Coppadge, Morehouse College

Cell desiccation is the process of removing water from a cell through evaporation or sublimation. One advantage of cell desiccation over cryopreservation is that it avoids the puncturing of cell walls by the volume increase of water when it is frozen. The long-term aim of the research group is to analyze the effects of drying on a two-dimensional vesicle, which is a

fluid-filled volume bounded by a membrane, that models a cell. In this project, we considered a preliminary problem that doesn't have drying, but that includes all other important effects. We simplified the problem so it was easier to solve by studying vesicles that have initial shapes similar to a circle. We used perturbation theory to identify a system of ordinary differential equations to describe how the vesicle behaves as it dries. The results gave us an insight into the physical process of vesicle motion. We managed to create a preliminary model of vesicle motion that will tie into the more complicated drying problem. *[Acknowledgment: SROP Program.]*

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OA #97

Subcategory: Mathematics and Statistics

Comparison of Adult Education Data

Artisha Davis, Southern University at New Orleans

Rachid Belmasrou, Southern University at New Orleans

The objective of this research is to compare two years of Adult Education (AE) data provided by the National Household Education Survey (NHES) on education of the population in the United States. This survey provides information to researchers who are using the educational services in order to determine which programs are successful. Adult Education surveys provide cross-sectional, national estimates of educational participation for non-institutionalized people age 16 and older who were not enrolled in grade 12 or below and not on active duty in the U.S. Armed Forces. I utilized data from the 1999 and 2005 surveys on AE. This particular survey consists of 103 questions asked to exactly 6697 people in 1999 and 8907 people in 2005.

One tail test and two tail tests were performed for proportions on different variables such as: 1.) what is the highest grade level completed, or 2.) how well you spoke English. Microsoft Excel was used to analyze the data sets. Null hypothesis is that all proportions among the two populations are equal. Alternative hypothesis is that population one proportion is less than population two proportion or vice versa.

The results for highest grade level completed are: in 1999 there were more people who obtained their Associate's Degree and Bachelor's Degree than in 2005. In 2005 there were more people who got their Doctorate Degree (PHD), Graduate and Master's Degree than in 1999. Further research will be conducted on the comparison of more variables.

[Acknowledgment: HRD – 0928797 SURE Program]

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OA #98

Subcategory: Mathematics and Statistics

Performance Indicators for Elementary and Middle School Students

Amber D'Ashly Dillon, Southern University at New Orleans

Rachid Belmasrou, Southern University at New Orleans

The objective of this research is to study the performance indicators for elementary and middle school students and what activities enable children to do better. Chi-Square, ANOVA, and Fisher's LSD were implemented to find out what is necessary in order for the child to succeed. The National Center for Educational Statistics is the primary federal agency for collecting, analyzing and reporting data related to education in the United States and other nations. This data presents non-parental care arrangements, for example, care by relative, care by persons to whom they were not related, participation in day care centers, educational programs of infants and preschool children, preschool programs. The weighted unit response rate was 84.4 percent. This research indicated that achievement is not independent of gender. There was no difference between the students' grades and who takes care of the child after school, and that there was significant difference in performance due to advising.

[Acknowledgment: NSF (HRD - 0928797)]

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OA #99

Subcategory: Mathematics and Statistics

Modeling Illegal Steroid Use Among Young Athletes in America

Quarail Hale, Norfolk State University

Steroids have been banned and deemed unethical, yet professional and young athletes still use them today. Young athletes make up the main subpopulation susceptible to steroid addiction, and evidence reveals that they, in fact, are using steroids. This paper models the dynamics of illegal steroid use between at-risk individuals, steroid users, steroid users in treatment, and recovered steroid users with a system of nonlinear ordinary differential equations while taking into account relapse and proper steroid prevention education. A basic reproduction number is computed to determine conditions for the stability of the epidemic equilibrium. Past research indicates that models with relapse parameters may exhibit a backward bifurcation. Following the method by Castillo-Chavez and Song, conditions are found for a backward bifurcation; this is an indication of an endemic of illegal steroids use. The results show that proper steroid education helps reduce the spread of illegal steroid use. Hence, prevention is the best method to defeat this societal problem. *[Acknowledgment:*

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OA #100

Subcategory: Mathematics and Statistics

Implementation of 3D Visualization of a Brain Tumor

Daniel Heslop, Savannah State University

Hyoungyun Oh, Savannah State University

The primary purpose of this project lies on the 3-D visualization of sequential under-resolved planar images, in particular, including medically abnormal cell structures. It thus contributes to medical engineering for better recognizing less informed planar images, such as the Magnetic Resonance Imaging (MRI), a medical imaging technique used in radiology. A series of head MRI scans of a brain with a tumor are imported into MATLAB as matrices. The distance from a fixed point on each matrix to a boundary point of the tumor is measured along the boundary point's corresponding angle. Using the numerical interpolation theories, boundary points on each layer in the polar coordinate systems are connected. In order to properly implement a real 3-D shape of the tumor, various procedures, such as treating of non-convex property of contours, scaling, recovering top and bottom caps, decision of patch types, etc. are achieved in an efficient manner. By manipulating the obtained surface functions, the rate of growth of the tumor in volume or surface or growth direction can be discussed as future work. *[Acknowledgment: National Science Foundation; Peach State LSAMP Program]*

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OA #101

Subcategory: Mathematics and Statistics

Weighed Walks and Generating Functions

Nadine Jansen, North Carolina Agricultural & Technical State University

Leon Woodson, Morgan State University

A walk is a path from the origin of the Cartesian plane to a point in the first quadrant of the Cartesian plane. These walks can be produced by using different arrows of different lengths, directions, and weights. One arrow will always have a weight of one; this is called the primary arrow. A weight is a function that multiplies the way to get from one point to another. Weighed walks have numbers that denote the number of ways to get to

that particular point from the origin while staying in the first quadrant.

The objective of this research project is two fold: (1) to analyze the numbers that were produced along the positive diagonals, and (2) to find a pattern in walks formed from three arrows. The pattern was discovered by taking the difference of the numbers on a certain diagonal depending on what diagonal it was (this notation was simplified by using a delta operator). [For example, zero difference on the zeroth diagonal, one difference, Δ , on the first diagonal, two differences, Δ^2 on the second diagonal, etc.].

A conjecture was made: the difference of each diagonal would always equal the same number; this number, which would always be the sum of the two non-primary arrows, raised the power of the diagonal. For example, if the two non-primary arrows had weights of 2 and 3, then the 4th difference of the 4th diagonal between any two points would be 54. The conjecture was proven using mathematical induction for two cases. One is for a $[1,1,n]$ walk, where n is a natural number representing the weight of the last arrow. The other proof was for a $[1,m,n]$ walk where m and n are natural numbers representing the weights of the two non-primary arrows. Generating functions were sought to represent each diagonal. A construction method that used preceding terms on the walk to produce the next one was used. The generating functions were rewritten as partial fractions and a pattern was found between the coefficients. A proof was developed to confirm the pattern.

This result means that given any walk, of any weights, one can determine the term on any diagonal at any height. Future research includes looking at walks in the x - y - z plane and seeing if what holds in 2-D also holds in 3-D. *[Acknowledgment: This study was supported in part, by grants from NSF and NSA awarded to the Math SPIRAL program at the University of Maryland.]*

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OA #102

Subcategory: Cancer Research

Genetic Emergent Behavior: Cervix Cancer Case

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Mauricio Cabrera, University of Puerto Rico

Emergent behavior can be defined as a compartment that is attributed to the system and not to the individuals that compose it. In the cancer area, this behavior can cause the development and metastases of tumors. This project represents an effort to devise a strategy to characterize, model and analyze

genetic emergent behavior in the context of cancer to contribute to its understanding. The starting point involves the use of mathematical network flow models with data from microarray experiments to establish signal pathways among potential biomarkers. Linear statistical correlation values between the expressions of different genes will be used as a first approach to represent signals. Correlation is a statistic that measures coordinated variation between two random variables estimated through the replicates of expression levels of two genes; which is used in this project as a proxy for inhibitory or excitatory behavior between the expression levels of two genes. Computation of every pairwise correlation is cumbersome, thus a pre-selection of genes based on a multiple criteria optimization strategy developed in our group is used to provide a shortlist. The values can then be associated to arcs in a network model, where the nodes to be connected are potential biomarker genes. A microarray database related to cervix cancer with 8 healthy tissues and 25 cancer tissues characterized in 28 potential biomarkers identified by our research group is used.

As a first step, correlation values between potential biomarkers are being utilized for exploration, from this we know that the pair with the most positive correlation involves genes AA913408, AA913864 and H23187 ($\rho=0.82$). The pair with the most negative correlation involves genes AA487237 and AA243749 ($\rho=-0.67$). These initial relationships will be studied to determine if they have any biological support.

The next step is to obtain the sequence of genes that maximize the sum of the absolute values of their correlations as the sequence with the strongest signal. Correlation and mathematical networks are the initial tools to be marshaled in this endeavor in the context of microarray experiments related to cervix cancer. An effort to extend the method to analyze results from multiple microarray experiments is being undertaken. The aim is to generate information to explain how cancers start, evolve, can be detected and treated, by generating tools that have mathematical consistency, repeatability, and biological relevance. *[Acknowledgment: This work was made possible thanks to the NIH-MARC grant "Assisting Bioinformatics Efforts at Minority Institutions" PAR-03-026, BioSEI UPRM grant 330103080301 and PRLSAMP.]*

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OA #103

Subcategory: Mathematics and Statistics

Data Encryption and Decryption

Gino P. Loverde, Southern University at New Orleans

From Ancient Mesopotamian ciphers to the Enigma Machine of World War II era Germany, the ability to securely code and decode messages has been a powerful, world changing tool.

Technological advancements have created a need for more efficient and ever more complex ways of coding information. Data encryption is common throughout one's home network, online banking experiences, and other websites that use secure servers. The purpose of this research is to analyze the process of securely encoding and decoding data via three different methods: matrix multiplication, power operation, and public key RSA (an encryption algorithm named for its three originators). Matrix multiplication invokes several elements of linear algebra and number theory including properties of inverse matrices, inspecting the determinant, modulus operator in Ring Z_{27} , and checks for coprimality. In the power operation, we use Euler's Theorem, for any integer x : $1 < x < p$ $(xe)^d = x^{1+k(p-1)} = x^{(xp-1)k} = x \pmod p$ If x is the original data, then $m = xe \pmod p$ is the encrypted data, and $md \pmod p$ is the decrypted data. RSA encryption also uses Euler's Theorem. However, we used two large prime numbers p and q and look for e and d such that $e \cdot d = 1 \pmod{(p-1)(q-1)}$. Programming was completed using MATLAB 7.5.0 (R2007b) or GNU Octave 3.2.4.

The result of this programming allowed us to develop a Graphical User Interface capable of coding and decoding user supplied data. We conclude that as the need for data security becomes ever more pervasive in our daily lives, advancing its complexity will employ increasingly intricate mathematics. Further research work will be concentrated in developing a window project, which can send encrypted email data and complete decryption by certain methods. This future programming project will be a combination of MATLAB and Microsoft Dot Net, requiring the creation of a Dot Net Dynamic Link Library (DLL) from MATLAB and applying it to the Dot Net program. *[Acknowledgment: This research was completed with funding from the National Science Foundation (HRD-0928797).]*

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OA #104

Subcategory: Mathematics and Statistics

Crack Cocaine Addiction and Its Impact on African-American Women- A Mathematical Approach

Asia Motley, Norfolk State University

With its introduction to impoverished communities in the 1980's, crack cocaine has devastated and destroyed many lives and families, especially those in the African-American communities. Although crack cocaine usage has declined over the years, this problem still greatly affects African-American women. This project explored crack cocaine addiction among these African-American women between the ages of 18-34 in the Washington, D.C. area. A SITR model with treatment and relapse was developed using a set of nonlinear differential equations to describe the interactions among non-users, users,

users in treatment, and those who recovered. The dynamics of the model revealed that the crack-free equilibrium is globally asymptotically stable when the basic reproduction number is less than a unity and unstable when it is greater than a unity. The mathematical analysis of the model also determined the bifurcation conditions when the crack-present equilibrium becomes unstable. Furthermore, the model showed that prevention has the greatest impact in controlling the epidemic of crack cocaine addiction. Further analysis of the model might include the optimal control of the prevention.

[*Acknowledgment: This project is a Mathematical Association of America activity funded by the National Security Agency (Grant H98230-11-1-0215) and the National Science Foundation (Grants DMS-0845277 and DMS-1156582). This work was also partially supported by the National Science Foundation (C. Ying, DMR-0602716), and by the School for Engineering of Matter, Transport Energy.*]

Faculty Advisor: Aprillya Lanz, dr.l.lanz@gmail.com

OA #105

Subcategory: Mathematics and Statistics

Signal and Image Denoising by Fourier Analysis in MATLAB

Risbah C. Sang, Southern University at New Orleans

We are currently immersed in the Digital Data Era. Most data is in digital format, such as digital medical signals, digital imagery, digital music and digital movies. However, the digital data could be perturbed by unwanted noise. An important topic in numerical research focuses on how to suppress enough noise and recover as much of the original digital data as possible. Fourier Transformation is an important mathematical tool that is used in many areas of science and engineering.

This research focuses on how to use the Fourier Transformation to remove the noise from one dimensional signal and two dimensional images. From Fourier Transformation theory, any spatial data can be decomposed into frequency data. We also know that what we refer to as noise occurs in areas of high frequency. Therefore we can use the following steps to remove the noise: Step 1: Apply 1D or 2D Fourier Transformation to the signal containing noise or image data to get their frequency distributions in the Fourier Domain; Step 2: Design a 1D and 2D filter in Fourier domain, which are normal distributions with maximum value of one and zero for the high frequencies; Step 3: Multiply such filters to the noised data in Fourier domain; and Step 4: Apply the inverse Fourier Transformation to the product to get the noiseless data. For the color image, we need to do so for each color component.

All of the above operations are performed in MATLAB. After those steps, we can see that most of the noise is gone, and the

original data is mostly recovered. Although, some high frequency data in the original signal or image is also gone, the outcome seems acceptable. In the future, we intend to look at how we can combine a process of several transformations through MATLAB and Mathematica programming that can create increasingly higher quality imagery. [*Acknowledgment: This research was completed with funding from the National Science Foundation (HRD-0928797).*]

Faculty Advisor: Joe Omojola, jomojola@suno.edu

OA #106

Subcategory: Education

Utilization of Early Childhood Programs

Schondell N. Thomas, Southern University at New Orleans

The objective of this research is to study Early Childhood Program Participation, which is a component of the National Household Education Survey (NHES). Specifically, we want to see which government programs are being used and whether more needs to be done in order to help. The Department of Education utilizes this report to accurately portray the makeup of American households, whether children are attending school, whether the post-secondary education status of the parents affect their children's ability to do well in school and to see which government programs are used to assist parents throughout their child's time in school. Our first approach was to use the Confidence Interval Estimate to test the samples that the NHES collected for validity. We then ran a test on samples from those samples to check for further accuracy. The variables used in our experiment were the ages of the children, the age when the children first started school, at any level, and the proportion of children who were going to school. As it turns out, we found that only 60 to 63.3 percent of all children in the United States, between the ages of 3 and 6, attend school. Tests were also run to check for the mode "highest frequency" of the children in our survey in order to perform a specific type of sampling to determine the correct sample size for the desired confidence level. Towards the conclusion of our research, we established a Chi-Squared Test to discern how household income affected what parents allotted for their child's education. The factors used were the ages of the children, the ages of the parents, household income and the effects it had on the health of the child. [*Acknowledgment: National Science Foundation (NSF-HRD-0928797)*]

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Nanoscience

OA #107

Subcategory: Nanoscience

The Optical Stressing of Indium Gallium Zinc Oxide Thin Film Transistors

Andrew Knight, Norfolk State University

Aprillya R. Lanz, Norfolk State University

Rajitha N. P. Vemuri and Terry L. Alford, Arizona State University

Over the last two decades, amorphous silicon has been the material of choice in display panels due to its low cost and availability. The ever-increasing demand for higher resolution and larger displays panels calls for improved and more reliable semiconducting channel materials. One such candidate, indium-gallium-zinc oxide (IGZO) has presented itself as a viable option to achieve much higher carrier mobility, optical transparency, and robustness under optical stress conditions. However, its instability remains an obstacle that must be overcome before IGZO TFTs can reach the manufacturing stage.

One reliability issue is IGZO's photosensitivity. This effect is highly noticeable under optical stress with photonic energies greater than 3 eV. This photosensitivity is due to the low-temperature processing of IGZO in which defects are inherently introduced. Therefore, under continuous optical stress there is deterioration in the threshold voltage (V_{th}) during prolonged operation. In this study, illumination stress analyses are performed on TFTs to determine the root-cause of the V_{th} shift (up to -17 V after 25000 sec). Based on previous insights, post fabrication anneals subsequently reduce defect densities that are inherent from the low temperature TFT fabrication process. After anneals in different ambients, the TFTs demonstrate higher stability. Future work will involve investigating the influence of electromechanical and mechanical strain on IGZO TFTs. *[Acknowledgment: This work is partially supported by the National Science Foundation (C. Ying, Grant No. DMR-0902277) to whom the authors are greatly indebted.]*

Faculty Advisor: Aprillya R. Lanz, alanz@nsu.edu

OA #108

Subcategory: Cell and Molecular Biology

Dual Layer Microfluidic Platform for Cell Galvanotaxis Studies in 3D

Justin Samorajski, University of Dallas

Yu-Ja Huang and Peter Searson, Johns Hopkins University

Galvanotaxis is the directional response of cells in the presence of an direct current electric field (dcEF). In vivo, endogenous

electric fields ranging from 0.1 – 5 V cm⁻¹ have been shown to influence wound healing and embryogenesis. Scientists have also hypothesized that the spread of cancer (metastasis) may be influenced by electrical impulses inside the body. To explore how an electric field directs cell migration, we propose the use of a 2-layer microfluidic device made of polydimethylsiloxane (PDMS) to study galvanotaxis in 3D. The device features pneumatically actuated micro-valves to allow a precise control of cell media flow. HT-1080 fibrosarcoma cells embedded in type I collagen matrix were seeded inside the galvanotaxis chamber and monitored in the presence of a physiological relevant electric field (0.5 V cm⁻¹).

We have observed galvanotaxis of cells in 3D environments, along with the alignment and migration of cells along collagen fibers, we have also observed that there is a lower threshold of voltage needed to stimulate the galvanotaxis-mechanism in comparison to 2D studies. Using this platform we can carry out applied electric field studies in order to characterize the response of cancer cells to electric fields in a physiological relevant environment. Gaining a better understand of galvanotaxis of cancer cells in 3D environments will provide an additional link to the scientific battle against cancer.

[Acknowledgment: This study was supported, in part, by: The National Cancer Institute, Alliance for Nanotechnology in Cancer program (NCI U54CA151838). The Sol Goldman Pancreatic Cancer Center, Johns Hopkins University. The National Institutes of Health.]

Faculty Advisor: Yu-Ja Huang, yuja.huang@gmail.com

OA #109

Subcategory: Nanoscience

The Effects and Migration of Copper Nanoparticles in Different Soil

Jerry Yost, Southern University of New Orleans

Terrell, Shreya, and Vishal, Southern University of New Orleans

Volcanic ash, forest fire smoke, combustion products, cooking, and sunscreen pigments contain and release tiny particles measuring from 1 to 100 nm into the environment.

Nanoparticles are the nano-sized particles of the bulk material. These tiny particles exist in our lives through engineered, natural, and accidental processes. The increasing interest and use of nanoparticles in all industries raise questions as to how do nanoparticles effect and migrate throughout the environment. Copper nanoparticles are found in sun cream, rubber, coatings, and plastic. Copper is known to be poisonous to plants, animals, and humans if consumed in excess amounts.

What if nanoparticles are able to migrate through the soil columns into the water table in excess amounts? Copper nanoparticles having negative effects on plant growth in the

environment could lead to a major disruption in the food chain! To investigate the effects and migration of copper nanoparticles, 13 soil samples were collected from different areas and clustered into 4 groups based on characteristics of the soil samples. One sample in each group were mixed with 75 milligrams of copper nanoparticles, 20 ml of deionized water or calcium chloride, and incubated for 30 minutes at 50 rpm and 30 Celsius. A suction filter was used to collect and separate the liquid and solid samples for copper analysis. Copper analysis indicated that most of the copper nanoparticles did not migrate through the soil. The nanoparticles remain in the soil samples for all 4 of the different soil types.

[Acknowledgment: This work was supported by NSF (grant # DUE-0806894 and # CBET 0966741) for financial support and Dowling College, NY for facilities.]

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Physics

OA #110

Subcategory: Materials Science

Characterizing the Ultrafast Optical Excitation of Spin Precession in Fe/CoO/MgO (001)

Joseph Gonzalez, University of South Florida/College of William and Mary

The ferromagnetic (FM) magnetization precession in the Fe/CoO/MgO (001) thin film system is characterized using the time-resolved Magneto-Optical Kerr Effect (TRMOKE). This bilayer was grown via Molecular Beam Epitaxy and field cooled at 1 Tesla to induce alignment of the antiferromagnetic (AF) domain walls. The TRMOKE measurements were made using 800-nm, 150-fs pump pulses with an intensity of 100-nJ, while the sample was held in a cryostat at 100 K. The photo excitation from the incident pump pulse causes a rapid change in the anisotropy of the structure, specifically the uniaxial component, K_u . We observe a dramatically different excitation process of the Fe spin precession, which exhibits no demagnetization phenomenon. This distinctive excitation mechanism is attributed to the ultrafast modulation of the exchange coupling between FM and AF spins via laser heating.

The precessional data is analyzed using a three-stage model based on our experimental geometry and the Landau-Lifshitz-Gilbert equation. Utilizing this model we find that K_u behaves as a step function and describes the experimental data well. We show that the uniaxial component experiences a modulation of ~ 350 erg/cm³ in the first 50-ps and the Fe spin precession has a frequency of 32 GHz. *[Acknowledgment: This work was made possible by the College of William and Mary: National Science Foundation, grant No. PHY-1156997. The Natural Science*

Foundation of China, grant No. 10925416, 10834001, 61222407, and 11074044. NCET grant No. 11-0119. The Department of Energy, grant No. DE-FG02-04ER46127.]

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OA #111

Subcategory: Physics (not Nanoscience)

Focusing Capillary Optics: Beam Stop Design

Corey Oses, Cornell University

Ellipsoidal single bounce monocabillaries are glass waveguides capable of focusing X-Ray beams to a narrow point through total external reflection. This instrument is used at the Cornell High Energy Synchrotron Source as a final focusing element placed at the very end of a long series of optics. Unfortunately, the capillary alone will output two projections of the X-Ray beam—one which converges to a narrow point at the focus of the optic and another which passes through the instrument's opening without bouncing on the glass wall. The unfocused portion of the beam is considered parasitic as it negatively contributes to the narrow intensity peak experimentalists are seeking. Utilizing the penetrating power of X-Rays, a beam stop has been designed that reduces the unfocused beam up to 10^{-8} of the total beam flux while permitting no less than 90% of the focused X-Ray beam.

Material selection for the supporting substrate was the most crucial aspect as it determined cost and machining feasibility. ANSYS was used to calculate the beam stop's thermal and structural integrity. After several ANSYS models which incorporated materials such as diamond, silicon, and silicon-based compounds, as well as collaboration with the engineering staff to consider fabrication feasibility, a thin-layer silica based device with supporting silicon layers will be used as the substrate to support the tungsten beam stop puck. With the positive feedback from ANSYS simulations, the beam stop is now in the fabrication phase. *[Acknowledgment: Cornell University High Energy Synchrotron Source Louis Stokes Alliances for Minority Participation]*

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OA #112

Subcategory: Physics (not Nanoscience)

Generation of Squeezed Light via Four-Wave Mixing in Rubidium Atomic Vapor

David Riser, Delaware State University

Renu Tripathi and Gour Pati, Delaware State University

Squeezed light is light that has phase or amplitude noise below the standard quantum limit. Interest in producing squeezed light has grown since it was first demonstrated in 1985 by using a nonlinear process occurring in an optical crystal. Modern techniques for producing squeezed light are based on a twin-beam approach. This approach entails subtraction of signals to produce an electrical signal with intensity fluctuations below the noise power of the original shot-noise limited beam. Squeezed light finds applications in precision interferometry, and as a source for generating time correlated photons. Our experiment for squeezed light generation uses the four-wave mixing (FWM) process in rubidium atomic vapor by incorporating a reverse double-lambda scheme. In this experimental setup, a pump and a probe beam (separated in frequency by the hyperfine ground-state splitting; for D1 in 85Rb \sim 3 GHz), also known as the Raman beams; interact in the atomic medium to produce a conjugate field as a result of the FWM process. This process adds photons into the probe and the conjugate fields, thereby increasing the individual noise in each beam, but increasing the correlation between these two fields.

During my presentation, I will describe our endeavor to produce squeezing of light below the shot-noise for the laser source using quantum-noise-limited detection, and measure the magnitude and bandwidth of the resultant squeezed light. We will also provide a theoretical model that relates the degree of squeezing to the gain in the atomic system. Our future work involves carrying out an experiment to verify conservation of orbital angular momentum in the FWM process outlined above, and also implementing quantum imaging experiments.

[Acknowledgment: These studies have been supported, in part by NSF MRI grant # 1039675 (PI: Dr. Tripathi), NASA URC-5 grant # NX09AU90A (Dr. Tripathi and Dr. Pati are the Co-I's), and NSF-CREST grant # 0630388 (Dr. Tripathi is a Co-I, and Dr. Pati is the Key Personal).]

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Science and Mathematics Education

OA #113

Subcategory: Mathematics and Statistics

Numerical Application of Generalize Monotone Method for Population Models

Noel Clark, Southern University at New Orleans

This paper provides a methodology to compute coupled upper and lower solutions. We will use mathematical modeling to examine population growth and decay of a single and dual animal species, of nonlinear differential equations with initial

and boundary conditions to compute solutions. The basic problem that we want to solve is to compute coupled upper and lower solutions to the unique solution on an extended interval. We are able to achieve this due to both theoretical and numerical results. *[Acknowledgment: University of Louisiana-Lafayette- REU and NSF grant DMS-1043223.]*

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OA #114

Subcategory: Computer Science & Information Systems

An Experimental Analysis of Compact Genetic Algorithm on a Quantum Computer

Jaleesa T. Harrigan, Howard University

Quantum computers shall be the future of quantum computation. Programming amongst classical and quantum computers differs due to the complexity and capacity of the computer. Similarly, rather than having the ability to withhold only a single state at a time, quantum computers are capable of withholding many states simultaneously, performing calculations exponentially faster than classical computers. An issue with computation may exist by measuring and analyzing subatomic particles that will change its values. This paper demonstrates the enhancement with respect to speed and quality shown by quantum computation. The simulation of quantum computing is carried out for solving a problem using the compact genetic algorithm. The results showed that QGA trials are more efficient than the CGA trials. *[Acknowledgment: HU-GearUp]*

Faculty Advisor: Tiffany Lathan, tlathan@howard.edu

OA #115

Subcategory: Education

How the Language of Science Can Be Altered to Enhance Student's Cognition and Retention

Lakia Mansell, Claflin University /Stanford University

Understanding the concepts of science can be difficult depending on the presentations that take place in the classroom. Contemporary teachers are not comfortable with simplifying the language of science, which causes a comprehension barrier in urban education. As a nation, the United States is ranked 29th in science. As a culture, low socioeconomic families receiving urban education are below the national reading and comprehension for the appropriate grade level of the student. This research explores the linguistics of science and how the subject is understood given its context. A

group of students were randomly selected as experimental or controlled variables. A video lecture of the same science concept was displayed to both variables; one using complex terms such as H₂O and carbon dioxide and the second using synonymous terms such as water and air. A post test was given to measure cognition and the retention of the previous lesson.

Results showed that there was not a notable difference in retention or cognition. Future research includes organizing a wider range of test variables and testing retention as opposed to cognition. *[Acknowledgment: This study was supported by a grant from the National Science Foundation awarded to Dr. Bryan Brown, Stanford University, School of Education.]*

Faculty Advisor: Bryan Brown, bbrown@stanford.edu

Social and Behavioral Sciences

OA #116

Subcategory: Social Sciences/Psychology/Economics

Embracing the Darkness: Negative Phototactic Behavior Across the Visual Spectrum in Subterranean Termites (*Rectilustermes sp.*)

Anthony Maurice Culp, Morehouse College

The area of study that focuses on the behavioral responses to light in blind worker subterranean termites (*Reticulitermes sp*) has not been extensively explored. Previous tests in our lab demonstrate that subterranean termites show a negative phototactic response to white fluorescent light. Our current study looks at termites' reaction to light across a spectrum between 450nm (blue light) to 650nm (red light). Our original hypothesis was that termites' reaction to light would vary across the different wavelengths, where termites would find long wavelength light (650nm) less aversive. The reasoning behind this notion is the fact that most insects cannot detect light with a wavelength greater than 650nm.

To test our hypothesis, 10 termites were placed in a 55mm petri dish in which one side was painted black and the other side remained clear (Experimental group). A second group of 10 termites were placed in another 55mm petri dish with a black line drawn down the middle, in which one side was arbitrarily designated as the dark side and the other the light side (Control group). The Experimental and Control group were placed in a black painted arena in an environmental chamber at 26°C ± 2°C and at 80% ± 2 relative humidity. Light at different wavelengths was presented using a Fiber-Lite Metal Halide Machine Vision Illuminator in conjunction with wavelengths filters ranging from 450nm to 650nm in increments of 50nm. A video camera was used to record each experiment. A previous experiment in our lab ruled out heat as a confounding variable, two P300

thermocouples were used to monitor the temperature inside each petri dish under these experimental conditions, and there was no significant difference in temperature between the experiment and control (light & dark side) petri dishes.

Preliminary results showed that termites spent significantly more time in the dark than in the light in the Experimental group. For the Control group there was no difference, in regards to time spent on the arbitrarily designated dark and light side. Also there was no difference in the Experimental group in regards to avoiding light at different wavelengths. Based on these preliminary results, termites will avoid light equally between 450nm and 650nm. This suggests that blind termites may be able to detect the entire visible spectrum. This suggests a broad range of light at different wavelengths could be used as a biological control for termites. *[Acknowledgment: This study was supported by a grant from the National Science Foundation awarded to Lycurgus Muldrow Ph.D., Director of Integrated Programs, Morehouse College, Atlanta, Georgia, 2010; HRD-1043330; and the Morehouse-Wide Initiative for Sustainable Energy (M-WISE).]*

Faculty Advisor: Duane Jackson, tmculp371@gmail.com

OA #117

Subcategory: Social Sciences/Psychology/Economics

Severe Traumatic Brain Injury and the Efficacy of Treatment Models: The Efficacy of Treatment Models With and Without a Comprehensive Psychosocial Component

Alecia Lane, University of the District of Columbia

The researcher will present a summary of the etiology of traumatic brain injury (TBI) and a meta-analysis of a preliminary review of the literature. The review includes the most common treatment modalities for individuals recovering from severe TBI and the types of treatment models. The researcher will present areas of perceived strengths and weaknesses of present models and the presence or absence of treatment components that address psychosocial functioning. Evidence suggests that individuals who survive severe TBI struggle to experience quality of life. The literature indicates that recovery must extend beyond regaining ambulatory ability. Months of in-patient rehabilitation, years of outpatient treatment, and daily basic living support have adequately addressed restoring ambulatory functions, expressive communication, basic life skills such as preparing meals and successful community integration; however, psychosocial difficulties have not been effectively addressed.

TBI is a life threatening experience. If an individual survives such insult to the brain, the interdisciplinary medical team is faced with a more difficult challenge: facilitating a new normalcy for

the victim. This new normalcy has baseline measures defined by TBI. Treating the broken bones, punctured organs and lacerations does not heal the injured brain. Green, Stevens and Wolfe (1997) refer to the brain as the only human organ capable of studying itself. Ironically, it is also perhaps the last frontier: an area of life that is somewhat still a mystery to man. However, a known truth is that the sense of consciousness begins and ends with the brain and what the conscious brain is most sure of is the self. As the seat of consciousness, this extremely fragile organ learns, thinks, remembers, and processes. When the brain experiences a traumatic induced physiological disruption, the result can be a total absence of consciousness, and one's identity can be transiently or permanently lost (Kreutzer & Wehman, 1990). When the brain ceases to function, it is believed that life as one knows it ceases to exist. (Or does it really?) The medical profession is uncertain about life within the brain, the unconscious state. *[Acknowledgment: Minority Access to Research Careers MARC/ NIH/NIGMS - 1T34GM087172-01A1]*

Faculty Advisor: Philicia Jefferson, pjwilson@udc.edu

OA #118

Subcategory: Social Sciences/Psychology/Economics

Vulnerability of Personal Devices to Cyber Attack

Cotina Lane, University of the District of Columbia
Darris Taylor, University of the District of Columbia

There are more than 4 billion cellular phones and mobile devices in use around the world. With the advent of the internet, terrorists find little to no resistance and an ease in planning and attacking from miles away. The purpose of this project was to examine the factors that make users of mobile devices vulnerable to cyber attacks. We offer a brief description of cyber terrorism and the underpinnings of cyber terrorism research before focusing on cyber attacks. The roles of users are also examined followed by empirical research on users' beliefs in security which have been associated with the penetration of personal devices.

Although there is not a sole cause for vulnerability, the three types of attacks that were looked at were Trojans, viruses and worms, and denial of service attacks. Using prior research and data collected on the cyber attacks, we surveyed users and estimated the number of people who could be infected from each of these types of cyber attacks. Based on surveys conducted, the conclusion that we reached were that even though most users are aware of security programs and their importance, they actively did not engage in consistent use of such systems on mobile devices, nor did they understand the vulnerability of mobile devices to terrorists. Future research on this topic should refine the survey methods to produce more

accurate picture of user behaviors. *[Acknowledgment: NSF HBCU-UP Program.]*

Faculty Advisor: Angelyn Flowers, aflowers@udc.edu

OA #119

Subcategory: Education

Understanding the Correlation Between Classroom Enthusiasm and Students' Retention Rates

Gloria Mills, Harris-Stowe State University

The quality of education in a classroom can be directly affected by the enthusiasm of the instructor and the students. The structure of the science curriculum and the disposition of the educator can positively affect students' retention rates. Historical research can aid in providing the understanding needed to analyze education practices. By identifying key factors that objectively enhance the educational environment, the enthusiasm of each student can be altered, thereby altering the rate at which students retain information and providing students with a high quality education.

Through research-based observations, an enthusiasm formula has been composed. The formula highlights the determining components of the ideal urban middle-school classroom. These components are: 1) instilling enthusiasm in the educator in order to ensure dedication to teaching and high levels of self-efficacy; 2) the ability to understand the social climate and history of the environment the urban learner resides in; 3) maintaining an effective and on-going parent-teacher relationship; and 4) promoting interactive, hands-on lesson plans. The aim of this research is to observe urban middle schools in hopes of perfecting said formula and reaching the optimum enthusiasm quotient within science and math classes.

Preliminary research was conducted through educator questionnaires and middle-school math and science class observations. The grade levels ranged from sixth to eighth grade. Enthusiasm was measured by applying the enthusiasm formula and assessing the determinants based on a rubric-generated score. Correlations between the factors included in the enthusiasm formula and the classroom "success rate" (which is based on an average class grade) were found. Classrooms that encompassed the characteristics of an "enthusiastic classroom" earned higher scores on the observational rubric (out of 24 points). These classrooms held higher 'success rates', as determined by the average class grade.

In the preliminary analysis of cumulative factors, urban schools' enthusiasm quotient (13.75 out of 24 points) was less than suburban schools' enthusiasm quotient (18.25 out of 24 points). The difference between urban school enthusiasm and suburban

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school enthusiasm yielded a significant result of $p < 0.05$ utilizing t-test analyses. [Acknowledgment: National Science Foundation]

Faculty Advisor: John MacDougal, MacDougJ@hssu.edu

OA #120

Subcategory: Social Sciences/Psychology/Economics

Pre-Freshman Bridge Scientific Literacy Study

Ethen Pollard, Morehouse College

Lycurgus Muldrow, Bryant Marks, and Thomas Benjamin, Morehouse College

During the summer of 2012, 34 pre-freshman students attended a six-week summer bridge program at Morehouse College. The hypothesis is that participation in the program will increase their overall scientific literacy. The program participants were primarily African-American males, who intended to major in science, technology, engineering, or mathematics (STEM), showed an interest in research careers, and planned to attend the college. The program was comprised of four primary activities: an innovative Scientific Literacy course, a unique quantitative literacy/applied mathematics class, research and guided inquiry laboratory experiences, and site visits to research and science facilities. To assess the impact of this summer program on the level of scientific literacy, students were given an identical survey prior to beginning the summer bridge program, and following its completion. This survey was designed to evaluate the overall scientific literacy of the students, as well as five individual domains of scientific literacy. Students showed significantly increased overall scientific literacy scores, as well as significant increases in composite scores for four of the five domains. Research of this nature is vital for creating solutions that work towards closing the academic achievement gap in schools, as well as fostering greater academic achievement for all students. [Acknowledgment: The funding for this research and the summer bridge program was received from the National Science Foundation Historically Black Colleges and Universities Undergraduate Program (HBCU-UP 1036269 and 1043330).]

Faculty Advisor: Lycurgus Muldrow, lmuldrow@morehouse.edu

OA #121

Subcategory: Cancer Research

The Native Comic Book Project

Corinna Tordillos, University of Washington

The availability of cancer screening tests, high quality health care, cancer education, prevention programs, and access to cancer clinical trials are often not available to tribal communities. As a result, American Indians and Alaska Natives

experience the worst cancer related disparities and have the poorest survival rate among all other racial/ethnic groups. Comic books have long been used as an educational tool to improve and protect public health in the U.S. In 2008, the Native Comic Book Project was launched as a youth-focused community education pilot project of Native People for Cancer Control; a National Cancer Institute-funded Community Network Program Center, based at the University of Washington. The purpose of the Native Comic Book Project is to offer cancer education and cancer prevention methods to Native youth through the means of comic book creation. Participants receive education on traditional foods and wellness, non-ceremonial tobacco use, human papillomavirus (HPV), obesity prevention and basic art skills. Modeled after Dr. Michael Bitz's Comic Book Project, the Native Comic Book Project has been adapted for both urban and reservation-based American Indian and Alaska Native youth, and incorporates Native storytelling and traditional values.

The ultimate goal of the Native Comic Book Project is to promote healthy decision making among Native youth and their communities. We are currently conducting a formal evaluation of the Native Comic Book Project using pre- and post-intervention assessments to measure knowledge, habits, and decision-making regarding tobacco use, healthy eating, exercise habits, and human papilloma virus (HPV) among youth participants. The Native Comic Book Project is on-going. To date, the project has been implemented at 10 sites with 55 participants enrolled, and is currently identifying future sites. Data will be analyzed in Winter 2013. Future research and education activities include developing additional youth oriented cancer and health interventions. [Acknowledgment: This study was supported, in part, by a grant from National Cancer Institute awarded to Dedra Buchwald, M.D., Director for the Center of Clinical and Epidemiological Research, University of Washington, Seattle, WA, U54CA153498.]

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Technology and Engineering

OA #122

Subcategory: Civil/Mechanical/Manufacturing Engineering

Analysis of Stream Flow for Climate Change Evaluation based on Flow Duration Curves within Potomac Watershed

Mir Ali, University of the District of Columbia

Yonas Gadissa, University of the District of Columbia

In the recent years it has been recognized that climate change is real which can have severe impact on the water resources, water resources systems, and operation and management of these systems. The flow rates in the streams and rivers are

dependent upon watershed characteristics, meteorological, hydrological, terrestrial and land developmental factors. In this research we investigate the stream flow flow rates at specific locations of creeks and rivers within Potomac Watershed using the flow duration curve (FDC). Flow duration curve provides information about variation of magnitude of flow rates over time. The FDC curve provides information about the percentage of time stream flow rate equaled or exceed a certain design flow rate. The long-term daily flow data and monthly flow data were collected for several stations located within Virginia portion of the Potomac Watershed from the USGS web site. The chronological flow data are divided into time periods (e.g., 20 years). For each chronological period, FDC were developed and statistics were estimated. The chronological FDC along the river at various locations were compared for different time periods to see the trend of climate change and other land development impacts. [Acknowledgment: HBCU-UP]

Faculty Advisor: P.Behera, pbehera@udc.edu

OA #123

Subcategory: Electrical Engineering

Preparation of PEDOT-PSS for Use as Electrode Material in Supercapacitors

Shantonio Birch, Georgia Perimeter College / University of South Florida

The need for alternative energies has increased research interest in energy storage devices. Batteries have essentially become outdated, and supercapacitors have emerged as backups for batteries in applications where high power density is needed. Today, commercial supercapacitor use electrodes coated with activated carbon, which provides a large surface area for storing ions. However, because of the nature of carbon materials, conventional supercapacitors are only capable of storing energy electrostatically. Therefore, it was proposed that conductive polymers could be used as alternative electrode materials. Among conductive polymers, poly (3, 4-ethylene dioxythiophene)- poly (styrene sulfonate) (PEDOT-PSS) is appreciated for electrode materials because of its high stability and ease of processability. However, because of relatively low conductivity, pristine PEDOT-PSS does not make the best electrode material.

Therefore, in this study, a series of experiments were conducted to produce highly conductive PEDOT-PSS electrodes by synthesizing pristine PEDOT-PSS with ethylene glycol and dimethyl sulfoxide. Afterwards, a thorough investigation was done to determine the effect of Triton X-100 on the porosity and capacitance of composite PEDOT-PSS electrodes. At the end of the study, a peak specific capacitance of 21.5 F/g was observed for PEDOT-PSS electrodes treated with 5% ethylene glycol and 4% Triton X-100. In addition to this, PEDOT-PSS films

were very conductive, and Scanning Electronic Microscopy and electronic microscopic images revealed a conformational change in the porosity of PEDOT-PSS due to the addition of Triton X-100.

This result indicated that composite PEDOT-PSS films could be further doped with conductive materials such as graphene. Such combination, we predicted, would yield very porous and conductive PEDOT-PSS nanocomposites which could be used in supercapacitors applications and hybrid energy storage devices. [Acknowledgment: This study was supported by a grant from the NSF awarded to Dr. Sylvia Thomas, Principal Investigator of the Sustainable Energy and Advanced Materials Research Experience for Undergraduates, University of South Florida (USF), Tampa, FL. Award #0851973 and the Bio/Organic Electronics Laboratory at USF.]

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OA #124

Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

The Production of Xanthan Gum as a Sustainable Source of Hydraulic Fracturing

Lindsay Davis, Langston University / Kansas State University
Benjamin Katz and Deane Lehmann, Kansas State University

For many years, scientists have been searching for more sustainable ways to support life on Earth. The fossil fuels that have been used for millions of years are being depleted, leaving researchers to find quick solutions. Hydraulic fracturing is a fairly new process that extracts oil, natural gas, geothermal energy, and other resources from the shale layer of the Earth. How exactly do we get the resources without damaging and contaminating the environment? To date, Guar Gum and Kerosene are being used to produce fracking fluid that makes the process run smoothly. However, these are expensive non-biodegradable products. Guar Gum is a thickener used to clear rocky detritus. Xanthan Gum is a biodegradable thickener used in a large amount of food, common household products, and industrial applications.

This study investigates how to efficiently produce a Xanthan Gum product in the lab to use as a less costly biodegradable alternative in fracking fluid. Xanthan Gum can be derived from *Xanthomonas campestris*. *X. campestris* was planted on 3 different types of media to analyze the best method for growth: solid media, liquid media, and intermediate media consisting of immobilized *X. campestris*. Results demonstrated only immobilization of *X. campestris* allowed growth and enabled us to produce Xanthan Gum.

Results from viscometer analyses support that our lab-produced Xanthan Gum is comparable to mass produced Xanthan Gum and has a higher viscosity in the presence of H₂O₂, a biodegradable chemical currently used in fracking fluid. Using our technique to produce Xanthan Gum may be beneficial for two reasons. First, growing Xanthan Gum from immobilized bacteria will secure the food supply and reduce cost of commonly used goods; presently most of the fracking gum is taken from gum supply used for food, consumer products, and industrial usage. This adds to elevated prices of goods. Second, this technique may reduce America's gas prices and dependency on foreign oil by making fracking more sustainable via using less expensive techniques and using biodegradable material.

[Acknowledgment: The funding for this study was supported, in part by National Science Foundation, Kansas-Idea Network of Biological Research Excellence, OK-Louis Stokes Alliance for Minority Participation and KSU Graduate School.]

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OA #125

Subcategory: Electrical Engineering

All Solid-State-Based Ultracapacitor

Brannon Floyd, Norfolk State University

Charles Perkins, Norfolk State University

A supercapacitor is a device that is able to store and deliver large amounts of energy. Supercapacitors bridge the gap between high power capacitors and high energy batteries. With advancements in downsizing technology, smaller and flexible power sources are in high demand. The immediate objective of this research is to power a laser diode for the purpose of neural sensing. Gold thin-films were used as electrodes due to their biocompatibility. Potassium chloride was used in the electrolytic solution due to its ability to hold a charge within polymeric substances. Future studies will focus on testing and development of the supercapacitor. The key factors limiting the power density and frequency response of a supercapacitor are the internal resistivity of the electrode itself, the contact resistivity between the electrode and the current collector, and the resistivity of the electrolyte within the porous structure of the electrode.

The method we will be using to obtain the capacitance value will be using cyclic voltammetry. With the constant scan rate (dU/dT), an ideal capacitor should give a constant current. There is a reaction that occurs between the electrode and the electrolytic solution. The solution moves to the surface of the interface (mass transport), then electron transfer can occur via quantum mechanical tunneling between the electrode and the electrolyte close to the electrode. The final product moves away from the electrode and allows for a fresh electrolyte to take its place. A voltage is swept between two values at a fixed rate. Once V_2 is

reached, the scan is reversed and the voltage is swept back to V_1 . In conclusion, from the supercapacitor that was designed, an improved version can be fabricated. The gold films may be replaced by polypyrrole in hopes to improve the capacitance, specific energy and specific power. Another improvement that can be obtained is using a 20% PVA solution and testing the results. Growing nanowires on the gold films could also be done to the current supercapacitor designed. This will increase the surface area of the electrode allowing for more charge to be stored. Overall this project was a great learning experience for conducting research and obtaining knowledge about a new technology. *[Acknowledgment: NSF HBCU UP]*

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OA #126

Subcategory: Environmental Engineering

Stream Flow Analysis Based on Flow Duration Curves for Potomac Watershed

Yonas Gadissa, University of the District of Columbia

Mir Ali and Pradeep Behera, University of the District of Columbia

It is recognized that climate change can have severe impact on the water resources, water resources systems, and operation and management of these systems. The flowrates in the streams and rivers are dependent upon meteorological, hydrological, terrestrial and land developmental factors. In this research, we investigate the flowrates at specific locations of creeks and rivers of the Potomac Watershed using the flow duration curve (FDC). Flow duration curve is a graphical representation of a recorded flow magnitude occurring during the given recorded period of time, which shows the percentage of time that the flowrate is likely to equal or exceed some specified value. The FDC provides information about the percentage of time stream flowrate equalled or exceeded a certain design flowrate. The long-term daily flow data were collected from the USGS web site. The chronological flow data are divided into time periods (e.g., 20 years). For each chronological period, FDC were developed and statistics were estimated. The chronological FDC along the river at various locations were compared for different time periods to see the trend of climate change and other land development impacts. Results are presented for various creeks and rivers located within the Potomac Watershed which is very useful for engineers, water resources professionals and regulatory authorities. *[Acknowledgment: STEM Center/NSF/HBCU-UP - HRD-0928444]*

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OA #127*Subcategory: Climate Change***Carbon Emission Study and Building Energy Assessment****Bizuayehu Hailemeskel, University of the District of Columbia**

This paper presents research work on Carbon Emission Study and Building Energy Assessment. Carbon Footprint is the measurement of greenhouse gasses that are released into the atmosphere by our daily use of carbon releasing energy, directly or indirectly. The direct carbon footprint is referred to as the primary footprint and the indirect carbon footprint is referred to as the secondary footprint. The primary footprint is a measure of our direct emissions of CO₂ from the burning of fossil fuels including domestic energy consumption and transportation. We have direct control of these because we can choose to consume less energy such as electricity from a power plant or to use public transportation instead of our own cars to reduce our carbon footprint. The secondary footprint is a measure of the indirect CO₂ emissions from the whole lifecycle of products we use - those associated with their manufacture and eventual breakdown. A survey of estimated environmental impact or greenhouse emission in tons of carbon dioxide, CO₂, equivalent per year for 20 students was conducted. The Building Energy Assessment research demonstrates how saving consumption of a building's electricity can have an environmental impact. We did this by documenting the energy consumption of the lighting fixtures at the University's Van Ness campus buildings, and calculating the energy savings if the fluorescent lightings were replaced with high efficient power LEDs lightings. The environmental impact will be monitored in real-time with wireless sensors and the cost savings evaluated. This energy conservation attempt with LED retrofit lights will decrease power consumption, increase life-span of lights, and decrease maintenance of lights on campus. [Acknowledgment: MARC/NIH/NIGMS - 1T34GM087172-01A1, STEM Center - NSF/HBCU-UP - HRD-0928444, Cancer Academy/NIH/NCI: 5R25CA129035-04].]

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OA#128*Subcategory: Electrical Engineering***Improving Communications via GNU Radio and Underlay Schemes****Aaron Henderson, Tennessee State University**

With the internet being abundantly used by cell phones and tablets, communication frequencies are being used more readily. Since natural resources are being depleted at an astounding rate, one can imagine that the same thing will

happen to man-made resources. A man-made resource that most of us depend on every day is communication. A wide range of electrical devices used to communicate are a way of life. For many years, researchers have been finding and continue to find new ways to improve our global communication systems to keep up with the growing need. Some have even used GNU Radio and cognitive radio systems to accomplish this task; however, attempting to solve our communication issues through manipulating the underlay scheme has not. If a signal can be transmitted under an already existing signal on an already existing frequency, without disturbing the primary user's communication, then we can make use of an established framework. This is being tested through GNU Radio and cognitive radio systems. By placing this relatively new hardware at various distances, we established a baseline for accuracy of transmission. Once a baseline of accuracy was established, a secondary test bed was implemented with a two-way transmission by inserting two RFX 1200 daughter boards into a single device and synchronizing those daughter boards to transmit the same signal. This research has shown that, with a more robust signal and by using underlay schemes, signals can be sent on already used frequencies with an improvement in the accuracy rate ten times that of the original test bed.

The conclusion that can be derived from these results is that secondary users can communicate on the same frequency that primary users are operating on without disturbing either the primary or secondary user's communication. The question that lies in the near future is, "Will the same results hold true with multiple primary and secondary users?" This will simulate a real-world scenario where many people are using their devices at the same time. [Acknowledgment: This study was funded by the NSF Research Initiation Grant awarded to Sachin Shetty, Assistant Professor, Tennessee State University]

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OA #129*Subcategory: Materials Science***Porosity in Sintered Recycled Glass Designed for Polluted Soil Filtering****Liliana Hernández, University of Puerto Rico, Mayagüez**

Wesley Cuadrado, Jasmine Figueroa, Andrea López, Gerardo Nazario, and O. Marcelo Suárez, University of Puerto Rico, Mayagüez

Soil pollution, a problem of concern today, results in serious damage to the environment and public health. To contribute to the control soil pollution and identify alternative uses for recycled glass, this investigation deals with the fabrication of porous glass beds by controlled sintering. Those glass beds can then be used as a filter for polluted soils. In determining the

glass porosity, we use recycled powdered glass of particles size of MG-30, 0.60 mm and MG-80, 0.18 mm, which were sintered at different temperatures (from 700°C to 800°C) and at times (from 10 minutes to 30 minutes). The resulting porous glass specimens were characterized by optical microscopy and their porosity assessed by quantitative image analysis. The highest average porosity of the MG-30 samples was 62.62% obtained at 725°C for 10 minutes, and the lowest average porosity was 0% obtained at 800°C for 25 to 30 minutes. Also, the highest average porosity of the MG-80 samples was 68.7% obtained at 700°C for 10 minutes, and the lowest average porosity was 4.06% obtained at 800°C for 25 minutes.

These results showed an inverse relationship between temperature and time of sintering with the amount of porosity of the samples, which properly modeled allows adjusting sintering parameters to desired filtering specifications. Ongoing work includes porosity analysis of sintered samples with different mass ratios of MG-30 and MG-80 powdered glass. *[Acknowledgment: This project and its participants are supported by: The Center for Education and Training in Agriculture and Related Sciences of the University of Puerto Rico-Mayaguez and The Center for Research Excellence in Science and Technology.]*

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OA #130

Subcategory: Electrical Engineering

The Effects of Stress on CZTS Thin Film Solar Cells

Brett Jones, Southern Polytechnic State University

CuZnSnS₄ (CZTS) is quickly becoming a popular element to work with because it is abundant, has a low cost, and there is no toxicity. This research is important because it will provide a clean source of renewable energy at a low cost of production. This research will replace the commonly used silicon in solar panels with CZTS thin films. The effect of stress on CZTS thin film solar cells is investigated so that we can learn how to reduce the stress. Stress affects the CZTS thin films by reducing the efficiency level and damaging the thin films. Factors such as temperature, deposition time, and annealing methods determine if the solar cell will contain stress (cracks/voids). To help determine if stress is contained in the thin films, the X-ray Diffraction or XRD graphs and the Field Emission Scanning Electron Microscopy are used to obtain an accurate view on the thin films. The effects of stress on the CZTS thin films and the various factors that cause stress will be discussed to improve our research of getting high conversion efficiency levels in our CZTS absorber layer which will be placed in solar panels instead of the common element silicon to produce a clean source of renewable energy. In the current state, our efficiency levels are

still not close to what we want, we now know how to successfully reduce stress in the CZTS thin films. We are now considering different deposition methods and fabrication techniques to improve our efficiency levels. We would like to thank the National Science Foundation for the funding and for the grant for new equipment in our laboratory. *[Acknowledgment: National Science Foundation]*

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OA #131

Subcategory: Civil/Mechanical/Manufacturing Engineering

Renewable Energy-Powered Bulk Milk Cooling for Smallholder Dairy Farmers

Jonathan Jones, University of Georgia

Uganda's population of 30.7 million is predominantly found in rural agricultural areas. Agriculture makes up 15.1% of the country's total GDP and 90% of its exports, with dairy production commanding a large portion. Due to poor road networks, insufficient labor, and lack of electricity in rural areas, many of smallholder dairy farmers lack the means to preserve night milk, which results in large economic losses. Much of the night milk is disposed of or converted into low-quality products like ghee, a clarified butter from anhydrous milk fat. With decreased agricultural production and growth in population, near future food scarcity is hypothesized. Previous field studies by the Ugandan Industrial Research Institute and the Kisaalita Lab at the University of Georgia completed in Mbarara district in the southwestern part of Uganda have shown success in developing a 15.5-liter renewable energy-powered evaporative cooler that utilizes zeolite absorption methods to lower the temperature of milk by 18° C while smaller farmers failed to adopt it due to disbelief. Cooling milk to 4°C within a four-hour time frame of milking meets the international milk quality standards. The vacuum-tight system under extreme low pressure cools milk through the transfer of heat from the milk and to the surrounding water, resulting in absorbable water vapor for the zeolite. A repeatable biogas regeneration system is created from cow dung. Our goal is to optimize the system to cool a larger capacity of milk (100 liters) and assess lab and field performance.

By optimizing the system's wicking and regeneration, larger and more educated dairy farmers will utilize the system, which will increase the adoption of the technology into rural communities of smallholder farmers by increasing the belief in the system's results. The use of the device will permit more milk from smallholder dairy farmers to enter cold chain by allowing for night milk to be cooled, facilitating increased incomes for rural smallholder farmers and the overall increase of the GDP of Uganda. The excess biogas from the secretions of livestock

created by this system can be used for cooking and lighting, decrease the demand for timber to meet energy needs of rural areas, and reduce the release of methane gas into the atmosphere from fermenting cow dung. *[Acknowledgment: World Bank Development Marketplace Program Award DM08 5681, EPA Grant Number SU834725, NSF Award 0528062]*

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OA #132

Subcategory: Electrical Engineering

Implementation of a Wireless Body Area Network for Healthcare Monitoring

Ahsenafi Lambebo, University of the District of Columbia

Advances in electronics and wireless sensor network technologies have facilitated the development of Wireless Body Area Networks (WBANs). These networks allow a continuous remote monitoring of patients' vital signs at hospitals, nursing homes and at home, thus improving the healthcare system. Sensors worn on clothes or implanted on the patient's skin collect information about vital signs such as pulse rate and body temperature. In this project, a real-time patient monitoring system based on a wireless body area network was built and tested. The WBAN consists of two nodes and a base station. Each node comprises a pulse sensor, a temperature sensor, a GPS module, and a ZigBee wireless module. The base station consists of a receiving Zigbee module and a Wi-Fi module. The captured data is made available to the user through a graphing application programming interface. The system was built and successfully tested in real time where data was successfully captured and displayed. *[Acknowledgment: This study is supported by a grant from NSF/HBCU-UP - HRD-0928444 awarded to Freddie M. Dixon, Professor, Department of Biology, at the University of the District of Columbia.]*

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OA #133

Subcategory: Plant Research

Plant Biotechnology: Standardization of Nutrient Media for Tissue Culture

Briana Lee, Southern University at New Orleans
Murty S. Kambhampati, Southern University at New Orleans

Plant tissue culture is a technique that is needed in the improvement and enhancement of crops in agriculture. Plant tissue culture is a collection of techniques that are used to develop and maintain plant cells, tissues, and organs under sterile conditions. The long-term goal for this study is to apply

tissue culture techniques in crop improvement. The short-term goal of this research project is to standardize the best possible nutrient media for tissue culture. We hypothesize that callus formation and organogenesis in different crop plants respond differently to the same plant stimulators. Effect of various combinations of different media (MS Basal Medium with Vitamins, LB Agar, MS Basal Salt Mixture, and MS Basal Medium with Gamborg Vitamins) and different hormones (BAP, 2,4-D, NAA, IBA, Kinetin, and IAA) were investigated for callus formation using different plant parts. Plants that were used in the study were: alfalfa, corn, pea, peanut, sunflower, and tobacco. Dry seeds and leaf explants were sterilized prior to inoculation. MS Basal Medium with Vitamins supplemented with BAP, 2,4-D and kinetin was the most suitable for callus formation with the highest percentage of response: 100% peanut embryo and hypocotyl, peanut and sunflower endosperm. All media supplemented with NAA, 2-4 D, and kinetin had an overall low response of callus formation. The data in this study is supported by previous studies in which BAP and 2,4-D induced a high percentage of callus response. MS Medium with Vitamins proved to be a source for complete plant regeneration from a variety of explants. *[Acknowledgment: This research is supported by the National Science Foundation (HRD-0928797).]*

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OA #134

Subcategory: Civil/Mechanical/Manufacturing Engineering

Design, Fabrication, and Testing of Microstrip Transmission Lines and Antennas

James Lee, Elizabeth City State University
Henry Mishoe, Akbar Eslami, and Jamiiru Luttamaguzi, Elizabeth City State University

A Microstrip is a type of electrical transmission line that transmits microwave frequency signals from a generator to load. The Microstrip has a signal conductor transmission line on the top of the dielectric substrate and a ground plane on the bottom. The transmission lines are used to guide low power over limited distances with little or no loss of power. Microstrips can be used in antennas, couplers, filters, power dividers and many more microwave and mm-wave components. Microstrip has been one of the most popular microwave transmission-line formats for decades. It is lighter and less expensive than traditional waveguide technology and hence preferred in many of NASA's space instruments. Furthermore, it is advantageous for the space applications because of their low power requirements. In the present project, we designed, fabricated, and tested: (1) a Microstrip transmission line that passes through many substrate layers, (2) an L-band dual polarized wideband antenna. The measured results for both cases (Microstrip transmission line and L-band antenna) are found to

be in excellent agreement with our design. [*Acknowledgment: NASA STEM program*]

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OA #135

Subcategory: Civil/Mechanical/Manufacturing Engineering

Dynamic Measurement of Thin-Films of Bubbles During Boiling Using Fluorescence Microscopy

Jenny Lei, University of California, Santa Barbara

Gopinath Warriar and H. Pirouz Kavehpour, University of California, Los Angeles

Nucleate boiling is a heat transfer process that efficiently removes energy from a heated surface. This process is important for systems such as nuclear reactors, electronic cooling, etc., where overheating can result in system failure. During boiling, vapor bubbles nucleate from cavities on the heated surface, grow, and then depart from the surface. There is a thin (nanometers to microns) wedge-shaped film underneath the bubble, between the bubble and the heated surface; evaporation from this thin-film contributes to approximately 20% of the total heat transfer to the bubble. Understanding the heat and mass transfer process in this thin-film is critical if one needs to incorporate models for thin-film evaporation into numerical simulations. Characterization of the film thickness during the bubble growth cycle is a crucial step in this process. The thickness was quantified using fluorescence microscopy, an optical technique that measures the intensity of the emitted electromagnetic radiation, stimulated by the absorption of white light. A fluorescent dye, that emits light at a different wavelength than the incident light, was added to the test liquid. The incident light illuminated the solution from below the device through an objective lens in an inverted microscope. This excited the fluorescent molecules and produced an emission band that passed through a filter in the objective lens; this filter narrowed the receptivity of the camera. The captured images indicated the intensity of the emitted light, which is linearly proportional to the thickness of the thin-films. The thickness of the thin-film was found to be approximately 150 microns, which is much too large to be the actual thickness of the thin-film due to the fact that it is nearly the diameter of the bubble. This inaccuracy is due to the unwanted light that was captured by the camera. The vapor bubble is not a solid object; therefore, the camera also detected some of the light from above the bubble. Also, the incident light illuminated a large area due to its small magnification, which led to additional light detection.

Future work for this project will include using higher magnification lenses to decrease the size of the illuminated area to improve accuracy of the measurement, running experiments

with varying concentrations of dye to reassure thickness values, and capture multiple images of the bubble during one bubble growth cycle to monitor the change in thin-film thickness throughout the process.

[*Acknowledgment: This study was made possible, in part, to the University of California Leadership Through Advanced Degrees program.*]

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OA #136

Subcategory: Computer Engineering

Text To Speech Translator

Angelo McCaw, Virginia State University

Meesha Rashidi and Christopher Wills, Virginia State University

In 2010, the overall percentage of people in the United States of all ages with one or more disabilities was 11.9%. That is 36,399,700 of the 305,353,600 individuals in the United States. These are a lot of people who are not always offered the same opportunities as the other 88.1% of the population. This research is aimed at helping people with disabilities to use their computers. The team members have come up with a text to speech translator for PC that is not solely in software, and hence is compatible with many machines. When the implementation is strictly in software, the user would have to install the software and be allowed to use it on the same system, rather than any machine. This can be a hinder when there are clearance and wait time constraints involved. This product would be a strong benefit to use of computers by disabled users.

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OA #137

Subcategory: Materials Science

A Bayesian Analysis of Viscoelasticity Using Stochastic Based Homogenization

Paul Miles, Florida State University

William S. Oates and Michael Hays, Florida A&M and Florida State

Time dependent nonlinear deformation of the elastomer VHB is not trivial to predict due to complexities associated with nonlinear polymer chain mobility that occurs during finite deformation. Some specific behaviors, such as hyperelasticity, have highly accurate models, but rate dependent effects including viscoelasticity, are still under development. This research was conducted to enhance model predictions of viscoelasticity using a stochastic-based homogenized model that included time constant distributions to predict the viscoelastic

behavior of a VHB dielectric elastomer used for smart structure applications. Unique to this analysis was the utilization of a Bayesian statistical analysis to identify the probability densities of the viscoelastic time constants (τ). The VHB specimens were stretched uniaxially through load and unload cycles for five different constant stretch rates (0.0472, 0.10, 0.335, 0.50, 0.67 Hz) for multiple specimens. The specimens were stretched to six times their initial length and then relaxed back to zero stress.

This load and unload cycle was conducted twelve times to reach steady-state hysteresis and to clearly delineate viscoplasticity from viscoelasticity. In order to find the time constant distributions, the model was first assumed to have a discrete time constant. During model optimization, τ was designated as an unknown parameter and optimized to create the best fit between the model and data. By using Bayesian methods, probability distributions were created for the unknown parameters. From this distribution, values were extracted and applied to the constitutive model. By using the probabilities densities found in the Bayesian analysis and incorporating them into a stochastic based homogenized viscoelastic model, excellent prediction of the constitutive behavior was predicted in comparison to experiments conducted over a relatively broad range of stretch rates and large deformations. The results are also compared to a conventional discrete set of hyperelastic-spring dashpots that were optimized using a gradient-based constrained optimization algorithm. Superior model predictions are obtained using the stochastic-based model and support through the Bayesian statistical analysis. *[Acknowledgment: This study was supported by a grant from NSF awarded to Florida State University to support REU in mechanical engineering.]*

Faculty Advisor: William S. Oates, woates@fsu.edu

OA #138

Subcategory: Computer Science & Information Systems

Characterization and Analysis of High Traffic Website Events

Paige Piggott, Howard University

Camille Carter, Howard University

Used by a number of hacker groups, Denial of Service (DOS) Attacks are used to shut down a website in order to infiltrate a specific network system. DOS attacks can be graphically viewed as an extreme spike in the amount of traffic visiting that website. Similarly, the "Michael Jackson Effect," which describes a large increase in traffic due to a major event, can also shut down a website. This research was conducted to formulate a mathematical method that would describe and predict the difference between DOS Attacks and High-Traffic events. Graphical data on each of the websites was collected using Alexa.com. With the support of news articles and hacker blogs

as soft data, the spikes on each graph could be identified as an attack or result of a High-Traffic event. The plots graphed the percentage of global activity on each website verses time. Using the slope of the events beginning and end, early deductions were made about how the DOS and High-Traffic events differed from one another.

Data did show that the lengths of the event and slopes were marginally different between DOS and High-Traffic events. Unfortunately, using the slopes alone proved that there was no significant difference between the two. Dataplot, statistical analysis software created by National Institute of Standards and Technology, warranted more tests for comparison. Using T-Tests for Equal Means, Shapiro-Wilk Normality Test, Kolmogorov-Smirnov Test, and Anderson Darling Distribution Test, the data proved to fit within normal distribution showing that the DOS attacks and High-Traffic events were all similar to each other within their respective category. However, while both cases fit within normal distribution, the data on DOS attacks and High-Traffic events did not differ enough to reach a conclusion about their behavior. Recently, there has been a revelation that the data was not measured on the same scale from site to site. There is research currently taking place that may show a conclusion supporting the hypothesis. *[Acknowledgment: This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.]*

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OA #139

Subcategory: Civil/Mechanical/Manufacturing Engineering

Long-term Precipitation Analysis for Mid-Atlantic Region for Evaluating Climate Variability and Change

Asteway Ribbiso, University of the District of Columbia

Pradeep Behera, University of the District of Columbia

Since the publication of the Intergovernmental Panel on Climate Change documents (IPCC, 2007), there has been a growing interests among scientists, engineers, governments and public to understand climate change issues and its associated impacts. Climate change and water resources management are closely related because climate change affects the hydrologic cycle directly. The potential climate change can have significant impacts on our water resources and related sectors such as water availability, flooding, urban infrastructures, water quality, ecosystems, coastal areas navigation, hydropower, economy and other energy (USGS, 2009).

To understand and in support of informed decision for adaptation of climate change related issues, this research

proposes to conduct a technical analysis of the long-term point rainfall data for determining the potential climate change trend. Available selected long-term hourly rainfall records within the Mid- Atlantic Region are divided chronologically into lengths of 10-20 year of segments. For each of the time segments, storm event analyses were conducted for many locations within the region. Storm event analysis were conducted based on the inter event time definition (IETD). The statistical characteristics of storm event characteristics (i.e., event volume, event duration, average intensity and inter event time) were obtained for each time period. A comparative analysis of design storm event volumes for various durations and storm event analysis for varying IETDs were conducted.

The preliminary result of this ongoing study is presented. Such information is very critical for our water resources professionals, engineers and regulatory authorities in evaluating the existing urban drainage infrastructures and future hydrologic analysis and stormwater management. *[Acknowledgment: This study was supported, in part, by grants from STEM Center-NSF/HBCU UP and DC WRRRI, Washington DC, STEM Center - NSF/HBCU-UP - HRD-0928444]*

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OA #140

Subcategory: Civil/Mechanical/Manufacturing Engineering

Searching the Experimental Region Where a Metamodel Fits Best

Jean C. Rivera-Nazario, University of Puerto Rico at Mayaguez

Metamodeling implies the use of an empirical model to represent data from another model, usually a simulation one. Typically, the metamodeling process starts with data generation to then find the empirical model parameter values that provide the best overall fit. In this sense, the data is fixed and the model is flexible. This work attempts an inversion of such process: trying to find the area defined by data where a metamodel fits best. That is, the data selection is flexible, and the model is fixed. There are several potential applications for this development, including genetic sequence alignment or the search for areas of control models with the physical and chemical industrial processes.

The initial experiment in this work involves the use of curated rheological data for a thermoplastic polymer. The metamodel in this case is simply an affine function. The objective was to find the area where linear behavior with a negative slope was apparent. In this problem, such area represents the decrease of polymer viscosity with increasing shear rate, that is, the shear-thinning region. The results of three different approaches in terms of mean square error and coefficient of determination (R²) are reported. The first approach requires fixating an initial

point and measures percentual change to select data. The second approach involved fitting multiple competing linear regressions with a fixed initial point. The third approach relaxes the need of having a fixed initial point and also relies on regression analysis. The initial experiments provide a positive assessment of the use of regression and the use of square error as a performance measure regression. The linear region of the viscosity data was successfully found for data sets at four different temperatures.

This work introduces an inverse-metamodeling problem and presents the first results. Devising a strategy to solve this problem will positively impact modeling efforts where the region of applicability of a model is sought. Practically all STEM fields have problems of this type. Future work includes the analysis of processes with multiple variables. This is the use of multivariable models in the search of region where those models maximize the fit taking into account the principles of minimizing the errors. Optimization techniques are expected to be used in the development of inverse metamodeling for a multivariable process. *[Acknowledgment: The Applied Optimization Group acknowledges the support of NSF UPRM CREST Nanotechnology Center for Biomedical and Energy-Driven Systems and Applications (Project 0833112) as well as the NIH MARC Assisting Bioinformatics Efforts at Minority Schools.]*

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OA #141

Subcategory: Computer Science & Information Systems

Service-Oriented Architecture Within UMB: Improving Banking with Technology

Jodeci Ross, Langston University

Jay Ashbaugh, Shawn Lopeman, Sultan Kaja, J.M. Baugh, and Mike Sheehan, UMB Financial Corporation, Kansas City, MO

UMB Financial Corporation is an American financial services company based in Kansas City, MO. UMB needed to utilize methodology that would allow efficient communication and understanding of tasks and projects between its disparate departments. When all departments are in communication, services are easier to get done and customers are satisfied which brings more customers to the bank. The immediate object of this research project was to meet the needs of UMB. Service-oriented architecture, SOA, is a set of principles and methodologies for designing and developing software in the form of interoperable services that aid businesses. Some benefits of SOA include: flexibility between IT and business; reuse of existing services; providing a model for the integration of business partners', customers', and suppliers' services; cost reduction; customer satisfaction; and reducing business risk by

keeping the company within the guidelines of government regulations.

We hypothesized that constructing specific SOA will meet the needs of UMB. We utilized IBM's WebSphere software to produce SOA. The approach also involved scrum agile software development methods based on iterative and incremental development, where requirements and solutions evolve through collaboration between self-organizing, cross-function teams. Removing impediments to the ability of the development team to deliver the sprint goal/deliverables was maintained by an assigned scrum master. SOA is still being implemented within the bank. Current indications demonstrate SOA is a great technique that will benefit UMB. *[Acknowledgment: Langston Integrated Network College (LINC), Oklahoma Louis Stokes Alliance Minority Program (Ok-Lsamp), INROADS UMB Financial Corporation.]*

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OA #142

Subcategory: Water

Surface Water-Quality Modeling of Universitas Indonesia Recharge Pond Towards Optimum Management

Cameron Sanders, Howard University

The actual situation of the UI (Universitas Indonesia) recharge pond, post construction in year 2006, is showing signs to alert those who maintain it. Besides the physical condition of the facility such as control house malfunctioning, the physical and chemical properties of the water of the recharge pond also point towards decreasing quality. Water quantity of the pond especially during dry seasons seems to decline. This is indicated by water level marks on the wall of the main pond. Furthermore, related research evaluating several parameters of water quality has shown a value exceeding the water quality standard for raw water utilization. Since the function of the pond is as a mediator for ground water recharge, obviously the ground water will be polluted if the recharged water has bad qualities. The aim of this research is to identify the rate of surface water quality changes of UI recharge pond, so that appropriate actions can be taken towards its sustained management. The research will cover two main activities: the first is field activity, such as survey, measurements, and water sampling; and the second will be laboratory activities that include analyzing water quality and numerical modeling, followed by interpretation of the results of simulations and the observation data.

The results and findings from this research are expected to provide basic information such as rate of water quality changes, and self purification ability of the recharge pond, so that a

conclusion and recommendation can be drawn regarding possible action that may be required to improve water quality as well as to mitigate pollution rates from the sources.

[Acknowledgment: This material is based upon work supported by the National Science Foundation under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the funder.]

Faculty Advisor: Tiffany Lathan, tlathan@howard.edu

OA #143

Subcategory: Computer Science & Information Systems

Multi Robot Exploration : Sector Search with Rendezvous

Tommy Suriel, University of the District of Columbia

Evanna Reynoso and Briana Wellman, University of the District of Columbia

In coverage applications, such as exploration, search and rescue, and hazardous waste clean-up, the deployment of humans teams can be risky. Instead, multirobot systems can perform these tasks safer and faster. Communication between robots is a key factor for the completeness of such tasks. It reduces duplication of work and prevents robots from interfering with one another. However, communication is not always guaranteed. Limitations of communication networks can be unpredictable, especially in unknown environments. The quality of wireless connections can fade due to environmental interference[1]. In addition, if robots are exchanging large amounts of data, they can run into the issue of receiving incomplete information due to cpu overload [2]. To deal with these challenges, approaches that do not require continuous point-to-point communications are needed. The Sector Search with Rendezvous approach is proposed as a way to overcome communication limitations. Each robot explores a sector or designated area, and periodically rendezvous to share information. Instead of continuous passing messages, robots only communicate during rendezvous. The approach is compared to when robots do not communicate and to when robots communicate the entire time. The approach using no communications serves as baseline results. We propose that Sector Search with Rendezvous can efficiently coordinate a team of robots in an exploration task. Each approach was simulated in the 3D simulator, Webots. The robot controller was developed in the C programming language and experiments were conducted on a Quad Core 3.2 GHz machine running Linux with 8G of RAM. An emitter and receiver were aggregated on all the robots for point-to-point communications. Twenty trials were conducted using a three-team robot.

Preliminary results suggest that Sector Search with Rendezvous is efficient in coordinating robots during exploration. The

multirobot team using this proposed approach outperformed the team using no communications. When compared to a team of robots continuously passing messages, it had comparable results. [1] A. J. Goldsmith and S. B. Wicker, Design challenges for energy-constrained ad hoc wireless networks, *Wireless Communications, IEEE*, vol. 9, no. 4, p. [2] P. E. Rybski, S. A. Stoeter, M. Gini, D. F. Hougen, and N. Papanikolopoulos, "Effects of limited bandwidth communications channels on the control of multiple robots," in 2001 IEEE/RSJ International Conference on Intelligent Robots and Systems, 2001. Proceedings, vol. 1, 2001. [Acknowledgment: The authors gratefully acknowledge the support of the following grant: NSF/HBCU-UP-HRD-0928444.]

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Undergraduate Abstracts for Poster Presentation

Biological Sciences

1

Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Enhancing the Stability of Bacterial Microcompartments with Natural and Engineered Covalent Crosslinking

Hoda Ahmed, University of California, Los Angeles
Michael C. Thompson, Krystal N. McCarty, and Todd O. Yeates, UCLA

Bacterial microcompartments (BMCs) are large protein complexes that are important for metabolic processes in prokaryotes. Structurally, BMCs consist of a polyhedral proteinaceous shell surrounding specific interior enzymes. In cyanobacteria, BMCs called carboxysomes are involved in CO₂ fixation, and in enteric bacteria, BMCs called metabolosomes, are responsible for propanediol and ethanolamine metabolism. Unfortunately, details of BMC function have remained elusive because purification and subsequent biochemical studies of BMCs have been a challenge due to their low stability in solution. We aim to explore specific covalent crosslinking between shell protein components as a method for improving the stability of BMCs in solution to allow purification and *in vitro* studies.

In carboxysomes from cyanobacterium *Synecococcus elongatus*, we engineered specific cysteine residues using site-directed mutagenesis as sites for modification with covalent crosslinkers. We found that carboxysome shell proteins containing engineered cysteine mutations can be modified with covalent crosslinkers *in vitro*. Additionally, using reducing and non-

reducing PAGE gels, we discovered naturally-occurring disulfide bonds in a BMC shell protein from Clostridia, which may connect neighboring shell protein subunits. As judged by electrophoretic mobility shift, this shell protein shows complex patterns of disulfide bond formation between monomeric subunits. Overall, our work demonstrates that both engineered and naturally-occurring disulfide bonds can be used to stabilize BMCs in solution. Utilization of BMCs with enhanced stability will allow purification and *in vitro* manipulation of these elaborate protein complexes, thus enabling new experiments that will expand our understanding of BMC function. [Acknowledgment: I want to acknowledge CAMP for supporting funding my research.]

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Subcategory: Microbiology/Immunology/Virology

Role of Lactosylceramide in the Central Nervous System Autoimmunity

Nadya Ali, University of Washington / Harvard Medical School
Francisco Quintana and Lior May, Harvard Catalyst Summer Clinical and Translational Research Program, Brigham and Women's Hospital, Department of Neurology

Multiple Sclerosis is a disease of degradation of the myelin sheath due to an autoimmune response. Although the cause of the immune response remains unknown, previous studies have discovered that a lipid molecule, lactosylceramide (LacCer), is present in high levels in Multiple Sclerosis patients. Furthermore, an inhibitor molecule, D-Threo-1-phenyl-2-decanoylamino-3-morpholino-1-propanol HCl (PDMP), inhibits the synthesis of LacCer.

The goal of this project was to establish a model with astrocytes and microglial cell lines that will allow for genetic manipulation and further mechanistic studies. An additional goal was to understand the role of LacCer in the pathogenesis of Multiple Sclerosis in both the innate and adaptive immune responses. To do this, we treated both CD4 effector T cells, Th1 and Th17, as well as astrocytes and microglial cells in the Central Nervous System with PDMP. These results will allow for a target molecule to be manipulated as a potential therapeutic tool for Multiple Sclerosis. [Acknowledgment: Harvard Catalyst | The Harvard Clinical and Translational Science Center (National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health Award 8UL1TR000170-05)]

Faculty Advisor: Francisco Javier Quintana, quintana@rics.bwh.harvard.edu

3*Subcategory: Biomedical Engineering***Effects of Propranolol and Sympathetic Reactivity on Spatial/ Visual Abilities in ASD****Ashli B. Allen, Fort Valley State University**

Autism spectrum disorder (ASD) is characterized by the presence of communication deficits, impaired social interactions, and repetitive, restricted behaviors. Most pharmacologic treatments for ASD are expensive and target psychiatric symptoms such as depression, repetitive behaviors, anxiety and agitation. Few treatments are aimed towards improving cognitive abilities. Propranolol, a non-selective beta-adrenergic antagonist, may provide cognitive benefits in ASD. Propranolol blocks the noradrenergic sympathetic response causing a decrease in stress and anxiety. Previous research suggests that propranolol improves cognitive flexibility in ASD. In the present study, individuals with ASD (N=5) participated in a two-session study where they received either 40mg of propranolol or placebo in a double-blinded, counterbalanced manner. Baseline sympathetic reactivity was tested prior to drug administration. Galvanic skin response (GSR), measuring eccrine sweat gland activity and heart rate variability, via electrocardiogram (ECG), serves as a measure of baseline sympathetic reactivity. Following drug administration and a 60 minute wait period, the participants were administered the Rey-Osterrieth Complex Figure (ROCF) task. This task serves as an assessment of visual-spatial constructional abilities and visual memory. During task administration, participants were asked to copy a complex drawing. After 30 minutes, the participants were asked to recall and draw the same figure from memory. The copy and recall time for each participant was recorded.

It is hypothesized that propranolol will improve visual-spatial memory abilities relative to placebo. This effect would be evident with decreased copy and recall time and increased overall task score. As the mechanism of propranolol is to block the noradrenergic sympathetic response, it is hypothesized that the participants with the highest baseline sympathetic reactivity will receive the greatest cognitive benefits from propranolol. Preliminary analysis shows no significant differences in task score and time between the propranolol and placebo conditions. However, increased sample size and further analysis will contribute to a more definitive conclusion.

[Acknowledgment: This study was supported, in part, by grants from NSF HRD HBCU-UP Program awarded to Dr. Sarwan Dhir, Fort Valley State University, Fort Valley, GA 31030 and NSF REU grants DBI 2062667, University of Missouri-Columbia.]

Faculty Advisor: Sarwan Dhir, dhirso@fvsu.edu

4*Subcategory: Cancer Research***Selection of Potential Bone Cancer Biomarkers Genes: A Mathematical Optimization Approach****Jorlys Isela Alvarado Morales, University of Puerto Rico at Mayaguez**

In the identification of potential cancer biomarkers lies a significant possibility to characterize, detect and understand the illness. In previous work, our research group proposed a novel method based on multiple criteria optimization aimed to detect potential cancer biomarker genes through the analysis of microarray data. More precisely, the multiple criteria optimization problem is approached through a technique called Data Envelopment Analysis (DEA). DEA concepts and methodologies have been incorporated in a collection of mathematical models. Six of these models were compared previously, concluding that the Banks-Charnes-Cooper (BCC) model is the most appropriate one for the intended use. In this study, a bone cancer microarray experiment that identified 1,718 differentially expressed genes when comparing normal (or wild type) osteoblasts versus tumor-forming osteoblasts is analyzed with the approach described above in search of potential biomarkers. The average p_value (minimized) and the absolute fold induction (maximized) were used as performance measures. The analysis resulted in 34 genes identified as potential bone cancer biomarkers. Experimental evidence on these genes, available from a previous study, point towards the effectiveness of the approach in potential biomarker detection. The results are encouraging at this point. Additional literature-based and experimental validation will be undertaken to guide the biological exploration of the genes detected in this study.

[Acknowledgment: This project was possible thanks to the NIH MARC Assisting Bioinformatics Efforts at Minority Schools project 2T36GM008789 and also to the NIH NCI U56CA118809 to PSC and WDC.]

Faculty Advisor: Mauricio Cabrera-Rios, mauricio.cabrera1@gmail.com

5*Subcategory: Cell and Molecular Biology***Regenerative Potential of Adipose and Cord Tissue Derived Mesenchymal Stem Cells****Jorge A. Alvarez, University of Arizona**

Stem cell therapies can provide an alternative approach for repair and regeneration of tissues and organs. Mesenchymal stem cells (MSCs) are promising candidates for cell-based therapies. Although bone marrow derived MSCs (BM-MSCs)

have multi-lineage differentiation potential, it is not a preferred stem cell source because of the isolation process and low yield. The goal of this work is to evaluate the regenerative potential of human MSCs from two other sources: umbilical cord tissue and adipose tissue. We are also investigating the effect of harvest-site, sex, age and health status on the regenerative potential of MSCs. Cells from each tissue were isolated and characterized by flow cytometry using typical MSC markers. Growth characteristics were investigated by population doublings, saturation density and plating efficiency. MSCs derived from both types of tissues were assessed for differentiation potential, qualitatively and quantitatively. *In vitro* assays for wound healing and angiogenesis were investigated by scratch and matrigel assays, respectively. FACS analysis showed that cultured cells were positive for CD73, CD90 and CD105 while being negative for CD45. MSCs from all sources showed high proliferative potential and CFUs. After induction, MSCs efficiently differentiated into adipose, bone, cartilage and neuronal structures as determined with histochemistry, immunofluorescence and real time RT-PCR.

We conclude that MSCs can easily be obtained from human tissues, and it appears that adipose and cord tissues are suitable sources of stem cells for potential use in regenerative medicine. [Acknowledgment: Minority Health Disparities Research Program supported in part by the National Institutes of Health's Division of General Medical Sciences (NIGMS) Initiatives to Maximize Student Diversity, Grant No. 5R25GM062584-12 and the Graduate College of the University of Arizona. Current funding from UA/NASA Space Grant and Dr. David T. Harris.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

The Effect of Cold Atmospheric Pressure Plasma on Tail Regeneration of Tadpoles *Xenopus Laevis*

Chima Amadi, William Paterson University

Joyce June, Kevin Martus, and Jaishri Menon, William Paterson University

Plasma medicine is one of the newest fields of modern applied plasma chemistry, and its applications for wound healing and tissue regeneration, as well as various skin diseases, have been reported. A healthy wound requires a balanced combination of nutrients and growth factors. Additionally, nitric oxide (NO) – a free radical is also crucial in wound healing processes and linked with production of several cytokines, interaction with other free radicals and influence on microcirculation. We hypothesize that a) exposure to plasma will affect wound healing and tail regeneration in tadpoles *Xenopus laevis* and b) plasma induced

endogenous NO production may have an important role to play at the cellular level. Tail amputation was carried out by removing 40% of tail and immediately the amputated region was exposed to helium plasma for 40 and 60 seconds. The plasma was generated inside a quartz tube with a single electrode powered by a low frequency (15kHz) AC voltage having peak-to-peak voltages of 18kV. The feedstock gas was Helium flowing at 50 sccm that ultimately produced optically emitting species in the discharge region that included Helium, Nitrogen and OH radicals. Rate of growth of the regenerating tail was measured every alternate day. For histological features, blastema (growing regenerate) was fixed in 4% neutral buffer formalin for paraffin sections. *In situ* staining for NO was carried out 5 days post amputation. Our results show that the rate of the regenerating tail was proportional to the exposure time of plasma flow, being higher in 60 second exposed ones but at the expense of metamorphic rate. Histological features show that the tadpoles exposed to the plasma flow showed higher level of cellular proliferation and microvasculature in blastema. *In situ* staining for NO also indicated its increased endogenous production compared to control.

These findings suggest that accelerated wound healing as well as tail regeneration following exposure to helium plasma flow may be due to a) its direct effect on cell proliferation and b) increased NO production which may be involved in microvascularization. NO also could be involved in regulation of cell death in remodeling of amputated tail tissue. For future studies, discharges of helium and oxygen mixtures as well as different isoforms of nitric oxide synthase (enzymes responsible for production of NO) will be investigated. [Acknowledgment: This study was supported, in part, by the National Science Foundation under Grant No. #1040108 to Dr. Martus.]

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Subcategory: Genetics

Next Generation Sequencing in Metagenomics

Nsisong Amama, North Carolina Agricultural and Technical State University

Metagenomics is the sequencing of deoxyribonucleic acid (DNA) in an environmental sample. Sequencing is a process through which scientists decode the DNA sequence of an organism. Next Generation Sequencing (NGS) is a method used for determining the order of the nucleotide bases- Adenine, Guanine, Cytosine, and Thymine- in a molecule of DNA. The basic sequencing technology which was designed by Frederick Sanger (Sanger sequencing) is still widely used today by scientists. However, it is limited to only decode between 1,000 and 2,000 base-pairs of DNA at a time. This could be quite cumbersome, considering the fact that even the simplest of viruses contain tens of thousands

of base-pairs, bacteria contain millions, and mammals contain billions of base-pairs. Therefore, my hypothesis was to prove that breaking down large sequencing datasets into smaller, “connected” datasets is more appropriate for complex mixed communities. Our main method deployed a metagenomic sequencing analysis tool (shotgun sequencing) called assembly. Using the metagenomic process, we used the NGS data and data manipulations in PYTHON to evaluate the characteristics of a mixture assembly and the characteristics of separated partitions. In conclusion, we were able to demonstrate that partitioning in metagenomic analysis was more efficient than alternative methods. [Acknowledgment: National Science Foundation Bio/computational Evolution in Action CONsortium (BEACON) iBLEND]

Faculty Advisor: Gregory Goins, gdgoins@ncat.edu

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Subcategory: Plant Research

Effects of a Plant Alkaloid on Adult Bumblebee Infection with a Trypanosome Parasite

Winston E. Anthony, University of Massachusetts

Anne S. Leonard and Lynn S. Adler, University of Massachusetts

The trypanosome *Crithidia bombi* is a pathogen common among bumblebees in North America (Gillespie, 2010). *C. bombi* affects bee fitness by inhibiting nutrient intake and has the potential to reduce pollination effectiveness (Gegear, Otterstatter, & Thomson, 2005). The USA produces \$1.3 billion in revenue in tomatoes alone, which are pollinated almost exclusively by bumblebees (USDA-NASS 2005). Recently, certain alkaloids that naturally occur in nectar have been shown to reduce levels of *C. bombi*. However, how these alkaloids affect survivorship among *C. bombi* parasitized bees is unknown.

Our hypothesis was that sucrose mixed with anabasine, an alkaloid found in the Nicotiana plant genus, would act on bees by: 1.) Increasing survivorship of the common eastern bumblebee, *Bombus impatiens* infected with *C. Bombi* and exhibit lower parasite levels than infected bees fed plain sucrose; and 2.) Not reducing survivorship in healthy bees. 139 Lab-reared *B. impatiens* workers inoculated with *C. bombi* or a control solution were crossed with a dietary treatment of sucrose mixed with anabasine at one of four different concentrations (0, 1.81, 3.62, or 7.25 ppm) until death. Any bees that died before inoculation of unnatural causes were excluded; methods of analysis consisted of ANOVA and survivorship curves.

Anabasine concentration significantly affected the probability of bees having *C. bombi* upon death: 39% in the highest concentration versus 69-88% in the other treatments (DF=3, Wald Chi-Square=9.2925, P=.0256). Anabasine also reduced

overall pathogen load ($F_{3,33}=3.51$, $P=.0257$), with the highest concentration providing the lowest parasite counts. There was a marginally significant tendency for infection to reduce survivorship, with infected bees dying on average one day sooner than uninfected bees. Consumption of anabasine did not affect survivorship among uninfected or infected bees. These findings indicate that plant alkaloids may be effective at increasing bumblebee resistance to pathogen infection. Whether these effects translate into fitness differences in more natural contexts remains a question for further research. If these laboratory results persist in more natural settings, this has the potential to lead to a natural antibiotic regulation for bee disease. [Acknowledgment: Funding provided jointly by NSF Grant: DEB-0742923, USDA Grant: NRI 2008-02346]

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Subcategory: Plant Research

The Effects of *Brassica Nigra* on Mycorrhizal Fungal Abundance

Olivia Anumudu, University of California, Irvine

Mycorrhizal fungi provide important ecosystem services to plants, such as helping to increase plant nutrient uptake and mineral absorption, resulting in improved plant vitality, and increased growth and quantity of plant biomass. Our main research focus examines how invasive plants, such as the non-mycorrhizal plant *Brassica nigra*, affect the abundance of obligate biotrophic arbuscular mycorrhizal fungi associated with native plants from an invaded grassland habitat. We predict that presence of *Brassica nigra* inhibits mycorrhizal fungi and thus reduces fungal abundance in soils. Soil samples were taken from an intact native grassland habitat (<50% native), manually managed *Brassica nigra* plots (30-50% native), highly invaded plots with high *Brassica nigra* cover (<10-15% native), as well as introduced *Brassica nigra* experimental plots. Plant bioassays will be performed with the native plant, *Stipa pulchra*, grown in each soil type. After harvesting the plant bioassay, soil hyphal extractions will be performed on all samples in order to investigate the difference in fungal abundance among these soil types. Extracted hyphae will be stained and examined under a microscope to quantify mycorrhizal abundance and evaluate the effect of *B.nigra* on fungal abundance in invaded and restored Southern California grasslands. [Acknowledgment: California Alliance of Minority Participation, University of California, Irvine]

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Subcategory: Physiology and Health

Development of a Novel *In Vivo* Model of Parkinson's Disease Linked Pesticide Exposures Using *Drosophila*

Angel Barajas, University of California, Los Angeles (UCLA)

Ciara A. Martin, Molecular Toxicology Interdepartmental Program, UCLA

David E. Krantz, Semel Institute of Neuroscience at David Geffen School of Medicine

The majority of Parkinson's disease (PD) cases are idiopathic and their etiology remains unclear. Epidemiology studies demonstrate that exposures to environmental toxins, such as pesticides, can increase the risk of acquiring PD up to three fold. Mice injected with pesticides, such as paraquat and maneb, exhibit some phenotypes characteristic of PD. Functional models via oral exposure, which would more closely mimic exposure in humans, have yet to be established. Exploring alternative routes of exposures and combining multiple pesticide exposures at varying doses has proven a hindrance in mammalian systems due to cost and time constraints.

Thus, our aim was to mimic human oral exposure to multiple PD-linked pesticides using *Drosophila* as a model organism. Validating phenotypes associated with PD is of first interest in this study; measured outputs include survival, dopaminergic neuron count and motor function. Survival was significantly lower in groups exposed to paraquat and paraquat combined with the pesticides maneb or benomyl and maneb. Individually paraquat and maneb exposures caused slight, but insignificant, losses of dopaminergic neurons. Interestingly, combined exposure to both paraquat and maneb appeared to be synergistic and resulted in a significant loss of dopaminergic neurons. Ongoing tests are assessing the effects these pesticide exposures may have on negative geotaxis, an assay to assess motor function. Once validation is complete, the selected drugs will be tested for their interactions with genes associated with higher PD incidence. In addition, we will determine if neuroprotective genes, shown to alleviate PD symptoms in past models in our lab, can alleviate symptoms caused by this new paraquat and maneb model. *[Acknowledgment: NIH Maximize Student Development grant]*

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Subcategory: Genetics

The Reverse Genetics Characterization of Four Genes Found in Yeast-2-Hybrid Screen

Christopher L. Benson II, University of Georgia

John P. Stanga and David Nelson, University of Georgia

After disasters like wild fires, the seeds left in the soil depend on karrikins that are found in the smoke to stimulate their growth. Strigolactone, also found in plants, is a germination stimulant like karrikins; some plants will germinate in the presence of karrikins, strigolactone, or both. I want to know if four genes, three protease enzymes and an unknown protein, are involved with *Arabidopsis thaliana*'s response to karrikins and strigolactone. We found the genes through a Yeast-2-Hybrid screen by using SMAX1 as bait to see what genes will interact with SMAX1 so that we can test those genes to see how they function.

Currently, we know that MAX2, an F-box protein, and SMAX1 deal with three phenotypes: hypocotyl lengths, seed germination, and branching, but SMAX1 only affects the germination and hypocotyl length of the seedlings. When max2 and smax1 are separate, max2 has a very low germination rate and isn't responsive to karrikins and strigolactone. However, smax1 does the exact opposite by increasing the germination rate of the seeds and responses to karrikins and strigolactone. If we were to have a max2smax1 double mutant, then there would be a moderate germination, but there won't be a response to karrikins and strigolactone. Since the branching is an adult phenotype, then we can look at the germination rate and hypocotyl length while they are seedlings. From the four genes, I have identified three of the genes to be homozygous while the other is heterozygous by genotyping the leaves from the adult plants. Once we found the homozygous seeds, we conducted a hypocotyl assay, where I placed the seeds into a red light incubator and measured their hypocotyl lengths after several days of exposure. We can only grow the seeds in red light because the phenotype that we want max2 to display can only be found under this condition.

The results from this assay showed us that the seedlings behaved like smax1 mutants by not deviating from the normal pattern of hypocotyl length averages, longer hypocotyls in acetone and shorter hypocotyls in strigolactone. As a future study, we've decided to do a germination assay for these seeds because smax1 mutants have a better germination rate when karrikins or strigolactone are present. From the germination assay, we can look for the phenotypes we are looking for from smax1. *[Acknowledgment: This project was supported, in part, by a grant from the Peach State LSAMP Alliance to David Nelson, Ph.D, Department of Genetics, University of Georgia.]*

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Subcategory: Cancer Research

Neoplastic Transformation of Mouse Mammary Epithelial Cells by *In Vitro* Exposure of Progesterone

Shareeta Boddie, Winston Salem State University

Stephanie T. Dance-Barnes, Winston Salem State University

Oral contraceptive use has been associated with an increase in the risk of breast cancer in young women. Progestins are frequently prescribed for contraception or during postmenopausal hormone replacement therapy, in which progestins are combined with estrogen as a means to block estrogen-induced endometrial growth. There is substantial evidence that breast cancer risk is associated with prolonged exposure to female hormones. Among these hormonal influences a leading role is attributed to estrogens. However, Progesterone (PR) action in breast cancer is grossly understudied and remains controversial.

This study attempted to investigate the influence of progesterone on normal mouse mammary cells by exposing them to varied progesterone doses (0-negative control, 1, 10 and 100nm) for 48 hours, and then assessing cell viability and morphology. We hypothesized that prolonged progesterone exposure by the normal mouse mammary cells would result in transformation. The viable cells were then passaged for two additional 48h intervals, and between each interval the viable cells are analyzed. Following the third and final cycle of progesterone treatment, the cells were evaluated microscopically for transformative morphological changes. Observations reveal that these selected cells were morphologically cancerous in nature, specified by their irregular shape with enlarged nuclei. Additionally, the viable cells from this final treatment were then co-cultured with normal untreated mammary cells to evaluate the clonogenic growth potential of the progesterone treated cells following sustained progesterone exposure. The increasing number and size of foci was evident in a dose dependent manner. The forming of the foci provides preliminary evidence that progesterone may be playing a role in transforming the normal mammary cells. This study attempts to mimic the effects of continual exposure of the mammary cells of women that have utilized PR-based contraception or replacement therapy.

The findings of this study could provide some clarity to the controversial role of PR in breast cancer development. We would like to continue this line of research to further confirm that the alterations that are induced by progesterone in the mouse mammary cells are indeed transformation associated, and to also elucidate the molecular events that may be involved. *[Acknowledgment: The National Science Foundation HBCU-UP Grant #HRD-0927905, US Department of Education Title-III CCRAA HBCU Grant, WSSU Professional Development Grant]*

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Subcategory: Microbiology/Immunology/Virology

A Survey of HIV Education Knowledge Among Students at a Historically Black College/University (HBCU) in Arkansas, the University of Arkansas at Pine Bluff (UAPB)

Jonathan Bolden, University of Arkansas at Pine Bluff

Sederick C. Rice, University of Arkansas at Pine Bluff

Education about the human immunodeficiency virus (HIV) has increased over the last twenty-five years, as a result of many mass media campaigns. The Black Entertainment Television (BET) Network began a campaign, in collaboration with the Centers for Disease Control (CDC), called Rap-It-Up, to educate populations about HIV and how it spreads. There have been other campaigns like Rap-It-Up which promoted HIV awareness on college/university campuses, but there is still a lack of information on how to reduce students' risk for contracting HIV, HIV testing options, and what to do if their test is positive. The goal of this study was to conduct a survey of fifty random students at a Historically Black College/University (HBCU), the University of Arkansas at Pine Bluff (UAPB) to determine if polled students knew important facts about HIV. We used an eight question anonymous survey to get feedback from students in the form of yes/no responses. Our objective was to poll twenty-five male and female students that lived and/or worked on the campus of UAPB. Preliminary data indicated that (17/25) (68%) of males and (20/25) (80%) of females knew options for finding out their HIV status. When males and females were polled (23/25) (92%) of males and (25/25) (100%) of females knew how HIV was transmitted. When males and females were polled (17/25) (68%) of males and (16/25) (64%) of females knew where HIV resources were located at UAPB. When males and females were polled (24/25) (96%) of males and (23/25) (92%) of females were aware of online resources related to HIV education. Males and females polled at UAPB indicated that (24/25) (96%) of males and (22/25) (88%) of females knew of the "Rap-It-Up" campaign. The majority of male (25/25) (100%) and female (25/25) (100%) students polled at UAPB indicated that more funding should be provided for HIV education. This study indicated that more polled female students knew how to find out their HIV status as compared to males and the majority of male and female students polled knew how HIV was transmitted. This study also indicated that polled male and female students at UAPB knew where to find resources about HIV, where to find HIV resources online, and were familiar with the "Rap It Up" campaign. Finally, both populations of students agreed that more funding for HIV education was needed. *[Acknowledgment: This study was supported in part by a grant from NSF/HBCU-UP awarded to Dr. Mary E. Benjamin, Vice Chancellor for Academic Affairs, University of Arkansas at Pine Bluff.]*

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Subcategory: Cell and Molecular Biology

Defining Markers of “Stemness” in Canine Mesenchymal Stem Cells from Various Tissue Sources

Nora Bouzihay, University of Arkansas at Little Rock

The development of cell-based regenerative therapies in veterinary medicine will be facilitated by an increased knowledge of mesenchymal stem cells (MSCs) characteristics. These cells are a subpopulation of adult tissue stem cells found in sources such as bone marrow, adipose tissue, and umbilical cord tissue. Isolation and differentiation of MSCs from these different sources has been successfully undertaken and reported in horses and dogs. The International Society for Cellular Therapy (ISCT) defines human MSCs as cells exhibiting plastic adherence in culture, mesenchymal tri-lineage differentiation potential, and a consistent cell surface marker profile. While human MSCs are well-characterized, canine MSCs are less so, with no reliable MSC surface marker panel currently available. This investigation seeks to identify potential cell surface markers of canine MSCs via the isolation and propagation of bone marrow- and adipose-derived canine cells containing putative MSCs. Canine peripheral blood mononuclear cells (PBMCs) isolated from canine whole blood were used as comparator cells. Flow cytometry was performed to examine the expression of a panel of cell surface markers. Our results show that the canine bone marrow- and adipose-derived cell lines exhibited plastic adherence and tri-lineage differentiation. In addition, the cells contain a population that express cell surface markers CD90, CD29, MHC I, CD44, and lack MHC II expression. Our findings suggest that the canine bone marrow and adipose-derived cell lines evaluated in this study contain a population of MSC-like cells. These markers could potentially serve as candidates in determining a future canine MSC cell surface marker profile. [Acknowledgment: Food and Drug Administration]

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Subcategory: Cell and Molecular Biology

Seroprevalence of Leishmania parasites in Egyptian Dogs

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Samuel A. Epps, A.M. El Behairy, M. Hilali, J.P. Dubey, and Alexa C. Rosypal, Johnson C. Smith University

Leishmaniasis is an insect-transmitted parasitic disease with worldwide distribution. *Leishmania spp.* infections cause a broad spectrum of clinical signs ranging from skin lesions to fatal visceral disease. Dogs are a major reservoir host for visceral

leishmaniasis in humans. Leishmaniasis is endemic in the Middle East and North Africa, but little is known concerning canine *Leishmania spp.* infections in Egypt. Blood samples were collected from 50 stray dogs in Giza, Egypt. Canine sera were tested for antibodies to visceralizing *Leishmania spp.* by commercial immunochromatographic strip assays based on recombinant antigen K39. Antibodies to *Leishmania spp.* were found in 5 of 50 (10%) of dogs tested from Egypt. Results from this study indicate that stray dogs are exposed to visceralizing *Leishmania spp.* in Egypt. [Acknowledgment: The work of Ms. Bowman and Mr. Epps was supported in part by a mini-grant from the Smith Institute of Applied Research at Johnson C. Smith University to Dr. Rosypal. Partial support provided by HBCU-UP]

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Subcategory: Cancer Research

Vernonia Amygdalina – Induced Activation of Cyclin A and P53 Tumor Suppressor Gene in Human Breast Cells

Viviauna Brown, Jackson State University

In the present study, we used the human breast adenocarcinoma (MCF-7) cell line as a test model to study the cellular and molecular mechanisms of anti-cancer properties of *Vernonia amygdalina*. We hypothesized that *V. amygdalina*-induced expression of stress genes and related proteins may play a role in the cellular and molecular events leading to cell cycle modulation in cancer cells. To test this hypothesis, we performed Western blot analysis to assess the expression of specific cellular response proteins including p53 and Cyclin A. Western Blot analyses demonstrated a strong dose-response relationship with regard to p53 and Cyclin A expression within the dose range tested. The images obtained from the confocal microscope show a statistically significant up-regulation of these proteins with increasing doses on *V. amygdalina* in MCF-7 cells. Up-regulation of Cyclin A suggests that it is required for S phase and passage through G2 phase in cell cycle progression. Taken together, these results indicate that *V. amygdalina* has the potential to induce cell cycle arrest through activation of the 53-kDa tumor suppressor protein. These data are in agreement with previous results generated in our laboratory, the pharmacology of *V. amygdalina* as anticancer agent is mediated through phosphatidylserine externalization, activation of caspase-3, and nucleosomal DNA fragmentation. [Acknowledgment: This research supported by a grant from the National Institutes of Health (Grant NO.1G12RR13459-14), through the NCCR-RCMI Center for Environmental Health at Jackson State University.]

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*Subcategory: Cancer Research***A High Throughput Screening Project to Identify the Inhibitors of GPR4, a Novel Acid Sensing G-protein Coupled Receptor****David A. Bullock, North Carolina Central University**

Eun Young Huh and Gordon Ibeanu, North Carolina Central University

Li V. Yang, Brody School of Medicine, East Carolina University

GPR4, a member of the OGR1 family of novel acid-sensing G protein-coupled receptor (GPCR) is expressed in several organs and tissues of the body. The mechanisms by which this receptor responds to acidosis are not well understood due to lack of chemical inhibitor molecules. In order to study the role of GPR4 in cellular function and disease process, it is necessary to identify surrogate ligands capable of modulating the activity of the receptor. Therefore, we embarked on a high throughput (HTS) screening project to identify potent chemical inhibitors of acid pH-induced activation of the GPR4 receptor. We have enabled and validated the GPR4 assay by screening a training set of FDA approved drugs. Potential chemical modulators identified in this limited screen are awaiting secondary assays to determine the specificity of the compounds.

[Acknowledgment: We wish to acknowledge the support of the Biomanufacturing Research Institute and Technology Enterprise, North Carolina Louis Stokes Alliance for Minority Participation at North Carolina Central University, Fostering Undergraduates Through University Research and Education in the Science at North Carolina Central University.]

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*Subcategory: Plant Research***Phylogeny and Diversification of Valerianaceae (Dipsacales)****Gloria Calderon, University of New Orleans**

The *Valerianaceae* (Dipsacales) is comprised of 250 species distributed worldwide (with the exception of Australia) across a wide ecological gradient. *Valerianaceae* is a family of the order Dipsacales. They are herbs, less frequently vines, subshrubs or shrubs, sometimes rosette herbs, perennial or annual. A characteristic of this family is the strong odor, especially when dry. Over the past decade, much attention has been paid to the phylogenetic relationships within this clade. Most of these studies, however, have relied exclusively on chloroplast DNA sequence data.

For this study, we collected additional data (from both sequences & taxa) to further resolve relationships among the

major lineages of *Valerianaceae*. The phylogenetic utility of each of these several conserved orthologous sequences (COSII markers) was compared to the internal transcribed spacer (ITS) region and several non-coding chloroplast loci that have been widely used in phylogenetic inference of plants. Using already developed primers from a recent study that identified a set of nuclear genes that occur in single copy in multiple sequenced angiosperms, we were able to use sequence data from 4 of these low copy genes. We performed several phylogenetic analyses with these genes and in combination with several chloroplast DNA regions. We used the program PAUP to find the most parsimonious tree that could describe the relations of the different species. Results from these analyses were in strong agreement with previous molecular study and provided additional support for several new hypotheses.

[Acknowledgment: National Science Foundation]

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*Subcategory: Physiology and Health***Obesity As It Relates to Adipogenesis****Shanice Caldwell, Savannah State University**

Johnny Johnson, Savannah State University

This research project responds to the dramatic increase in the prevalence of obesity as it relates to adipogenesis and the complex problem of determining gene expression of unknown pathways. Adipogenesis plays a vital role in energy homeostasis. It is a tightly regulated cellular differentiation process, in which the preadipocytes are transformed into differentiated adipocyte cells. Suppressed adipogenesis, accompanied by an increase in adipocyte size, is linked to increased insulin resistance (Meissburger, B., 2011). In contrast, up-regulation of adipocyte differentiation results in increased glucose disposal (Dubuisson, O., 2011), which is known to enhance insulin sensitivity and prevent excess lipid storage in the liver, heart or muscle (Berg, A. H., and Scherer, P.E., 2005). In 3T3-L1 preadipocytes GLP-1R and its FDA approved agonist liraglutide (currently used to treat diabetes m. type 2) mediates proliferation and apoptosis of pre-adipocytes via the transcription factor peroxisome proliferator-activated receptors, gamma (PPAR γ). The activation of PPAR γ by GLP-1 suggests that GLP-1R may be a direct target gene of PPAR γ .

In addition, the process of adipogenesis involves down-regulation of the gene encoding Hes-1, a target of the Notch signaling pathway. Although PPAR γ and CCAAT/enhancer binding protein (C/EBP), beta (C/EBP β) are distal to Hes-1 in the Notch pathway, their expression induces adipogenesis (Ross D. et al., 2004). Therefore, the mechanism by which Hes-1 blocks differentiation is not clear. Using the two models that have

already elucidated mechanisms for the adipogenesis agonist (GLP-1R) as well as antagonist (activation of Notch), we will determine if the agonistic characteristics of GLP-1 are mediated via suppression of the Hes-1 gene. [Acknowledgment: National Science Foundation MAGEC-STEM Plus Program.]

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Subcategory: Cell and Molecular Biology

Mapping Mouse Glycinergic Circuits Containing the Neuronal Transporter GlyT2

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Glycine neurotransmitter plays an essential role in the CNS by modulating the transmission of sensory and motor information. Two glycine transporters, glycine transporter 1 and glycine transporter 2, are essential for the clearance and re-uptake of gly respectively. Mutations of the GlyT2 causes hyperekplexia: a neuromotor disorder that results in exaggerated startle responses. Also, GlyT2 knock-out mice die prematurely by second postnatal week, displaying: rigid muscle tone, tremor and breathing abnormalities. Although it is described that GlyT2 is abundant in the spinal cord and caudal regions of the CNS, the location of glycinergic nuclei, axonal projections and connections have not been explored in detail. To map the neuronal pathways containing GlyT2, a transgenic mouse was developed and kindly provided by Dr. H. U. Zeilhofer, University of Erlangen-Nurnberg, Germany. In these mice, the GFP is expressed under the control of the GlyT2 promoter, and sagittal sections from different levels show that the majority of GFP signal is localized to the medulla, pons and midbrain and cerebellum. To better identify and characterize these glycinergic neurons, we prepared primary cultures from the brainstem and the retina using this transgenic mouse. After 7-21 days in culture, we subject these cells to immunostaining with GlyT1, GlyT2, GAD67, VGAT, MAP2 antibodies followed by identification of Gly neurons by fluorescence microscopy.

The results suggest the identification of three populations of GFP-positive neurons: those positive for GlyT1, other population containing GlyT2 and the third class devoid of either Gly transporter. Along with Gly, GABA is also an important inhibitory neurotransmitter. The possible third class of GFP-positive neurons may be GABAergic. We demonstrate the presence of GABA/Gly co-transmission in the retina and brainstem primary cultures. We concluded that retina GFP-positive neurons contained GAD67 and GlyT1, suggest the co-existence of GABA and Gly. Also, Brain sagittal sections from transgenic GFP-

expressing neurons suggest abundant Gly fibers in the brainstem area. A population of GFP-positive neurons in the brainstem contained GlyT2, GAD67 and VGAT.

Further directions include the identification of glycinergic nuclei in the transgenic mice by immunohistochemistry, and also identify GFP-positive neurons in the retina that express GlyT2. After this, they pave the way for optogenetic studies to find the function of the glycinergic circuits. [Acknowledgment: This work was supported by a grant from NIMH-SC1MH086070 to MM and MARC-U-STAR Undergraduate Biomedical Research Training 2T34GM008048 to Dr. K. H. Pannell.]

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Subcategory: Cancer Research

Sudemycin Alters Alternative Splicing in Primary Murine Hematopoietic Cells Expressing Mutant U2AF1

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Myelodysplastic syndromes (MDS) are a heterogeneous group of clonal hematopoietic stem cell disorders characterized by ineffective hematopoiesis and low blood counts, often progressing to secondary acute myeloid leukemia (sAML). Recent whole genome sequencing of sAML samples has revealed a novel recurrent missense mutation within the coding region of U2AF1, a gene encoding a splicing factor involved in 3'-splice site recognition. The U2AF1 (S34F or S34Y) mutation is an acquired heterozygous mutation in the first zinc finger of U2AF1 present in 13/150 (8.7%) MDS bone marrow samples. The mechanism by which mutations in the spliceosome contribute to MDS pathogenesis is unknown. Sudemycins, synthetic analogs of bacterial products Pladienolide B and FR901464, modulate the activity of the spliceosome and bind SF3B1. Treatment of cell lines with sudemycins causes accumulation of aberrantly spliced gene products. Sudemycins induce a significant decrease in cell growth and an increase in apoptosis in murine bone marrow cells expressing mutant U2AF1. We hypothesize that the S34F U2AF1 mutation alters pre-mRNA splicing, which can be modulated by Sudemycin treatment.

To test this, we have generated MSCV-based retroviruses encoding wild-type or mutant U2AF1. We infected c-kit+ primary murine bone marrow cells with these retroviruses or empty vector, cultured them *in vitro* and treated with 75nM Sudemycin for 6 hours. We then developed an RT-PCR assay to quantify the alternative splicing in these cells. Our results show the U2AF1 mutation increases aberrantly spliced transcripts and treatment with Sudemycin alters this splicing. We conclude that this assay can detect changes in alternative splicing due to the

U2AF1 mutation and Sudemycin modulation. Splicing modulators warrant further investigation as a novel therapy for patients harboring U2AF1 mutations. RNA sequencing will be done in the future to identify any biological relevant genes. The effect of Sudemycin modulation and U2AF1 mutation on the alternative splicing of these genes will be analyzed.

[Acknowledgment: This study was supported, in part, by a NIH grant (R25 HG006687-01) awarded to Opportunities in Genomics Research of The Genome Institute]

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Subcategory: Ecology

Analysis of Twenty Species of the USVI Fishery for Overfishing

Tasha Corneille, University of the Virgin Islands

Angela Dikou, University of the Virgin Islands

Currently 44, 16, and 6 % of fish stocks are fully to heavily exploited, overexploited and depleted, respectively, worldwide. Overfishing is the depletion of fish from the population to such an extent that it can't be replenished naturally. Overfishing may occur as a result of recruitment and/or growth overfishing. Recruitment overfishing is the removal of the fish from the population before it matures whereas growth overfishing is the depletion of larger size fish from the population such that fewer larger fish are represented in the catch. Fisheries management addresses overfishing for the sustainability of biological productivity through conservation of marine ecosystems. To determine whether overfishing is occurring at the USVI, data for 20 out of approximately 70 species of a port biosampling database [1980-2009] was analyzed and values of critical fish lengths (L_{mat} : length at maturity; L_{∞} =infinite length) were obtained from FishBase. Specifically, trends in average fish size in the catch, differences in average fish size among gear types, and contrasts of critical fish size values of the catch with those reported at Fishbase for relevant populations were evaluated. Significant trends in average fish size were revealed through regression analysis; significant differences in average fish size among gear types were revealed through one-way Analysis of Variance; contrasts between fish size critical values were evaluated graphically.

During the thirty year period, mean fish size decreased for two species (mutton snapper, $R^2_{adj.}=0.48$, $p=0.0004$, $Y=15529.84-7.57*X$, and Spanish hogfish, $R^2_{adj.}=0.99$, $p=0.0331$, $Y=7948.8-3.82*X$); increased for three species (longspine squirrelfish, $R^2_{adj.}=0.23$, $P=0.0023$, $Y=-1103+0.65$, spotted trunkfish, $R^2_{adj.}=0.37$, $P=0.0065$, $Y=-3141.3+1.67*X$ and white grunt, $R^2_{adj.}=0.48$, $P=0.0281$ $Y=-3128.16+1.72*X$); and remained unaltered for the rest of the fifteen species. However, contrast of critical values of L_{mat} and L_{∞} from FishBase indicated that

Spanish hogfish and spotted trunkfish may be subject to recruitment overfishing regardless of the negative and positive trends, respectively. There was significantly lower mean fish size for 6 out of 17 species caught with fish traps compared to the other fishing gear types. Mismatches between the direction of trends in mean size of fish in the catch and contrasts of critical length values of fish with minimum, maximum and average values of fish length in the catch, indicate probable creeping overfishing. Examination of the whole suite of species in the future may assist in highlighting the magnitude of creeping overfishing in USVI fisheries and prompt appropriate adjustment of regulatory tools, such as protected areas by the Department of Planning and Natural Resources. *[Acknowledgment: This research was supported, in part, by a grant from NSF awarded to ECS (Eastern Caribbean Scientists), University of the Virgin Islands, HBCU-UP, 2012.]*

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Subcategory: Cell and Molecular Biology

Establishment of Biotechnological Tools and Strategies for Long-Term Improvement of European Pear

Pablo Corredor, Washington State University

Christopher Hendrickson, Nathan Tarlyn, and Amit Dhingra, Washington State University

The pear industry faces challenges to its growth and stability. While newer varieties may enhance domestic markets, a narrow genetic pool limits the options available to address current challenges. Deployment of micropropagation and transformation require a set of procedures for introduction of improve genetic material and a selection mechanism must be utilized to isolate transgenic plants. Typically, engineered resistance to an antibiotic is used as a selection. Geneticin (G418) is an antibiotic that is expected to be an ideal selection agent due to its stability in a tissue culture environment. In order to determine the efficacy and optimal concentration of G418, the antibiotic was added in a graded concentration series to an optimized pear medium (TDH medium). Bartlett leaves were placed on TDH medium and incubated for 6 weeks in dark with 0, 25, 50, or 100 mg/L G418. Callusing was significantly inhibited by G418 at all concentrations, with growth only on control leaves (ANOVA, $P<0.05$).

Overall, the kill curve experiment showed that the concentrations of G418 were too high to serve as a suitable selection agent. Since kanamycin and similar antibiotics have been shown to be effective in pear selection during transformation, future transformation efforts will test lower G418 levels. Additionally, optimal nutrient concentrations in

plant growth media generally improve the growth and vigor of explants. Stem explants were placed in traditional Quorin and Lepoivre or TDH medium and incubated for 6 weeks to allow shoot induction. Dry weight of new growth was measured, and nutrient content was assessed. Finally, to produce viable plants from tissue culture, one must induce rooting. To determine a root induction protocol, a trial was conducted comparing cultural conditions. Rockwool was tested as a potential rooting substrate due to expected speed in rooting of plants. In this experiment, mean rooting response was determined among all explants. Both the liquid TDH and solidified 1/2-strength TDH medium contained 3.0-mg/L indolebutyric acid. Cultures were exposed to a dark period of one week for induction of root tissue, and then transferred to low light to allow for further growth. The 1/2 TDH medium combined with dark treatment had a significant positive effect on rooting ($P < 0.05$, t-test) compared to Rockwool. Due to knowledge gained in this work, efficiency of future transformation and propagation efforts in pear will be enhanced. *[Acknowledgment: This study was supported, in part, by PNW LSAMP research scholarship and The Cyber Boeing Scholarship, award.]*

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Subcategory: Genetics

Missense Variants of Voltage-Gated Calcium Channel Genes Implicated in Schizophrenia

Rebecca de Frates, University of Washington / Broad Institute of MIT and Harvard

Jen Pan and Colm O'Dushelaine, Broad Institute of MIT and Harvard

Schizophrenia is a severe mental disorder affecting 1.1% of the U.S. adult population. The molecular basis of this disease is currently unknown, and the treatment options are limited. Recent genetic studies have implicated variants of voltage-gated calcium channel genes with a number of psychiatric disorders, including schizophrenia and bipolar disorder. Voltage-gated calcium channels are molecules present in many cell types that regulate calcium influx by opening upon membrane depolarizations. Their function influences many cellular processes including proliferation, migration, neurotransmitter release, and gene expression. We hypothesize that calcium influx deficiencies may play a key role in a number of psychiatric phenotypes. Using data from recent exome sequencing and genome-wide association studies for schizophrenia, we surveyed coding variants in 10 genes that encode for the alpha subunit of voltage-gated calcium channels. A subset of missense variants in three genes [CACNA1B ($p=0.014$), CACNA1H ($p=0.0008$), and CACNA1S ($p=0.017$)] that had a significantly higher rare variant burden in cases versus controls were then

analyzed (assessed empirically by permutation of case/control status).

Subsequently, we introduced changes in the coding sequences of the significant calcium channel genes with reference to existing cDNA clones through site-directed mutagenesis, successfully creating five variants of the CACNA1S gene. We are currently pursuing functional studies of these variants using fluorescent calcium imaging and the whole-cell patch clamp technique to assess their impact on channel function. Our findings implicate a broader association between voltage-gated calcium channel genes and schizophrenia. The results of this study will yield important insights into the roles of calcium channel variants in the molecular pathophysiology of not only schizophrenia, but also in other psychiatric disorders.

[Acknowledgment: Stanley Medical Research Foundation, National Institute of Mental Health (RL1GM084437), Swedish Schizophrenia Consortium]

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Subcategory: Plant Research

Mass Spectrometry-Based Metabolomics Reveals Variation in Tomato Light Regulation

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Variation in metabolite composition and content is often observed in plants. However, the genetic basis for this variation is often poorly understood. Elucidating the interactions between genes, phenotype, and environment is critical to developing strategies for crop improvement, particularly for nutritional enhancement. We studied two tomato cultivars, Manapal and the photomorphogenic mutant high pigment-2 dark green (hp-2dg) mutant. These two cultivars share nearly identical genetic backgrounds with the exception of a point mutation in the DEETIOLATED-1 gene of the hp-2dg mutant leading to a single amino acid substitution. Despite their genetic similarity, these cultivars display a number of developmental, morphological, and biochemical differences including slower growth rates, reduced biomass production, and variation in metabolite concentrations in the hp-2dg mutant.

In this study, we used mass spectrometry-based metabolomics to examine the effects of light intensity on metabolite profiles in leaves of Manapal and hp-2dg. High light intensity increased primary metabolite production (sugars, amino acids) in both cultivars but to a much greater degree in Manapal. In contrast, light intensity had more subtle effects on secondary metabolites, with higher levels of the flavonoid rutin in hp-2dg but lower levels of the phenolic acid chlorogenic acid. These

data reveal complex pleiotropic effects of the DEETIOLATED-1 gene on the signal transduction pathway of light perception and photomorphogenesis in plant development and environmental adaptation. Through analyzing the effects of environmental and genetic factors on plant metabolic pathways, insights into regulation of the metabolome can be obtained which can guide efforts to improve the phytochemical composition of plants.

[Acknowledgment: Plant Powered Production (P3) Center through the Arkansas ASSET Initiatives (AR EPSCoR) (EPS-0701890, EPS-1003970) by the National Science Foundation and the Arkansas Science and Technology Center Arkansas Science and Technology Authority and the University of Arkansas at Pine Bluff.]

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Subcategory: Ecology

Do Eastern Hemlock Forests Provide Habitat to a Greater Variety of Spiders Compared to Non-Hemlock Forests?

Yvan Delgado de la Flor, Humboldt State University

Eastern hemlock is a foundation species in eastern North America, playing a critical role because it deeply shades the soil and creates a unique microclimate for some species (Ellison et al. 2005). Currently, hemlocks are dying due to the nonnative hemlock woolly adelgid, a phloem-feeding insect (Orwig 2011). Hemlocks are being replaced slowly by hardwood forests; this may cause alterations to the understory microclimates affecting the entire ecosystem, and may result in the local extinction of some arthropods (Rohr et al. 2009). I studied the impact of hemlock loss on spider communities; I hypothesized that the loss of eastern hemlock and associated increase in forest-floor temperature would result in the extirpation of some spider genera. The effect of the adelgid was mimicked with four 30x30m canopy-manipulation treatments: (1) hemlock control (stands dominated by hemlocks), (2) girdled hemlock, simulating tree mortality due to the hemlock woolly adelgid, (3) logged hemlock, mimicking the impact of pre-emptive salvage logging and (4) hardwood control, in which the forest is dominated by non-hemlock trees simulating the expected succession after the death of the hemlock trees (Ellison et al. 2011). Pitfall traps (180 ml buried plastic cups with 20 ml soapy water, left open in the field for 48 hr) in replicate plots of each treatment were sampled at 2–4 week intervals throughout the summer. Spiders collected in the pitfall traps were identified spiders to genus. Five hundred and ninety pitfall traps were collected during the study and 31 spider genera were encountered.

Results indicated 2 out of the top 3 most abundant spider genera were found in hemlock plots, and they were at least 2 times more abundant in hemlock plots than in any other plot.

Many questions such as the variation of spider genera in short periods or spider diversity in the canopies remain unanswered. However, this study is a good foundation for future work, and it provides us a better understanding of spiders in the Harvard Forest. Eastern hemlocks are dominant and local abundant tree in eastern North America, and the impact of their loss will be observed in 15+ years when hemlocks will be locally extinct potentially leading to the extirpation of species and the alteration of local food webs and ecosystems.

[Acknowledgment: I want to thank Clarisse Hart, Aaron Ellison, and Relena Ribbons for assistance with identification and mentorship of this project. Research was supported by NSF award DEB 10-03938.]

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Subcategory: Physiology and Health

The Effectiveness of Intensive Rehabilitation Program on Patients that Underwent Total Knee Arthroplasty

Eugene DeLoach, Jr., Langston University

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Total knee arthroplasty is an operation that provides patients with symptoms of osteoarthritis relief from knee pain and stiffness. Dramatic advancements in the knowledge of knee mechanics have led to design modifications that appear to be durable. Unfortunately, the mobility of patients post total knee operation is not consistent. The objective of this study was to investigate the comparative impact of post total knee arthroplasty rehabilitation on patients rehabilitating through the intensive functional rehabilitation program and those rehabilitating through standard care on knee mobility and pain reduction. Our hypothesis was that the combination of the intense rehabilitation and neuromuscular electrical stimulator would bring the best results in patients recovering from a total knee arthroplasty. Descriptive statistics were used to test the hypothesis. Two months after total knee arthroplasty, twelve patients were divided into three test groups. The first group underwent the Intensive rehabilitation program, the second group participated in the total rehabilitation program and was administered a neuromuscular electrical stimulator, and the third group was the control group, which participated in the standard care program. Preliminary results supported exercise and the neuromuscular electrical stimulator to be beneficial in the recovery of the knee. It is clear that the application of a single rehabilitation method has not provided timely efficient full recovery of patients. This research suggests an integration of two or more rehabilitation modalities will be more efficient in providing post total knee arthroplasty rehabilitation to patients.

[Acknowledgment: This study was supported, in part, by a grant from the Oklahoma Physical Therapy Foundation awarded to Dr. James Jackson, County Memorial Hospital Outpatient Facility, Lawton, OK.]

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Subcategory: Cell and Molecular Biology

Sclerotium Rolfsii Effect on the Growth and Regeneration of Tomato Callus

Princess Dollerson, Alabama A&M University

Sclerotium rolfsii, an omnivorous, soilborne fungal pathogen, causes disease on a wide range of agricultural and horticultural crops. This disease is known as “Southern Blight” (also called “southern wilt” and “southern stem rot”). Southern Blight is characterized by the wilting and yellowing of leaves. The disease is able to develop in the most severe conditions due to *Sclerotium rolfsii*'s ability to survive and thrive within a wide range of biological conditions. *Sclerotium rolfsii* attacks plants at or near the soil line. Before the pathogen penetrates host tissue, it produces a considerable mass of mycelium on the plant's surface. Then, the plant's outer cell layer deteriorates, the pathogen enters and infects the plant, and sclerotia begin to form where the mass of mycelium is present. Recent studies have shown an increase in the pathogen causing Southern Blight in tomato plants. The purpose of this experiment is to determine the positive and negative effects of *Sclerotium rolfsii* on the growth and regeneration of tomato callus, a cluster of differentiated cells. If the research is successful, we will be able to regenerate a tomato plant that resistant to the toxins secreted by *Sclerotium rolfsii*. This will lead to a substantial decrease in the number of tomato plants affected by the fungal pathogen.

First, the sclerotia produced by the fungal pathogen were scraped from infected plants, isolated, and cultured in favorable growing conditions. Next, explants taken from the hypocotyls of tomato plants were isolated, cultured in favorable growing conditions using different concentrations of cytokinins, and sub-cultured every 2-3 weeks to increase growth. After significant growth, the calli were treated with sclerotial extracts. After one week of observations, we found that the 0.3 g/mL of Kinetin was the most favorable concentration for growth. Therefore, this concentration, as well as a higher concentration, 10 g/mL of Kinetin, was used for the second part of the experiment. The calli were sub-cultured, treated with sclerotial extracts, and placed in favorable growing conditions. The control and inoculated groups continue to be observed for changes in growth. [Acknowledgment: This research has been supported in part by the NSF HBCU-UP Grant #HRD0928904.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Mutational Analysis and Transport Activity of ABC Transporter ABCB19 in *Arabidopsis thaliana*

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ATP-binding cassette (ABC) proteins are found across all phyla and use the energy from ATP hydrolysis to transport a wide range of substrates, including hormones, lipids, polypeptides, secondary metabolites, and xenobiotics, across biological membranes. In [i] planta [i], the B subfamily of ABC proteins (ABCBs) localize to the plasma membrane and transport a variety of aliphatic and aromatic organic acids. The best characterized ABCBs in [i] *Arabidopsis thaliana* [i], ABCB4 and ABCB19, transport the phytohormone indole-3-acetic acid (IAA). Polar transport of IAA is essential for growth, developmental, and environmental response processes in plants. ABCB4 is a conditional importer/exporter dependent on intracellular IAA concentrations. ABCB4 uptake activity displays broad substrate specificity whereas ABCB4 and ABCB19 exporters possess a high specificity for IAA. Crystal structures of multi-drug resistant exporters MmABCB1 and Sav1866 are commonly used as a modeling template for *Arabidopsis* transporters ABCB19 and ABCB4.

Based on these modeling predictions and biochemical analysis two hypotheses are proposed: 1) Inner leaflet sites within the transmembrane domains of ABCBs are responsible for determining substrate specificity and 2) substrate binding sites associated with the outer leaflet are thought to function in broad specificity and exclude hydrophobic substrates from within the plasma membrane. To test these hypotheses, inner leaflet mutants, called I105T, W108Y, E161D, E161Q, and N324D, and outer leaflet mutants, named I312T, M316Q, F840W, and F840Y were generated in ABCB19 via site-directed mutagenesis. We are in the process of analyzing transport activity and substrate specificity during heterologous expression of these mutants in *Schizosaccharomyces pombe* and *Arabidopsis thaliana* lab strains. Based on the proposed hypotheses, transport assay analysis is expected to demonstrate lower transport activity in the inner leaflet mutants indicating a higher substrate specificity for these binding sites and lower substrate specificity for outer leaflet mutants.

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*Subcategory: Plant Research***The Effects of Temperature and Water Type on Seed Germination in *Asclepias incarnata*****Natalya Dungee, North Carolina Agricultural & Technical State University**

As an intern at the Kellogg Biological Station located in Hickory Corners, MI along with the funding of Integrative Biomathematical Learning Enhancement Network for Diversity of North Carolina Agricultural & Technical State University, I was able to conduct an experiment with evolution in *Asclepias incarnata*, swamp milkweed, and study the possible limitations of growth when affected by temperature and water type. For my research I conducted an experiment in which I tested a range of temperatures from 27C-35C, in increments of two degrees, and treated the experimental seeds at each temperature with either deionized or tap water to see if either water type would affect germination once out of the cold chamber. Is germination success affected by temperature? Which temperature had the greatest effect on milkweed seed germination? Is germination success affected by water that contains ions?

My hypothesis was that the swamp milkweeds treated with the deionized water at higher temperatures would have a better outcome of growth when compared to the milkweeds treated with tap water because of the purity of deionized water. Upon completing my experiment, I was able to determine that *Asclepias incarnata* would be able to grow in extreme temperatures above the normal range without temperature or water type having an effect on growth. For further research I plan to increase temperatures to a higher extremity to confirm my hypothesis that *Asclepias incarnata* will be able to survive and produce healthy offspring. [Acknowledgment: Integrative Biomathematical Learning Enhancement Network.]

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*Subcategory: Cell and Molecular Biology***Cardioprotective Properties of Epicatechin in the Setting of Ischemia and Reperfusion****Jonathan Echeverri, California State University Los Angeles (CSULA)**

Andrea Herrera, Priya Khan, and Katrina Go Yamazaki, CSULA

Cardiovascular Disease (CVD) is one of major causes of deaths worldwide. Approximately one million people die from a heart attack every year. During a heart attack, the coronary arteries

become blocked, thereby impeding blood flow causing an ischemic event. After a heart attack, prompt and successful reperfusion is the most effective strategy for reducing the extent of injury, however, the return of blood flow to the myocardium results in reperfusion injury for which effective therapies have proven elusive. New studies have demonstrated that targeting the mitochondria during ischemia reperfusion (IR) may confer cardioprotection and lead to improved clinical outcomes. We have previously shown that epicatechin, a flavanol found in cocoa, has the ability to preserve mitochondrial structure and function in the setting of IR, thereby reducing the amount of injury. However, the mechanisms of this protection are unknown.

This study is investigating the means by which epicatechin prevents calcium overload, a key event that triggers apoptosis following a heart attack to confer protection. We hypothesize that epicatechin is acting on the mitochondria to help prevent the introduction of excess calcium into the mitochondria during IR. Using an *in vitro* model of simulated IR, HL-1 cardiomyocytes were subjected to 1hr ischemia and 1hr reperfusion. Cells were divided into four groups: normal conditions (i.e. no IR) \pm 1 μ M epicatechin and IR \pm 1 μ M epicatechin. Controls were treated with vehicle (ethanol). Using calcium green and mitotracker red, we were able to visualize the location of calcium, as well as functional mitochondria following IR. From the data gathered, we determined that control cells undergoing IR displayed higher levels of green fluorescence that correlated with lower levels of red fluorescence than epicatechin treated IR cells. These results suggest that epicatechin is preventing calcium influx (as noted by the decrease in green fluorescence) during IR, thereby preserving mitochondrial structure (as seen by the increase in red fluorescence). Results also demonstrated a decrease in cell death after IR in epicatechin treated groups as determined by trypan blue staining and cell counts. The significance of this study is to determine whether epicatechin, an inexpensive and safe dietary supplement, can be used clinically to decrease the long-term consequences of a heart attack. [Acknowledgment: Margaret Jefferson from CSULA LSAMP and Katrina Go Yamazaki as principal investigator.]

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*Subcategory: Cell and Molecular Biology***Prevalence of *Toxoplasma Gondii* in Heart and Breast Muscles of Raptors from North Carolina****Samuel A. Epps, Johnson C. Smith University**

Shañae S. Bowman, David S. Lindsay, David Scott, and Alexa C. Rosypal, Johnson C. Smith University

Toxoplasma gondii is a ubiquitous parasitic protozoan that can cause fatal disease in birds of prey. Raptors become infected

with *T. gondii* by consuming infected prey. Infected birds develop *T. gondii* tissue cysts in muscle and other tissues. Tissue cysts in the neurological system can cause fatal encephalitis. Little is known about how often *T. gondii* parasitizes raptors in the United States.

The purpose of this study was to determine the molecular prevalence of *T. gondii* in muscles from North Carolina raptors. Heart and pectoral muscles were collected from 67 raptors in North Carolina. Raptorial species included: 14 red-shouldered hawks, 15 barred owls, 13 red-tailed hawks, 7 Cooper's hawks, 7 great horned owls, 1 black vulture, 1 American kestrel, 1 eastern screech owl, 1 broad-winged hawk, 1 turkey vulture, and 6 raptors of unknown species. To detect the presence of encysted *T. gondii*, DNA from pectoral and cardiac muscles was extracted separately using a commercial kit (DNA Mini Kit, Quiagen®, Valencia, CA). Isolated DNA was then tested by PCR with the *T. gondii* ITS detection primers. *T. gondii* DNA was detected in 25 of 67 (37%) of raptors. Positive results were found in both heart and breast tissue from 12 birds, in breast only from 5 birds and 8 in heart only. Results from PCR will be compared to histological analysis on the same muscle tissues for microscopic evaluation of parasitic protozoa. This research will allow us to determine the diversity and prevalence of encysted muscle parasites infecting raptors in the United States. [Acknowledgment: Funding for the work of Mr. Epps and Ms. Bowman was provided by the Smith Institute for Applied Research at Johnson C. Smith University.]

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Subcategory: Physiology and Health

The Characterization of the Receptor for Advanced Glycation End-Products in Birds

Farid Eythrib, University of Arizona

Eldon Braun, University of Arizona

Advanced glycation end-products (AGEs) are the products of a non-enzymatic reaction between serum albumin and glucose that occurs in the blood stream as the first stage of glycation. The receptor for advanced glycation end-products (RAGE) is a transmembrane protein localized in vascular epithelium which binds AGEs. RAGE was first characterized as a member of the immunoglobulin protein family, and is involved in the initiation of an inflammatory response in the cell's genes when bound to its substrate (Neeper et al. 1992). Although this is most likely a natural immune response, in diseases that result in high levels of AGEs in the blood, such as Type II diabetes, the inflammation caused by over-activation of RAGE can cause damage to the vasculature by altering the microenvironment of the basal membrane over long periods of time. This creates what can be

described as 'leaky' vasculature, which can be detrimental to patients suffering from diabetes. The mourning dove, which has a blood glucose level 4-5 times higher than that of a fasting diabetic human, does not suffer from these RAGE-related symptoms. It was hypothesized that birds may not express the RAGE protein; however, Western Blot analysis has identified the likely presence of RAGE in mourning dove vasculature when treated with a RAGE-specific antibody derived from rabbits. Characterization of avian RAGE will help us understand how the RAGE-mediated pathway is regulated to avoid the complications associated with high AGE levels in the blood, and this may perhaps translate into a treatment for some of the symptoms of diabetes. We began preliminary characterization of this protein by determining its localization in various avian tissues through immunohistochemistry with DAP staining and immunofluorescent microscopy. Additionally, immunoprecipitation has been used to isolate the RAGE and sequencing of its primary structure is ongoing.

[Acknowledgment: We would like to acknowledge the Western Alliance for Expanding Student Opportunities for funding this project].

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Subcategory: Cell and Molecular Biology

Effect of ATP Synthase Subunits on Mitochondrial Morphology in *Drosophila Melanogaster*

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Mitochondria experience shape changes and movements during spermatogenesis in *Drosophila melanogaster*. The ms(2)1400 mutation results in a defective internal structure of the Nebenkern (a circular structure with two interconnected mitochondrial derivatives) and clumped mitochondria in the elongation stage of spermatogenesis, causing male infertility. Through genetic analyses, the CG7813 gene, which is abundantly expressed in the testis and encodes a paralog of ATP synthase subunit d, is suggested to be the gene associated with the ms(2)1400 mutation. In the inner mitochondrial membrane, the ATP synthase complex utilizes the proton gradient from the electron transport chain to provide energy in the form of ATP. This complex also plays a role in mitochondrial morphology by altering the shaping (curving and folding) of the cristae. Subunit d is part of the peripheral stalk of the ATP synthase complex with three other subunits (b, g and F6) within the peripheral stalk showing high expressions in the testes. RNA interference using the GAL4-UAS system was utilized to knock down genes encoding b and d ATP synthase subunits to characterize the resulting phenotypes.

The results indicate that both subunits play a role in how mitochondria shaping occurs and may also be affecting other processes such as meiosis and cytokinesis. [Acknowledgment: Research sponsored by NSF.]

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Subcategory: Cell and Molecular Biology

Plant Growth Promoting Rhizobacteria Resistance Against Early Blight in Tomato

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A study was undertaken to test the efficacy of fluorescent pseudomonad strains against the early blight in tomato under laboratory and glass house conditions. Ten isolates of fluorescent pseudomonads were isolated from rhizosphere of tomato plants. Biochemical and molecular characterization of fluorescent pseudomonads showed more similarity to the strains collected from the Department of Plant Pathology. The genotypic diversity that occurs in fluorescent pseudomonads provides an enormous resource for improving biological control of plant diseases. In this study, fluorescent pseudomonad isolates were assayed for the production of siderophore, HCN and other biochemical test. Among ten isolates of fluorescent pseudomonads, Pf1 enhanced the plant growth under glass house conditions.

Among the various fluorescent pseudomonad strains tested under *in vitro* conditions against the early blight of pathogens, Pf1 and TDK1 strains were found to be effective in inhibiting growth of the pathogens, and also they were found to promote the vigour index of tomato seedlings both under roll towel and pot culture studies. Among various fluorescent pseudomonad bioformulations tested under glass house conditions, Pf1 was found to be effective in reducing the disease incidence of early blight when compared to untreated control. The same bioformulation mixture enhanced the induction of the defense related enzymes viz., phenylalanine ammonia lyase, peroxidase, polyphenol oxidase, beta-1,3-glucanase, superoxide dismutase and catalase when plants were attacked by early blight pathogens. [Acknowledgment: National Science Foundation MAGEC-STEM Plus Program]

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Subcategory: Physiology and Health

Meprin B Degradation of Tight Junction Proteins in Kidney Cells Subjected to Hypoxia

Jasmine George, North Carolina A&T State University

Tight junctions are intercellular adhesion complexes that connect epithelial cells and thus prevent leakage between cells. They are made of tight junction proteins such as occludin, E-cadherin, Zonula occludins, and Nidogen-1. Meprins are metalloproteinases that are abundantly expressed in the brush border membrane of the proximal kidney tubules. Ischemia reperfusion (IR) causes injury to the kidneys. Disruption of the meprin B gene or pre-treatment with the meprin inhibitor, actinonin, has been shown to protect mice from IR induced renal injury. This suggests that meprins play a role in the pathology of IR induced renal injury. The mechanism by which meprins enhance kidney injury is not fully understood. Meprin beta has been shown to degrade the tight junction proteins, E-cadherin and occludin *in vitro*. The goal of the current study was to determine whether hypoxia activates meprin B leading to degradation of the tight junction proteins. Meprin β transfected Madin-Darby canine kidney (MDCK) cells were depleted of oxygen by treatment with cobalt chloride (CoCl₂) for 0, 0.5, 1, 2 and 3 hours. Non-transfected MDCK cells were used as controls. Proteins were then extracted from the cells, and Western blot analysis used to quantify the levels and fragmentation of occludin and E-cadherin. Degradation of both E-cadherin and occludin was observed in the CoCl₂ treated meprin β transfected cells but not in non-transfected control cells. This suggests that hypoxia activates meprin B, leading to degradation of tight junction proteins. This may be partly responsible for the IR induced renal injury observed *in vivo*. Future experiments will be done to determine if these tight junction proteins are degraded *in vivo* in the mouse kidney under ischemia reperfusion conditions. [Acknowledgment: iBLEND NSF Grant No. 1029426 awarded to Dr. Gregory Goins.]

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Subcategory: Cancer Research

The Effect of 3-Methylcholanthrene on Human Fetal Lung Cells

Brittany Glover, Winston Salem State University

Kellse Norris-Woods and Ahzha Grandberry, Winston Salem State University

Smoking during pregnancy is associated with a variety of negative consequences, including low birth weight, spontaneous abortion, placenta previa, and *abruptio placentae*. One additional potential negative effect of smoking during

pregnancy is fetal exposure to carcinogens that are transferred from the mother via the placenta. However, there is little research available regarding the impact of this carcinogen exposure on the developing lungs as it relates to future lung cancer development. In this study, human fetal lung cells were treated with 3-methylcholanthrene (3-MC), a polycyclic carcinogen, similar to those found in cigarette smoke. We hypothesized that the 3-MC would induce genetic mutations in the fetal lung cells resulting in transformation. The fetal lung cells in this study were exposed to 2 different doses of 3-MC (10 and 100nm), for 48 hours, and then the living cells were passaged into fresh 3-MC treated media at the same respective doses. This passaging to fresh 3-MC for 48 hour increments was done for 4 cycles. These exposure cycles were carried out in order to recapitulate the *in vivo* influence of cigarette carcinogens on fetal lung *in vitro*. Preliminary data from this study has revealed that microscopically there are obvious morphological changes in the fetal lung cells at the end of the 4 treatment cycles. Microscopically, there is increasingly more multi-nucleation and granulation, as well as abnormal mitotic divisions evident with the increase in dosage of 3-MC. Further analysis also addresses whether DNA damage can be implicated in the transformative properties displayed by the 3-MC treated fetal cells.

This preliminary data provides evidence that fetal lung exposure to carcinogens during pregnancy could result in alterations that could disrupt early life stage development of the lung, eventually leading to lung tumor formation. This research is important because it can provide implications as to the genetic events that could occur in fetal lung cells *in utero*. For future studies, we would like to treat cells with both 3-MC (a tumor initiating agent), and a tumor promoting agent, such as butylated hydroxytoluene, in order to evaluate the genetic events that could possibly be involved in both tumor initiation and promotion. Ultimately, we would like to research compounds that may block one or both of these event.

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Subcategory: Cell and Molecular Biology

Mitochondrial Dynamics in the Type 2 Diabetic Heart

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Cardiovascular disease (CVD) has already been established as

the leading cause of death for those with type-2 diabetes (T2D) due to lowered mitochondrial oxidative abilities. T2D's mitochondrial effects include imbalance of normally occurring fusion/fission events and therefore abnormal mitochondrial dynamics, and altered metabolism through utilization of fatty acids over glucose. Decreased fusion and increased fission events lead to fragmented mitochondria that can be abnormally small, have fragmented cristae with poor ATP efficiency and then increased ROS production. Fragmented mitochondria are cleared out of the cells by a process known as mitophagy. We have previously demonstrated that the cocoa flavanol epicatechin provides cardioprotection in the setting of ischemia-reperfusion by reducing inflammation and ROS production through unknown mechanisms. Our objectives are to observe the cardioprotective effects of epicatechin in the Type 2 diabetic heart using *in vitro* and *in vivo* models to specifically examine mitochondrial fusion/fission and mitophagy events. *In vitro*, C2C12 myoblasts will undergo glucolipotoxicity treatment, in which they will be cultured for 3 days in high glucose (~33 mM) and high fatty acids (0.6 mM) media in the absence or presence of epicatechin. Our *in vivo* rat model of T2D will consist of 5 experimental groups (n=10 per group) including normal controls, sham ± EPI (1 mg/kg/day), and diabetes ± EPI (1 mg/kg/day). Diabetes will be induced starting with 4 weeks of a high-energy diet (HED, 10% lard and 20% glucose) and a single, low-dose streptozotocin (30 mg/kg) IP injection followed by 5 weeks of HED and oral gavage treatments.

We will measure key proteins involved in mitochondrial dynamics in both models, and observe mitochondrial respiration *in vivo*. Thus far, we have observed the GLT setting to significantly increase cell death compared to normal C2C12 growth. In cells maintained with Epicatechin, less cell death has been observed. We predict further data analysis will continue to show a positive correlation between Epicatechin and the restoration of normal mitochondrial dynamics. As the incidence of T2D rises, further investigation into possible therapies and treatments is warranted. [Acknowledgment: This study was supported, in part, by a grant from NSF HRD 0802628 awarded to the LSAMP at California State University, Los Angeles.]

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Subcategory: Physiology and Health

Amyloid Beta Interference with Zinc Neurotransmission and its Possible Contribution to Neurodegeneration in Alzheimer's Disease

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Amyloid beta is found at the synapses and causes neurodegeneration in Alzheimer's disease. Amyloid beta binds

to zinc released at synapses during neurotransmission. Previous research has shown that zinc released in neurotransmission enhances inhibitory signaling pathways and reduces excitatory signaling, which may result in seizure activity. It has also been found that patients with Alzheimer's disease experience an increase in seizure activity. We hypothesize that once amyloid beta binds to zinc, there is an excess of excitatory signaling and produces seizure activity as neurons receiving irregular signaling degenerate. Previous research has shown that with the removal of zinc, amyloid beta plaques do not localize at the synapse.

Therefore, to test our hypothesis, we analyze the hippocampus of both wild type mice and zinc knockout mice as the hippocampus has high levels of zinc neurotransmission. The zinc knockout mice have been genetically altered to lack the protein transporter (ZNT3) responsible for loading zinc into the synaptic vesicles that are released in neurotransmission. In the knockout mice, we look for aberrant sprouting in dentate granule cells located in the hippocampus. Aberrant sprouting is a sign of seizure activity, and we do not expect to see the same in the wild type mice. Our method for the experiment is to perform immunohistochemistry to label synaptopodin in axons to see if the dentate granule cells are sending mossy fibers axons in the molecular layer rather than the hilus where they belong. We expect to see mossy fibers producing aberrant sprouting in the molecular layer rather than the hilus in knockout mice. In conclusion, we hypothesize for our continuing project that the amyloid beta interfering with Zinc neurotransmission may contribute to neurodegeneration in Alzheimer's disease. [Acknowledgment: Louis Stokes Alliances for Minority Participation, California Department of Public Health Alzheimer's Disease Program]

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Subcategory: Physiology and Health

Characterization of Tissue-specific Expression of *ndi1* in Long-lived *Drosophila Melanogaster*

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As organisms age, mitochondrial activity, required for the generation of energy, is significantly reduced. Previous studies have shown a correlation between NADH-ubiquinone oxidoreductase (*ndi1*), a yeast gene that can functionally substitute for some complex I functions of the electron transport chain in mammals and fruit flies, and an increase in mitochondrial activity in *Drosophila melanogaster*. These studies have shown that *ndi1* expression in neuronal tissues extends lifespan. While factors such as dietary restriction, low fertility

and small body size have been correlated with lifespan extension, the mechanism for *ndi1*-mediated lifespan extension is still unknown.

This study examined the influence of tissue-specific *ndi1* expression on feeding behavior, size and fertility. Flies that express *ndi1* in a tissue-specific manner were generated and survivorship, weight, feeding and fertility assays were conducted. The results show that flies expressing *ndi1* had a 30% increase in lifespan. Interestingly, flies expressing *ndi1* were not smaller in size nor did they eat less, suggesting *ndi1*-mediated lifespan extension is not correlated with either of those pathways. Moreover, the decrease in fertility that has been associated with long-lived flies was not observed in *ndi1* flies relative to controls. Overall, tissue-specific *ndi1* expression does in fact extend lifespan. However, this lifespan extension does not depend upon the dietary or size pathways and is independent of fertility. [Acknowledgment: This work was funded in part by an NIH Minority Access to Research Careers Undergraduate Student Training in Academic Research (MARC U STAR) to D. D. Simmons (GM008563-17).]

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Subcategory: Microbiology/Immunology/Virology

Evaluation of Potential Confounding Factors in Gut Microbiome of Preterm Infants

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Distinctive changes in the composition of the human gut microbial community have been shown to play a role in the development of diseases such as sepsis and necrotizing enterocolitis, diseases which effect a vast population of preterm infants. While many studies have examined and characterized the preterm infant gut microbiome, few have considered the role clinical characteristics play in alpha and beta diversity. Stool samples were collected from 63 preterm infants. Bacterial DNA was isolated and 454 pyrosequencing was conducted to identify bacterial species. Beta diversity was analyzed using Unifrac and Nonmetric Multidimensional Scaling. A backwards elimination linear regression model on Simpson and Chao1 indices was used to analyze alpha diversity. No examined variables significantly influenced beta diversity, however, infant birth weight exhibited a trend toward significance in alpha diversity.

For future microbiome studies of beta diversity, stratification on the examined variables may not be necessary. Though our data showed no statistically significant association, stratification on infant birth weight may be important for future study design.

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Subcategory: Cell and Molecular Biology

Developmental Regulation of rRNA Processing in Embryonic Stem Cells

Josue Gutierrez, University of California, San Diego

Embryonic stem cells (ESCs) are well recognized by their unique features: pluripotency and self-renewal. Stem cells must balance between cell growth and cell division so that they can maintain their cell identity so as to propagate differentiated progeny. ESCs, cycling very rapidly, may have substantial metabolic and synthetic needs that must be met to forecast future cell growth. As ribosome synthesis is required for the synthesis of cellular components, it is critical that this process is in sync with cell cycle progression. As ESCs are highly proliferative, an interesting question is how these cells respond to their high demands of metabolic and synthetic needs with an unusual cell cycle setting.

We hypothesize that ESCs would tightly regulate their translational machinery for ribosome production in anticipation of future cell growth. With this idea, we decided to assay the expression of different rRNA species with respect to their maturation status during the processing event (47S pre-rRNA v.s. 28S mature rRNA) in mouse ESCs. By both qPCR and *in situ* hybridization, we quantitatively measured expression levels of these rRNAs and found an overall accumulation of the 47S pre-rRNAs in the nucleolus, the initial cellular compartment of ribosome biogenesis. Surprisingly, we found a reduced level of mature 28S rRNAs in ESCs, suggesting that rRNA processing is delayed in the pluripotent state but could be accelerated after ESCs differentiate.

These findings indirectly correlate with previous observations implicating an increase in global translation after ESC differentiation and agree with the idea that increased expression of mature 28S rRNA could be used to support the higher demand of translation needed following differentiation. As a whole, these observations suggest that rRNA processing is somehow deregulated in mESCs, yet it is not known which rRNA processing genes may be responsible for this event and their potential roles on mESCs cell fate specification. Future questions to be elucidated is to characterize rRNA processing and kinetics during mESCs differentiation, as well as identifying rRNA processing factors and their effects in mESC upon differentiation. Understanding how ESCs maintain their features

of pluripotency and self-renewal will be the key to regenerative medicine. [Acknowledgment: CIRRM]

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Subcategory: Cell and Molecular Biology

Visualizing the Three-Dimensional Protein Structure Associated with Huntington's Disease

Andre H. Hall, North Carolina A&T State University

Huntington's disease is a dominant autosomal neurodegenerative genetic disorder. The gene that codes for the huntingtin protein is found on chromosome 4. Altered huntingtin protein can affect muscle coordination, cognitive abilities, behavior, and can lead to psychiatric problems. Huntington's disease is caused by a mutated form of the huntingtin gene showing increased CAG repeats coding for the amino acid glutamine. The objectives of the present research were to use computer modeling to compare the mutant and normal huntingtin proteins. We used MATLAB, a computer numerical analysis software package, combined with molviewer scripting to compare and inspect three-dimensional structures of the mutant and normal huntingtin protein. By superimposing the 3-D molecular structures of the normal and mutant protein, we predicted more possible aggregates in the mutant folded protein structure as compared to wild-type huntingtin. The analysis suggested that the string of polyglutamines found in the mutant protein may create an extended surface which could disrupt interactions with other cellular proteins critical to Htt function. Upon evaluation of our results, it was found that the onset of the disease could also be triggered by a "polar zipper effect" caused by the polyglutamine chain. It is believed that the polarity of the glutamines possibly disrupts the natural structure of the protein, leading to its dysfunction.

[Acknowledgment: National Science Foundation]

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Subcategory: Cell and Molecular Biology

UV Irradiation and the Reduction of DNA Concentrations from Porcine Blood

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The use of DNA evidence has revolutionized the study of forensic science by the uniqueness of an individual's nucleotide sequence giving us each our own unique DNA fingerprint. DNA

typing has been instrumental in exonerating wrongfully convicted individuals and solving many crimes which involved biological or DNA evidence. However, there are also caveats associated with the analysis of DNA evidence, such as damage or degradation of DNA in blood evidence collected from a crime scene. Environmental factors such as heat, humidity and UV irradiation may facilitate damage to the integrity of nuclear DNA, thus resulting in the inability to analyze short tandem repeats. The biological system of living organisms is armed with extensive mechanisms to patrol and repair spontaneous and induced DNA damage. Interruptions in the normal homeostatic process, i.e. blood deposit or stains, result in damage that cannot be repaired. Previous studies by McNally et al (1989) showed that bloodstains exposed to UV irradiation showed a loss of allelic signal intensity with increase exposure.

The objective of this study was to investigate the effect of UV irradiation on the obtainable concentration of nuclear DNA from porcine blood. Pre-determined volumes of blood were exposed to 1200 J of UVC light for 1-3 minutes, and DNA was extracted using a Chelex resin method. Concentrations were measured via Nanodrop 2000 and analyzed on an agarose gel for degradation. The results from three trials demonstrate a decrease in the concentrations of obtainable DNA after 1- 3 minutes of UV exposure. Longer exposures would eventually degrade the DNA completely thus preventing its use for amplification via polymerase chain reaction (PCR). This information could prove useful for forensic cases that are based on blood evidence that has been exposed to environmental agents such as heat, humidity and UV irradiation. The future direction of this study is to analyze the integrity of the DNA after UV exposure via PCR and DNA fingerprinting. My goal is to determine the maximum time of exposure to UV irradiation that would render DNA unusable for forensic analysis. *[Acknowledgment: The project described was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number R25GM089669 and the National Science Foundation EPSCoR Grant No. EPS-0814251.]*

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Subcategory: Nanoscience

Synthesis, Characterization, and Biocompatibility Studies on Gold Nanoparticles

Joshua Haynes, Norfolk State University

Gold nanoparticles can be inserted into the human body and used in labeling, drug delivery, and heating by absorbing infrared lights, cancer and Alzheimer treatment, implants and more. A problem with nanoparticles arises when they are made or used with unsafe precautions. Nanoparticles, in the form of

powders or even liquids, are to be handled with masks and gloves. When these precautions are not taken, they can be inhaled and transported by the nasal pathway to the lungs. In order for nanoparticles to be safe to the human body, it must be biocompatible. If a substance that is not biocompatible enters into the body, the body can reject it, affecting the immune system and causing infections while also killing cells. For a substance to be biocompatible, it must be non-toxic, able to live without causing harm to cells or cell growth, and be safe. It was hypothesized that Gold nanoparticles synthesized biologically would be more biocompatible than that of Gold nanoparticles synthesized chemically. Chemical and biological synthesis of Gold nanoparticles was done and then characterized using the Field Emission Scanning Electron Microscope with Energy-Dispersive X-Ray Spectroscopy and Transmission Electron Microscope. The biocompatibility was tested on Rat Lung Epithelial (RL-65) Cells. The biocompatibility studies used were: Reactive Oxygen Species (ROS), Cell Viability Assay (MTT Assay), and Live/Dead Viability Cytotoxicity Assay. The ROS study showed that the biological synthesis had fewer DCF Fluorescence Units as opposed to the chemically synthesized particles, thus concluding that more cells undergo stress with the chemically synthesized Gold nanoparticles. In the MTT Assay with the Gold nanoparticles synthesized biologically, the cell's viability percent was 10-25 $\mu\text{g/ml}$ higher in concentration than the chemically synthesized. The Live/Dead cell Assay confirmed that with the biological route, cells live with Gold nanoparticles concentrations from 10 – 50 $\mu\text{g/ml}$. With the Gold nanoparticles synthesized chemically, cells live only with concentrations of 10 - 25 $\mu\text{g/ml}$. The results suggest that Gold nanoparticles synthesized biologically are more suitable because they are safer to use and have better biocompatibility results with living cells. A further study of biomedical applications, particularly in imaging, will be done to make nanoparticles more effective in the medical field. *[Acknowledgment: STARS: 0714930 (NSF), NASA]*

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Subcategory: Mathematics and Statistics

Comparison of Biomechanical Properties of Hermit Crabs

Adrianna Hernandez, California State University, Los Angeles

This study at San Miguel Biological Station, Cabo Blanco Absolute Nature Reserve on the Pacific Coast of Costa Rica, compared commonly-utilized shell types of hermit crabs. We hypothesized that hermit crabs may have a preference for a certain type of shell which allows them to yield the best performance in terms of crab speed, crab strength, and shell resistance to crushing. We also considered the relationship between shell species preference and biomechanical properties

of hermit crabs and their shells. Two hundred and forty hermit crabs were selected from six different species of shells. Half of the individuals were examined for hermit crab performance (pulling force, velocity), and the remaining were utilized for shell physical properties (length, width, thickness of aperture and body). The pulling force (lb/f) was measured using a digital force gauge, and the velocity was measured by the distance traveled within 15 seconds. Measurements of the shell physical properties were made using a dial caliper. The empty shells were put through a crushing test by applying two flat rocks on a scale and placing the shells individually in between the rocks and recording the weight at the moment of crushing. A paired student's t-test ($P < 0.05$), showed that how well a crab fits within its shell does not affect the performance of the hermit crab. The shell species that offered the best performance were tooth, turban, and bubble respectively. The shell species that proved to have the greatest resistance to crushing were rock, turban and cerith. It was found that the best performing species had average shell protection in regards to crushing weight. According to a concurrent study performed in San Miguel Biological Station (Blaylock, A., Estevez-Olea, A. & Rios, A. 2012), the shells that hermit crabs choose most frequently have been found in the present study to house crabs that have the best performance.

Based on the results of the tests conducted in this study, the hypothesis was not rejected. For future research, newly abandoned shells would be ideal to collect in order to compare the strength of fresh shells versus old gastropod shells and perhaps identify if fresh gastropod shells offer higher chances of survival than they would have with the older gastropod shells. [Acknowledgment: I would like to acknowledge CSU-LSAMP Costa Rica Summer Research Program 2012 funded by NSF under grant #HRD-0802628.]

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Subcategory: Cell and Molecular Biology

IgY Antibody Response in Juvenile *Rana pipiens* Following PCB-126 Exposure

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Amphibian population declines have become prevalent worldwide, and it is proposed that pollutants may be a contributing factor. Tadpoles exposed to PCB-126, an organic pollutant, lowered antibody response to keyhole limpet hemacyanin (KLH) in juvenile *Rana pipiens*, a native Wisconsin frog. To determine whether PCB exposure would alter immune response to a smaller antigen in *R. pipiens*, we tested di-

nitrophenol (DNP), a manufactured peptide used in biochemical research. We hypothesized that *R. pipiens* exposed to PCB-126 would have a lowered level of IgY antibodies to DNP, compared to unexposed frogs.

In a six week span, control and PCB-126 exposed frogs were given a primary and secondary injection of KLH conjugated with DNP (KLH-DNP; 2mg/ml), and then euthanized to collect plasma for analysis of antibody levels using an Enzyme Linked Immunosorbant Assay. There was no measurable amount of anti-DNP IgY antibodies detected, though there were measurable amounts of anti-KLH IgY antibodies; however, anti-KLH levels were much lower than expected. There was no significant difference in anti-KLH IgY antibodies between treatment groups, but we did determine that the general health (i.e, growth) of frogs was not affected by PCB-126 exposure. Frogs having a lowered antibody response may suggest a suppressed immune system which may decrease their ability to fight pathogens, but due to our findings we are unable to provide evidence to support this theory. [Acknowledgment: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA.]

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Subcategory: Cell and Molecular Biology

Molecular Diagnostics Can Detect and Identify Prokaryotic and Eukaryotic Pathogens in Terrestrial and Marine Organisms

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The proteobacterial order, Rickettsiales, contains numerous pathogens including medically important *Rickettsia* and *Ehrlichia* spp. transmitted by ticks. Babesia, a blood-borne protozoan parasite, is also transmitted by ticks. *Rhipicephalus sanguineus*, the brown dog tick, is ubiquitous and distributed worldwide. *R. sanguineus* transmits numerous pathogens, including disease-causing *Rickettsia*, *Ehrlichia* and *Babesia* to humans and animals. *R. sanguineus* was recently implicated in transmission of fatal Rocky Mountain spotted fever (*Rickettsia*) infections to humans. Previously, a *Rickettsia*-specific PCR assay amplified DNA fragments of various sizes from total genomic DNA extracted from *R. sanguineus* of Virgin Islands (VI) dogs. When visualized by gel electrophoresis, amplified DNA matched the expected length, 381 bp, of the *Rickettsia* *gltA* gene region targeted by this assay.

To test my hypothesis that *R. sanguineus* in VI are infected with *Rickettsia*, I gel-purified the PCR amplified ~381 bp DNA fragments. The purified DNA was submitted for direct DNA sequencing and cloned on a plasmid in *Escherichia coli* for

analysis. Direct DNA sequencing was inconclusive due to contamination of purified DNA sample. Cloning attempt of the *gltA* gene failed in consequence of the *E. coli* being inactive. The experiment would have to be repeated to determine whether or not the *Rickettsia gltA* gene is present in the genome of *R. sanguinis*. PCR-RFLP assays can quickly detect and differentiate between species that cause canine babesiosis. Species of *Babesia* are known to cause diseases in select hosts including dogs, cattle and humans. *B. canis* and *B. gibsoni* are the cause of severe disease and fatality in VI canines. Infections require different, high-risk treatments.

Unfortunately, rapid diagnostics required to determine appropriate treatment are not available in the Virgin Islands. So, I developed an assay that will rapidly detect and differentiate between agents of canine babesiosis. The assay (RFLP) uses restriction endonucleases to cut PCR-amplified DNA into different length fragments based on nucleotide sequence differences. Conserved PCR primers were selected to amplify 18S rDNA from all canine *Babesia* pathogens. Selected enzymes will generate unique fragment lengths for each pathogen, allowing species differentiation. *Babesia* infected blood samples would have to be obtained to test the PCR-RFLP assay I developed. [Acknowledgment: NSF HBCU-UP (Grant Number HRD: 0506096)]

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Subcategory: Cell and Molecular Biology

TA Cloning of Plasmid L4440 to be Used for RNAi of Genes Associated with Autism in *Caenorhabditis elegans*

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Angela D-Hinklein, Suffolk County Community College
Kristen La Magna, Stony Brook University

Autism Spectrum Disorder (ASD) is a widely spread, complex and poorly understood neurodevelopmental disorder that affects many in the United States today. The purpose of this study was to create a model of autism in the nematode *Caenorhabditis elegans* in order to better understand the genetics, potential causes and treatments of the disease. The goal of this experiment was to genetically engineer the plasmid L4440 using the technique of TA Cloning to insert a gene associated with autism. The engineered plasmid would then be used for RNA interference in *C. elegans* to study the effect of the gene. The genes RIG-6, RIG-4 and LEV-10 were successfully amplified using Taq Polymerase. The plasmid L4440 was successfully digested with SMA1 and purified. Following the treatment of L4440 with terminal transferase and ligation with the desired gene, a single transformed colony of BL21 Gold *E. coli* was produced. Further work is required to verify that the transformed *E. coli* contains

the recombinant L4440 plasmid. This plasmid would then be used to induce RNA interference in *C. elegans* through feeding. Observational and RNA analysis is required to determine the effect of these autism related genes on *C. elegans*.

[Acknowledgment: I would like to acknowledge Daniel Moloney, Ph.D., Kristen La Magna, Jennie Williams, and Dr. Farah Daccueil for their excellent guidance, mentorship and patience during the BioPrep 2012 program and thanks to Dr. David Bynum for his support. Thanks to Dr. C. Foley, SCCC/NSF S STEM for her support. This research was supported by National Institutes of Health Bridges to the Baccalaureate Grant #GM50070]

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Subcategory: Cell and Molecular Biology

A Systems Genomics Approach Finds Candidate Genes for Non-Insulin Dependent Diabetes Mellitus

Joilah L. James, Virginia State University

Non-insulin dependent diabetes mellitus (NIDDM) is one of the most significant chronic human diseases, affecting over 20 million people in the United States (7% of the population). NIDDM is associated with obesity and characterized primarily by insulin resistance and impaired insulin production. In this study, a multiple SNP (single nucleotide polymorphism) analysis was conducted to identify potential candidates for the disease. Mouse SNP data was mined from databases that included strains for accepted NIDDM models, Tallyho (NIDDM model) and SWR/J (wild type). Expressed genes were captured in the form of mRNA, converted to cDNA, and analyzed for differential expression in 4 different tissues (fat, skeletal muscle, liver and pancreas). The results show several of the gene candidates tested were found to be differentially expressed in various tissue samples: *Alpk1*, *Hfe2*, *Manba*, *Slc22a15*, *Slc30a7* and *Tchhl1*. Future efforts can now focus attention and resources on these likely candidates for NIDDM with obesity phenotypes. These efforts confirm the significant impact a systems genomics approach can have on identifying potential candidates for multigenic inherited human diseases such as NIDDM.

[Acknowledgment: NSF HBCU-UP program at Virginia State University]

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Subcategory: Mathematics and Statistics

An Extended Mathematical Model of the Sleep/Wake Cycle

Nija James, North Carolina A&T State University

The Sleep-Wake cycle is a biological pattern of alternating sleep and wakefulness, in humans roughly 8 hours of nocturnal sleep and 16 hours of daytime activity. Insomnia is the inability to obtain sufficient sleep, especially when chronic; difficulty in falling or staying asleep; sleeplessness. This study focuses on the understanding of the sleep-wake cycle and the possible effects insomnia may play a role in their everyday life. The mathematical model for the sleep/wake cycle, a system of ordinary differential equations, has been developed in a previous study. This base model demonstrates the interaction between VLPO (Ventrolateral preoptic nucleus) which is sleep promoting neurons and AMIN (Monoaminergic cell groups) which is wake promoting. In this study, the model is extended with insomniac circumstances for the sleep/wake cycle. The extended model shows the interaction of the original model with disruption by insomnia. Since the exact analytical solutions cannot be obtained, the numerical simulations are carried in MATLAB. Then, the solutions are analyzed to show the timing of sleep and wakefulness under normal conditions and of insomniac conditions. This study provides us information about the different types of sleep, how it works and how it is disrupted by insomnia. Lastly, we will examine the differences between the base model and the extended model. The research concludes that insomnia shortens the time of sleep and lengthens the time of wakefulness. In future studies, I plan to further this study to all sleep disorders and show the affects it will have on the sleep-wake cycle. *[Acknowledgment: 1. This study is partially supported by the Interdisciplinary Training for Undergraduates in Biological and Mathematical Sciences Program (Grants 0634598 and 1029426 from the National Science Foundation) and 2. HBCU-UP]*

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Subcategory: Genetics

Genetic Mapping of EMS Induced Drosophila Mutants with Defects in Synaptic Development

Monicah Jepkemboi, Southern University at New Orleans
Nicolas G. Bazanand Chunlai Wu, Louisiana State University Health Sciences Center

Drosophila serves as powerful model system to study the development of synapse. Synaptic studies are the central issues in developmental neurobiology that have been used to isolate

the large number of drosophila mutations using phenotypic analysis. Taking advantage of forward genetic screen, the Wu lab previously isolated a group of EMS (Ethylmethanesulfonate)-induced fly mutant alleles that show a spectrum of interesting phenotypes in synaptic development. The research entails genetic mapping of two of these EMS-induced mutants (3p062 and 3p036). In this way, it is possible to narrow down the mutation to a specific locus, thus allowing further study to identify an individual gene that is responsible for synapse development.

The two goals of this research are first to use deficiency mapping to map two EMS-induced fly mutant alleles, and secondly, to confirm the identified region using phenotypic analysis and characterize the mutant phenotype using synaptogenesis. For the earlier goal, the two independent mutations on the third chromosome were mapped using deficiency mapping. Adult flies of 177 individual deficiency lines were crossed with three virgin flies of the mutant genes. First generation progenies were then examined to identify their genotypes by phenotypic markers, afterwards they were searched for lines showing pupal lethality among mutant over deficiency animals. Five mutants of 3p062 and one mutant of 3p036 failed to complement the mutant pupal lethality. The mutant phenotype 3p062 was characterized through immunocytochemistry (IHC) with multiple pre- and post-synaptic markers of mutant larval NMJ. The IHC staining showed enlarged synaptic boutons. In summary, my work narrows down the mutation to a more specific locus in the chromosome, thus allowing subsequent loss-of-function study to decisively identify the individual gene that is responsible for normal synaptic development. *[Acknowledgment: This project was funded by the National Institutes of Health through the National Center for Research and National Institute of General Medical Sciences, Louisiana Board of Reagents Support Fund and Louisiana Biomedical Research Network.]*

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Subcategory: Cell and Molecular Biology

Characterization of Microbes Isolated from Soil Applied with Red Gypsum and Organic Matter

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Despite the vast research performed by scientists, there is still unknown information when it comes to the perception of microbes, and how they contribute to the growing process of a plant. The importance of this research is to understand the microbiology of soil especially how specific microbes can

become beneficial to the agricultural industry. The objective of this research was the enumeration of the population of bacteria, fungi and actinomycetes found in soil applied with lime, red gypsum, and organic matter. The dilution plate count technique was utilized to conduct the experiment. The advantage of utilizing this technique is that this method can be performed within a limited time. The soil observed was collected from a maize field added with red gypsum, lime and organic material in Lanchang, Malaysia. The results indicated that the populations of bacteria (3.49350×10^3) were higher than fungi and actinomycetes. The staining technique utilized was gram staining in order to further understand and identify gram positive bacteria and gram negative bacteria. Mycorrhiza spores resulted in $49 \text{ spores}/10^{-1} \text{ g}$ of soil in treatment with red gypsum. Among the tested bacteria, two of the bacteria were gram negative and one gram positive. Gram positive bacteria were isolated from red gypsum and chicken dung applied soil. The pH procedure was used to identify acidic and basic levels of the soil; the studied soil pH was around 6.5. Nitrogen plays an important role in the growing process of plants. The Nitrogen Free Agar was tested to see if there was any trace of nitrogen being given off by the bacteria. A number of 3 nitrogen fixing isolates were found in only red gypsum applied soil. However, the entire test was performed to understand why the population of each microbe varied depending on the treatment. It was found that red gypsum added with chicken dung amended soil harbor higher amount of microbes. *[Acknowledgment: National Science Foundation MAGEC-STEM Plus Program]*

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Subcategory: Microbiology/Immunology/Virology

Validation of Cooked Meat Via Mitochondrial DNA and Polymerase Chain Reaction

Briana Johnson, Delaware State University

There are many illegal, health, and religious issues associated with the mislabeling and/or adulteration to processed food. Mixing meats and/or fats of different origins are illegal. Certain religious practices, dietary constraints and personal preferences are the reasons for not consuming pork or pork products. DNA technologies have provided scientists with the ability to identify unknown samples via primer specific polymerase chain reactions and DNA sequencing. Mitochondrial DNA has a higher copy number and can be extracted from small or degraded samples in which nuclear DNA is not obtainable. In this current study, cooked meats from local restaurants in Dover, Delaware were tested to identify the products as they were advertised. DNA was extracted using the Promega Wizard SV Genomic DNA Purification System from beef, pork and chicken products and

subjected to PCR with primers targeting the D-loop region, Cytochrome b region and the ATPase 8 region of mitochondrial DNA, respectively. All samples were electrophoresed on 2% agarose gels, stained with SYBR green and visualized under UV light.

The overall objective of this study was to determine if molecular applications may be applied to the identification of cooked or processed food. Our results demonstrated the capability to isolate mitochondrial DNA from cooked foods and their identification using primer specific- PCR. Figures 1 and 2 verified each sample as to how it was advertised. Figures 3,4, and 5 verified if there was any contamination between each sample collected. Our results also implicated one of the beef samples being contaminated with pork (Figure 5). Additional work is needed to validate this finding. This project is an example of the application of forensic science to the study of food safety and is important to deter the adulteration of food products within the food industry. The future direction of this study will expand the investigation to other food products such as seafood.

[Acknowledgment: This study was made possible by the National Science Foundation EPSCoR Grant No. EPS-0814251.]

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Subcategory: Physiology and Health

Effects of Neonatal Hyperoxia on the Lung: A Rodent Model for Chronic Lung Disease in Premature Infants

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Despite its potentially adverse effects on lung development and function, supplemental oxygen is commonly used to treat premature infants in respiratory distress. Preterm birth is associated with bronchopulmonary dysplasia and chronic lung disease. The survival of these infants has improved due to hyperoxia treatment, but the long term morbidity, in particular respiratory morbidity, has remained high. The known effects associated with hyperoxia prompted the question: does the inhalation of high oxygen at birth followed by a return to room air alter the structure of the forming adult lung?

A mouse model was used to study the effects on the lungs due to hyperoxic conditions. The experimental newborn mice were maintained in hyperoxic conditions (80% O₂, n=3) for 2 weeks and then placed in room air for 3 weeks. The control group were placed and kept in room air (21% O₂, n=3) for 5 weeks. Following that, both groups were sacrificed, and the lungs excised. Archived formalin-fixed and paraffin-embedded lungs from 5 week-old mice (CD1 strain) were sectioned and stained with H&E and a mast cell marker. The area of alveolar space and

the number of alveoli were measured. Lungs from the control mice had a greater number of alveoli than the lungs from mice maintained in hyperoxic conditions. The alveolar space was increased in the lungs of the hyperoxic mice compared to the lungs from mice maintained in room air. Mast cells were also found in the lungs of mice maintained in hyperoxic conditions. Collectively, these data demonstrate a significant change in the alveolar structure of lungs from hyperoxic mice. The structural changes of an enlarged alveolar airspace are emphysemic-like in appearance. [Acknowledgment: National Institute of Health]

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Subcategory: Cell and Molecular Biology

Protein HbpA and *Bartonella bacilliformis* Deformin Activity in Erythrocytes

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Laura Hendrix, Texas A & M Health Science Center College of Medicine

Bartonella bacilliformis, a species of the pathogenic genus *Bartonella*, infects human red blood cells, and this parasitic relationship leads to Carrion's disease, which is characterized by severe acute anemia. *Bartonella bacilliformis* occurs within the specific geographic areas of Peru, Ecuador, and Colombia and can be regulated with antibiotics and insecticides. It remains an organism of great interest because of its unique virulence mechanisms and high pathogenicity. The protein deformin, which can be found in culture supernatants of *B. bacilliformis*, produces indentations on red blood cell membranes that allow the bacterium to enter the cell. The *Bartonella* protein HbpA (hemin-binding protein A) contains a repeated region of approximately 1,400 Daltons in *B. bacilliformis* strain KC583 that is missing in strain KC584. Strain KC584 is unable to produce deformin in culture supernatants. Researchers discovered that the protein region required for producing deformations has a molecular weight of 1,400 Daltons, but they have been unable to sequence the region. We hypothesized that *Bartonella bacilliformis* KC583 hemin-binding protein A (HbpA) is required for the appearance of indentations on human red blood cell membranes known as deformations and required for entrance of the bacterium into erythrocytes.

Our methods were as follows: 1. Grow bacteria on blood agar plates in PBS overlays and transfer PBS overlays with bacteria onto BCYE Legionella plates; 2. Perform protein assays of culture supernatants and cell pellets of strains KC584 & KC583 from BCYE plates; 3. Perform deformin assays with strains KC584 & KC583; 4. Indirect Fluorescent Antibody Stain of deformed red blood cells; 5. Purify antibodies using protein A agarose; 6. Analysis of IgG Fractions by Electrophoresis; and 7. Inhibit

deformin activity using antibody and deformin sera. Our results show that the additions of the α com1, α HbpA, α Bb antibodies and normal rabbit serum have no significant effect on deformin activity of *Bartonella bacilliformis*. These results do not indicate a relationship between these proteins and the deformin activity of *Bartonella bacilliformis*. Future studies include finding other methods to block deformin activity and observing the different effects. [Acknowledgment: This research was funded by Texas A&M Health Science Center College of Medicine Office of the Dean and Office of the Vice President for Research and Graduate Studies, and Scott and White Hospital Research Foundation.]

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Subcategory: Cell and Molecular Biology

The Effects of Parkin, the Protein Product of PARK2 Gene, in Amyloid Plaques in Induced Alzheimer's Disease

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Alzheimer's disease is the most common form of dementia found in humans. Its progressive deterioration of the brain eventually results in death of the individual. The formation of extracellular deposits, amyloid plaques, in neurons is the main characteristics of Alzheimer's disease. Unfortunately, there is no cure for this disease. Studies have shown that the protein, Parkin, translated from the gene, PARKIN2, has an ability to eliminate defective mitochondria and vesicles by autophagy in diseased brain tissue. We hypothesized that the brain tissue induced with Alzheimer's disease when injected with Parkin will undergo a process of avid phagocytosis, thereby eliminating the plaque formation in the extracellular matrix of the neuron.

Tissue was obtained from a triple transgenic AD (3xTg-AD) mouse that had been injected with three genes, APPSwe, TauP301L and PS1M146V. These genes initiate Alzheimer's disease in the injected mice. The brain tissue was prepared for light and transmission electron Microscopy. The tissue was fixed in 2% glutaraldehyde buffered with 0.1 sodium cacodylate for 1 hour and post-fixed in osmium tetroxide buffered with 0.1M sodium cacodylate for 3 hours and further processed for routine electron microscopy. Thick sections of 1000nm were sectioned for light microscopy and thin sections of 60nm for electron microscopy. When the brain tissue is treated with Parkin, electron micrograph indicated clear vesicles associated with a healthy endoplasmic reticulum and normal mitochondria.

On the other hand, the tissue obtained from the untreated area showed defective vesicles associated with endoplasmic reticulum and abnormal mitochondria as compared to the tissue treated with Parkin. These extremely significant data provides an optimistic forecast that a major treatment and possible cure is on the horizon for this devastating disease.

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Subcategory: Microbiology/Immunology/Virology

Characterization of Chlamydia trachomatis MOMP-278 Protein Encapsulated in PLA-PEG Nanoparticles

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Chlamydia trachomatis is the most commonly reported bacterial sexually transmitted infectious agent worldwide. Therefore, development of a safe efficacious prophylactic mucosal vaccine for *C. trachomatis* is the key to reduce its transmission. However, to date there is no efficacious vaccine against this human pathogen. Different strategies have been used to meet this challenge, and one such strategy is the development of nanoparticle delivery systems. Poly (lactic acid)-poly (ethylene glycol) (PLA-PEG) copolymer is one of the most promising and widely accepted delivery systems for vaccines due to its biodegradable, biocompatible and bioresorbable nature.

Thus the main goals of this study were to successfully encapsulate and characterize a *C. trachomatis* recombinant protein (rMOMP-278) in PLA-PEG nanoparticles to serve as a nanovaccine delivery system against this pathogen. rMOMP-278 was encapsulated in PLA-PEG by the double emulsion method (water/oil/water) and characterized using zetasizer and zeta potential measurements which showed the size of the PLA-PEG-BSA and PLA-PEG-rMOMP-278 to be about 100 and 200 nm, and the zeta potential to be -12.17 mV, respectively, which indicate successful encapsulation, small size and high stability. The protein encapsulation efficiency of the PLA-PEG-rMOMP-278 was found to be 55%. The toxicity study of PLA-PEG (concentrations ranging from 3.9 to 1000 µg/ml) to mouse J774 macrophages using the MTT assay revealed minimal toxicity up to 500 µg/ml. Overall, our study shows the successful encapsulation and characterization of our model BSA protein in PLA-PEG nanoparticles. The rMOMP-278 protein encapsulated in PLA-PEG is currently being evaluated as a nanovaccine delivery system for *C. trachomatis*.

[Acknowledgment: National Institute of Health]

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Subcategory: Microbiology/Immunology/Virology

Determining the Status of Indoor Airborne Microbial Organisms in the Gentilly Community Post Hurricane Katrina

Nichole Lathan, Dillard University

After Hurricane Katrina struck New Orleans on August 29, 2005, 80% of the city was inundated with water including the Gentilly community. In 2006, studies were conducted by our group to establish the types and concentrations of airborne microbes both inside and outside of selected buildings in neighborhoods around the greater New Orleans area. Mold and other contaminants grew inside of the building, and high concentrations of harmful microorganisms were found. The purpose of this study is to determine the status of indoor airborne microbial organisms in buildings within the Gentilly area post Hurricane Katrina. Indoor airborne sampling was conducted for 6 hours in 4 buildings within the Gentilly area in 2012. Various tests were then conducted on samples to identify the types of microorganisms present. It was found that most bacteria identified were gram positive cocci and bacilli. These bacteria were acid producers but did not produce gas. No spores were identified. Some mold colonies were identified. After 48 hours, there was little to no growth of microorganisms as compared to the samples collected by our group in 2006. These results show that there has been improvement in the air quality of the buildings since Hurricane Katrina. This is probably the result of proper refurbishing and remediation of the buildings. Future consideration includes conducting DNA analysis for further identification of the microorganisms as was done before by the group. [Acknowledgment: Dr. Bernard Singleton, LSAMP]

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Subcategory: Electrical Engineering

Battlefield Automated DNA Analysis and Sampling System

Daniel Lee, California State University, Los Angeles

The Battlefield Automated DNA Analysis and Sampling System (BADASS) extraction module is an innovative system capable of extracting human DNA from a buccal swab autonomously. Here, we conducted a series of experiments to test whether the use of head-pressure and syringe pumps were able to effectively replicate and replace a benchtop centrifuge and micropipets for performing the extraction protocol. Incorporating these components into a system consisting of multiport valves, subminiature check-valves, pressure transducers, and custom microfluidic fittings, we were able to engineer a compact, portable, rapid DNA extraction module. These individual

components together enable the system to function autonomously via a PC-based custom graphical user interface. The physical user-to-system interface houses a small 2mL Zymo-spin tube where the buccal swab is introduced. Once introduced, the Zymo-tube is then sealed and allowed to incubate in lysis buffer. Once incubation is complete, the system adds head pressure repeatedly, which is used to expel the lysis buffer to an external waste reservoir, analogous to supernatant flow-through in a centrifuge-based method. Once the lysis buffer step is cleared from the Zymo-tube, the extraction module's syringe pump picks-up and delivers the pre-wash buffer into the Zymo-tube. This process is repeated with the wash buffer. After the wash buffer has been cleared from the Zymo-tube, the final elution buffer is introduced. At this step, the solution is allowed to incubate in the Zymo-tube. Once incubation is complete, an automated valve at the system outlet directs the eluted sample to a collection port where it can be recovered for analysis. Using the Zymo Quick-gDNA MicroPrep, 20 consecutive trials were performed, giving an average concentration of 3.33 ng/ μ L of DNA and an average purity level (A260/A280) of 1.21.

These results indicate that the BADASS extraction module is capable of extracting DNA with high enough concentrations to perform further downstream analysis (i.e. PCR amplification). Forensic DNA analysis is a long and tedious process. By engineering a compact portable DNA extraction device, forensic DNA analysis can be performed autonomously and analyzed quickly on scene without the need for costly and infrastructure-intensive laboratory instruments and processes. Future considerations involve extracting DNA from blood, tissues, bone, and hair. [Acknowledgment: This internship was funded and supported by NSF funds to CSU-LSAMP via grant number (HRD-0802628) and the CSU Office of the Chancellor, Oak Ridge Institute for Science and Education, Department of Homeland Security, and Sandia National Laboratories. Additional sponsors included the Department of Defense and United State Army Criminal Investigation Lab. I would like to thank Dr. Michael Bartsh, Dr. Kathrine Roberts, Dr. Krishna Foster, and LSAMP faculty and staff for their support.]

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Subcategory: Biomedical Engineering

Evolutionary Qbeta RNA Coliphage Display Functional Peptide as a Vaccine Candidate for Foot-and-Mouth Disease Virus: Advantage and Limitations

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Jade P. Grimes, Shanavia Crenshaw, Rana Singleton, and Alain B. Waffo, Alabama State University

For the first time, we have displayed and optimized a functional peptide (integrin receptor-like) on the surface of the RNA Coliphage Q β . An exposed loop of capsid protein VP1 is a major antigen of Foot-and-Mouth-Disease (FMDV). It serves as an integrin-recognition site-mediating virus entry into the host cell. The randomized GH-Loop of FMDV was inserted to the C terminus of the A1 capsid protein of RNA bacteriophage Q β within the plasmid pBRT7Q β , pQ β 8 harboring the full cDNA of Q β . The recombinant plasmid obtained was used to produce chimeric phages *in vivo*. The chimeric Q β -GH-Loop phages were producing normal plaques and were efficiently binding SD6, the GH-Loop of FMDV monoclonal antibodies, through Ouchterlony double diffusion and dot blot. The GH-Loop of VP1 displayed was found to decorate the 12 corners of Q β phageicosahedron on electron micrograph images. After 6 rounds of biopanning and selection using SD6, phages were sequenced and the predominant peptide display sequence was: Val-Arg-Gly-Pro-Cys. This was different from the original sequence: Arg-Gly-Asp-Leu-Ala but with key amino acids Arg-Gly kept in place and in order. The optimized chimeric phages induced polyclonal antibodies in guinea pigs with very good avidities to both FMDV and chimeric Q β -GH-Loop, while the parental Q β construct bearing a deletion at the C-terminus of the A1 protein did not.

This chimeric construct could be a candidate product for devising efficient vaccination agents. Every attempt at displaying larger functional peptides like: fluorescent protein (GFP), periplasmic histidine-binding (HisJ) and the cyclase subunit of imidazole glycerol phosphate synthase (tHisF) proteins on the surface of Q β failed to produce stable chimeric phages. This failure could be due to the packaging of chimeric components into hybrid phages since the expression and solubility of a larger protein with A1 protein was found to be successful. The broad mutant spectra, called quasispecies of Q β , in conjunction with the display technology, provide a new tool that could create a useful nano-tag. [Acknowledgment: We must acknowledge CNBR of ASU for grant # NSF-HBCU-UP (HRD-1135863) for supporting this project.]

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Subcategory: Microbiology/Immunology/Virology

Observing Diversity of the Microbial Population in Active Sludge

Darryl D. Lopez, California State University

Sanitation plants treat millions of gallons of wastewater containing disease-causing microbes, pollutants, and organic matter every day to prevent diseases or contamination of the environment. Many treatment plants use ICEAS (Intermittent Cycle Extended Aeration System) to enhance the growth of

desirable microorganisms responsible for the degradation of the organic material in the wastewater. These treatment systems must maintain a balance of microorganisms to maximize the efficacy of digestion. In January 2010, Salida Sanitary District (SSD) modified their system by replacing all ICEAS tank diffusers and creating a permanent aerobic digester. For the past three years, wastewater samples have been collected from the plant in an effort to monitor and characterize the microbial population. The intent of this project is to monitor the microbial parameters that will maximize efficacy of the treatment process. If the treatment process was effective, the balance and diversity of microbial population should increase. Over the course of three years, water samples were collected and analyzed to determine any changes within the diversity of the microbial population.

The methods used for water analysis includes microscopy on wet-mounts, gram stains, and endospore stains. Prior to modification of the treatment process, there was a high population of *Nocardia* and *Microthrix*, and a low population of other bacteria and protozoan. After modification, the number of *Nocardia* and *Microthrix* species decreased, while the diversity of other bacterial species and protozoan population increased. The alterations made by SSD greatly improved the efficacy of the wastewater treatment by establishing a balanced, diverse microbial population of protozoan and bacteria. There was a decrease in the number of *Nocardia*, a filamentous bacterium that causes foaming and disrupts the treatment process and an increase in other microorganisms.

The most drastic change observed was the protozoan population. It took 6 months for a diverse population of protozoan to become established. The protozoan population was initially predominated by free-swimming ciliates and flagellates (6-12 months), followed by the stalked ciliates (12-24 months), and currently by rotifers (almost 36 months). Future research is to continue monitoring the succession of microbes in the next few years to see how effective the aerobic digester is compared to the ICEAS in keeping a balanced diversity in the microbial population. *[Acknowledgment: Louis Stokes Alliances for Minority Participation (CSU, Stanislaus) and the Salida Sanitary District]*

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Subcategory: Physiology and Health

Chemical Toxicity Screening for Chemotherapeutic Treatments using Human Pluripotent Stem Cell Derived Cardiomyocytes

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Many chemotherapeutic treatments on the market today have serious cardiotoxic side effects, and as they are created, the cardiotoxicity of each must be evaluated. Current models available for screening include, but are not limited to, lab animals and cultured human adult cardiomyocytes. These models have so far sufficed; however, we aim to create a more convenient, more accurate method. Lab animal models are not from human origin and adult cardiomyocytes are much less convenient and tend to resist cell culture.

For these obstacles, there is a proposed solution: human pluripotent stem cell derived cardiomyocytes (hPS-CM). hPS-CM are easily cultured, genetically modifiable, rhythmically contracting, human cells; however, before they are used to determine cardiotoxicity, their compatibility to adult cardiomyocytes must first be further evaluated. The hPS-CM are challenged for forty-eight hours with specific concentrations of the drugs Adrenaline, Propranolol, Doxorubicin, and Sunitinib, which all have known effects on adult cardiomyocytes, in order to test the hypothesis that hPS-CM are valid models for chemical toxicity screening. Endothelial colony forming cell-derived endothelial cell (ECFC-EC) and normal human lung fibroblast (NHLF) are identically challenged to compare sensitivity; the hPS-CM should be more sensitive to the drugs than the ECFC-EC and NHLF. 50% inhibitory concentration (IC50) and 50% lethal concentration (LC50) dose response curves are created for each cell line, using cell death analysis.

The two methods to assess cell death are a Live/Dead Viability/Cytotoxicity stain and a Click-iT®TUNEL assay (both from Invitrogen, Carlsbad, CA). These curves were compared against each other and revealed that hPS-CM had normal IC50 and LC50 compared to the other cell lines, showing promising results for future chemical toxicity screening. Using these results, the accurateness of hPS-CM as a model for adult human cardiomyocytes can be assessed, opening doors for cardiotoxicity screening, not only of chemotherapeutic drugs, but of other cardiac related treatments.

The next step will be to test the effects of different metabolic pathways on the sensitivity to the drugs, due to the varying products that the different cycles yield. This will help determine the conditions in which the hPS-CM can provide accurate models. The drug challenges will be repeated on cell cultures with varying amounts of glucose, which should affect the metabolic pathways taken. *[Acknowledgment: National Institutes of Health UH2 TR000481 grant.]*

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Subcategory: Physiology and Health

The Role of MAPK-Mediated Cytoskeletal and Junctional Reorganization in Histamine-induced Endothelial Hyperpermeability

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Nutrient and waste exchange between blood and tissues is tightly regulated by the integrity of endothelial lining of the microvasculature, and this is disrupted by histamine. Elucidating the mechanism of histamine on the signaling mechanisms is the objective of this study. Hypothesis: Histamine increases endothelial permeability through a MAPK-mediated spatial reorganization of actin and VE-cadherin and was examined using the HUVEC model.

Methods: Cells were treated with histamine for various durations, and different concentrations. Western blot method was used to quantify histamine-induced changes in p38, p42/44. Kinase inhibitor, SB203850, was used to probe the histamine effect.

Result: Our data indicated that histamine activated p38, p42/44 and SB203850 prevented an effect of histamine on p38 but not activation of p42/44. Using the ECIS to measure transcellular resistance (TER), the effect of histamine on cell impedance was measured in the presence of the kinase inhibitors. All the inhibitors prevented histamine effect of reducing TER.

Conclusion: All these data supported the hypothesized involvement of the MAPK proteins in histamine-induced hyperpermeability. Future Research Question: Which histamine receptor is responsible for histamine-induced hyperpermeability. [Acknowledgment: Southern University's E3mas/SURE Program; LBRN Summer Research Internship awarded to Dr. Joseph Olubadewo and NIH grant awarded to Dr. Jerome Breslin.]

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Subcategory: Pollution/Toxic Substances/Waste

The Toxicity of Fluometuron on the Development of the Japanese Medaka (*Oryzias latipes*)

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Agricultural pesticides are heavily used in the Mississippi Delta to protect crops against unwanted pests and have become a source of exposure to human and the environment. Pesticides may have the potential to cause birth defect in animals and humans. We evaluated the acute toxicity of the herbicide Fluometuron (C₁₀H₁₁F₃N₂O), and investigated its sub-chronic effects on the embryonic development of Japanese medaka (*Oryzias latipes*) to determine teratogenicity. One-day old embryos were exposed under static renewal condition to nominal concentrations (0, 50, 150, 200, and 240 mg/L) of fluometuron for 10 days. Prior to exposure, embryos were microscopically examined for fungal fertilization, fungal infection, stage development and death. Temperature was maintained at 25°C, pH 7.5 and dissolved oxygen was kept at 5 mg/L. Time to hatching for untreated medaka embryo was 11 to 17 days. The endpoints that were evaluated were embryo viability, hatchability, and morphological abnormalities.

The study revealed a significant reduction in embryo survival and hatchability to sub-chronic concentrations of fluometuron in a concentration dependent manner in exposed groups. At the highest concentration (240mg/L), egg and larval survival and hatchability were significantly reduced (23%). The lowest concentration (50mg/L) showed a higher percentage of hatching (80%), however, it did produced significant developmental defects but not as severe as those observed in the higher concentrations. Fluometuron toxicity produced numerous developmental effects that included mild yolk sac edema, defects of the cardiovascular and circulatory systems, blood pooling, fin deformity, and premature hatching. In this study, Fluometuron was shown to be acutely toxic to the development and hatchability of the Japanese medaka fry. The exposure to sublethal concentrations of fluometuron resulted in a reduction in hatching, as well as the development of morphological and physiological abnormalities in the Japanese medaka fry. Fluometuron appears to be teratogenic to the Japanese medaka embryo and could pose a serious threat to the ecological system and human health. [Acknowledgment: This study was supported by funds from the Department of Natural Sciences and Environmental Health at Mississippi Valley State University, Itta Bena, Mississippi.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Processing Methods on Flavonoid and Phenolic Content of Peanuts and Walnuts

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Peanuts and walnuts are good sources of phytochemicals shown to have health protective properties. These phytochemicals act as strong antioxidants which are effective in the prevention of certain diseases such as cancer and cardio vascular disease. It has also been reported that processing methods can have a positive as well as an adverse effect on the bioavailability of phytochemicals. The objective of this study is to determine the effects of various processing methods such as steam roasting, drying, microwaving, and open pan roasting on flavonoids and phenolic content of peanuts and walnuts. Total phenolic in walnuts (GAE mg/L) ranged from 39.9; 28.9; 22.4; 39.6; 30.4 in raw, oven dried, steam roasted, open pan roasted, and microwave roasted walnut respectively. While the phenolic content in peanuts ranged from 13.7 to 30.4. Steam roasted walnuts and peanuts had the lowest phenolic content compared to the other treatment groups, however, microwave roasted peanuts and walnuts had the highest phenolic content. The flavonoid content (CAE mg/100g) ranged from 36.7 to 56.35 in raw, oven dried, steam roasted, open pan roasted, and microwave roasted walnuts. The flavonoid content in peanuts ranged from 14.06 to 27.95. Open pan roasted peanuts had the lowest flavonoids compared to other treatment groups while steam roasted walnuts had the highest total flavonoids content. These results indicate that the processing of walnuts and peanuts may impact the total phenolic and flavonoids. Thereby the selection of processing method is critical.

[Acknowledgment: This research has been supported in part by the NSF HBCU-UP Grant #HRD0928904.]

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Subcategory: Cancer Research

Detecting Fluorescent EGFR Antibody On Breast Cancer Cells: Application for Image Guided Surgery

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Surgery is the most common and effective method world-wide to treat cancer. Yet, the local recurrence of tumors remains high in many tumor types, e.g. breast cancer recurs in greater than 20% of women after surgery. A hand-held device to detect fluorescent contrast agent accumulation in tumors has recently been developed to intraoperatively detect tumor presence and guide surgical removal of the tumor. A key component to this technology is being able to specifically target cancerous tissue. Epidermal growth factor receptor (EGFR) is overexpressed on many tumor types, including breast, lung, and brain among others.

To that end, this project focused on determining the presence and location of EGFR on MDA-MB-231 breast tumor cells for

application in targeting contrast agents for image-guided surgery. MDA-MB-453 cells were used as an EGFR negative control. We employed cell culture techniques, the CCK-8 assay, which was used to determine cell proliferation based on metabolic activity, and fluorescence microscopy to determine EGFR expression. We confirm the overexpression of EGFR on MDA-MB 231 human breast cancer cells by fluorescence microscopy, which is consistent with the literature. MDA-MB-453 breast cancer cells (negative of EGFR) showed little to none of a signal when incubated with fluorescent EGFR antibody. Due to the strong EGFR signal on EGFR positive breast cancer cells, this suggests that EGFR is a suitable target for fluorescent imaging agents that can be detected by our novel devices. EGFR could be targeted by multiple methods, e.g. developing fluorescent antibody or antibody fragments directed at EGFR or fluorescently labeling the natural ligand for EGFR.

[Acknowledgment: Partial support provided by HBCU-UP]

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Subcategory: Cancer Research

Measuring the pRb Status in Breast Cancer Cell Lines

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Triple negative breast cancer (TNBC) is described as a subtype of breast cancer that lacks three common protein targets of breast cancer chemotherapy. These protein drug targets are the hormone receptors estrogen and progesterone, and the human epidermal growth factor receptor (HER2). Because TNBC patients are missing the common drug targets, it has presented a challenge to effectively treat this type of breast cancer. The purpose of this research study was to evaluate the status of the Retinoblastoma (pRb) tumor suppressor pathway in TNBC cells. The pRb pathway prevents excessive cell growth by inhibiting the cell cycle. By knowing the status of the pRb pathway, we may be able to devise better treatment options for people diagnosed with TNBC. Interestingly, it has been reported that there is a high prevalence of pRb loss in TNBC, but that it may suggest better outcomes to chemotherapy. Three different types of human breast cell lines were used in the evaluation of the pRb protein: AG11132 (normal/control), HCC 70 (luminal subtype), and HCC 1806 (TNBC subtype). We hypothesize that the TNBC cells will express reduced pRb protein as compared with the normal and luminal cells, while exhibiting a comparable apoptotic response. We treated the cells with the chemotherapeutic drug staurosporine (1uM) for 24 hours. Staurosporine is an antibiotic used in cancer research to elicit a cell response linked to mitochondrial dependent apoptosis. We show by light microscopy significant apoptosis 24 hrs post-staurosporine treatment in the cells. Protein was extracted from the cells using RIPA lysis buffer for Western blot analysis which

showed that pRb was expressed in untreated AG11132, treated HCC70, and untreated 1806; while the expression of pRb decreased in treated AG11132, untreated HCC70, and treated 1806 cells. In conclusion, the untreated Western blot analysis revealed that there is less pRb in HCC70 and HCC1806 than the AG11132 cells. Staurosporine treatment caused a decrease in the expression of pRb in all of the cell lines. These results suggest that we may be able to elicit a pRb response in order to maximize the effectiveness of chemotherapy. We plan to repeat our experiments for consistency and to probe for other pRb pathway proteins including p16 to determine if we can also manipulate the pathway downstream. We are also planning on studying the effects of other drugs or chemotherapeutics on the pRb tumor suppressor pathway. [Acknowledgment: This study was supported, in part, by a grant from NIH awarded to the Biology Department and Checo Rorie, PhD, North Carolina Agricultural and Technical State University, Greensboro, North Carolina, 2012.]

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Subcategory: Ecology

Detection of the Amphibian Pathogen *Batrachochytrium dendrobatidis* in Different Ponds of the San Joaquin Valley and the Foothills of the Sierra Nevada in California

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Amphibian populations are declining globally at a drastic rate. Recent studies have shown the source to be a disease called chytridiomycosis, which is caused by *Batrachochytrium dendrobatidis* (Bd) (Berger et al., 1999; Woodhams et al., 2011). In our project we collected seasonal water samples from five different ponds in the Southern San Joaquin Valley and the foothills of the Sierra Nevada mountains to detect Bd using PCR with Bd specific primers (Annis et al., 2004). Because Bd is known to be temperature sensitive (Forrest and Schlaepfer, 2011), we hypothesized that ponds in the Valley would be Bd negative when the water temperature increased above 20 C, and that we would detect the pathogen predominantly in ponds of the foothills of the Sierra Nevada. After evaluating water samples taken in 2011 and 2012, we discovered that our hypothesis was not supported. Ponds in the Valley were positive independently of the water temperature, and one pond in the foothills was negative for most samples. Other factors, such as presence/absence of certain amphibian species, presence/absence of natural predators of Bd zoospores (e.g. filter-feeding microcrustaceans) and other factors which still need to be determined likely played a role.

Our future work will include feeding experiments with microcrustaceans isolated from Bd negative and positive ponds

to investigate if they use Bd zoospores as food source. (References: Annis SL, Dastoor FP, Ziel H, Daszak P and Longcore JE. 2004. A DNA-based assay identifies *Batrachochytrium dendrobatidis* in amphibians. *Journal of Wildlife Diseases*, 40:420-428. Berger L, Speare R, Hyatt AD. Chytrid fungi and amphibian declines: Overview, implications and future directions. In: Campbell A. (ed) Declines and disappearances of Australian frogs. *Environment Australia: Canberra*. 1999: 23-33. Forrest MJ, and Schlaepfer MA. 2011. Nothing a Hot Bath Won't Cure: Infection Rates of Amphibian Chytrid Fungus Correlate Negatively with Water Temperature under Natural Field Settings. *PLOS One*, 6, Issue 12, e28444. Woodhams D, Bosch J, Briggs CJ, Cashins S, Davis LR, Lauer A, Muths E, Puschendorf R, Schmidt BR, Shaefor B, Voyles J. 2011. Mitigating Amphibian Disease: Strategies to maintain wild populations. *Frontiers in Ecology*. Accepted April 2011.) [Acknowledgment: This study was funded by a grant from NSF/LSAMP, awarded to students, including myself at California State University, Bakersfield]

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Subcategory: Ecology

Identification of Microcrustaceans as Natural Predators of the Amphibian Pathogen *Batrachochytrium Dendrobatidis*

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Amphibian populations are declining rapidly worldwide because of destruction of their habitat and more recently because of the emergence of the amphibian pathogen *Batrachochytrium dendrobatidis* (Bd) (Kriger and Hero, 2006; Woodhams et al., 2011). Freshwater environments, such as ponds and lakes, have also been altered (introduction of fish and shrimp, nutrients, pollution etc.) by humans ultimately eliminating many microcrustacean species that are natural predators of Bd-zoospores (Sarnelle and Knapp, 2004). Microcrustacean diversity was monitored over the seasons (seasonal samples) using molecular methods and microscopy. Water samples were taken in the spring, summer, fall and winter of 2011/2012. After DNA extraction, microeukaryote diversity was assessed by PCR followed by Denaturing Gradient Gel Electrophoresis (DGGE) (Yan et al., 2006), and different microcrustacean species that belonged to Cladocerans, Copepods and Ostracods were identified by microscopy from five ponds in the Southern San Joaquin Valley and the foothills of the Sierra Nevada in California. Four out of five ponds were also Bd-positive (fall samples only) when investigated with molecular methods (PCR with Bd-specific primers).

We hypothesized that microcrustacean diversity in Bd negative ponds and seasons would be different from microcrustacean

diversity in Bd positive ponds which was indeed the case when all samples were evaluated. However, feeding experiments that we will perform this year will prove if certain microcrustacean species are in fact feeding on Bd zoospores when mixed diets of spores and algae are offered. References: Kriger, K.M. and J.M. Hero. 2006. Large-scale seasonal variation in the prevalence and severity of chytridiomycosis. *Journal of Zoology*. 271: 352-59. Sarnelle, O. and R. A. Knapp. 2004. Zooplankton recovery after fish removal: Limitations of the egg bank. *Limnology and Oceanography*. 49: 1382-1392. Yan, Q.Y., Y.H. Yu, W.S. Feng, W.N. Deng, and X.H. Song. 2006. Genetic diversity of plankton community as depicted by PCR-DGGE fingerprinting and its relation to morphological composition and environmental factors in Lake Donghu. *Microbial Ecology*. 54: 290-97. Woodhams D, Bosch J, Briggs CJ, Cashins S, DavisLR, Lauer A, Muths E, Puschendorf R, Schmidt BR, Shaefor B, Voyles J. 2011. Mitigating Amphibian Disease: Strategies to maintain wild populations. *Frontiers in Ecology*. Accepted April 2011. [Acknowledgment: This study was supported, in part, by a grant from NSF/LSAMP, awarded to students, including myself at California State University, Bakersfield.]

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Subcategory: Cell and Molecular Biology

Localization and Distribution of Protease HtrA in *Porphyromonas gingivalis* W83

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Many pathogens have developed strategies for microbial host invasion. Proteases play a significant role in the process of cellular invasion. Previous studies show that HtrA of *P. gingivalis* is needed for cellular invasion. Our lab has previously demonstrated that inactivation of HtrA results in altered gingipain activities, distribution, and protein profiling when exposed to elevated temperatures. rHtrA also interacts with the gingipains. This evidence suggests that HtrA may play a significant role in virulence factor regulation during the cellular invasion process. Since it has been shown that HtrA is needed for cellular invasion, it may need to be secreted along with the gingipains to enhance cellular contact for invasion. This study is to test the hypothesis that HtrA is secreted, along with the gingipains, for *P. gingivalis* to facilitate the host cellular invasion process. Currently, there is no evidence of HtrA secretion from *P. gingivalis*. Bioinformatics and immunoblot analysis was used to determine protein distribution and localization. Bioinformatics analysis predicts a possible signal peptide

sequence and transmembrane helices in HtrA. Immunoblot analysis of cell-associated HtrA shows multiple immunoreactive bands ranging between 28-51 kDa in *P. gingivalis* W83. However, these bands were not the predicted 52 kDa molecular weight. Membrane vesicles of *P. gingivalis* W83 show the presence of secreted HtrA. In the vim-defective mutants, several high molecular weight bands above 51 kDa are present in the vimA (FLL92) and vimF- (FLL95) defective mutants that were absent in the *P. gingivalis* W83. Taken together, HtrA is associated with the cell and is secreted from *P. gingivalis*. There may be other forms of HtrA or proteins that may have domains exhibiting high homology to HtrA that are being expressed. This data suggests that HtrA secretion, along with the gingipains, may help facilitate interaction with the host. [Acknowledgment: This research was funded by a grant from NSF-HBCUP Program, Grant # 811507]

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Subcategory: Microbiology/Immunology/Virology

Somali Oral Health Practices and the Prevalence of *Actinobacillus actinomycetemcomitans* in the Saliva: A Gram Negative Anaerobic Bacteria that Causes Periodontal Disease

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Periodontal disease is marked by bacterial overgrowth, mainly caused by *A. actinomycetemcomitans*, a gram-negative anaerobic bacteria. Anaerobic bacteria are present as indigenous flora of the skin and all mucosal surfaces of the body. Under normal circumstances, the mucous membranes and natural barriers of the host contain these organisms. When these barriers are disrupted by conditions such as trauma and manipulations, (e.g. oral surgery, invasive procedures), the host is compromised by various disorders (e.g. cancer); the normal anaerobic inhabitants may penetrate neighboring tissues and establish infection. One reason these conditions and numerous other conditions predispose is that they result in poor blood supply and tissue necrosis that lower the oxidation reduction potential of the tissue to a level favoring anaerobic growth.

The present study was undertaken to measure the amount of *A. actinomycetemcomitans* found in the saliva of various Somali individuals to test the hypothesis that Somali oral health practices in the United States lead to the increase in periodontal disease. Surveys were given to individuals in various Somali communities in the Twin Cities, and saliva samples were taken to determine the amount of *A. actinomycetemcomitans* present in the saliva. The surveys included self-rating questions regarding oral health (different ages and sexes were considered and not separated). Since *A. actinomycetemcomitans* has been reported to produce a number of unidentified proteins with cell

cycle-inhibitory activity, the number of bacteria was found using a protein dye. Many Somalis practice cultural traditions that are inconsistent with American lifestyles. Those who rated their oral health as poor (75%) had a higher amount of *A. actinomycetemcomitans* in their saliva. These data indicate that although almost all participants had various traces of *A. actinomycetemcomitans*, those who didn't have proper oral health had larger traces of the bacteria in their saliva, and provide evidence to support the hypothesis that Somali oral health practices lead to the increase in periodontal disease.

[Acknowledgment: This study was supported, in part, by a grant from HCOP awarded to Sara Mohammed Nur, University of Minnesota.]

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Subcategory: Cell and Molecular Biology

Selective Classes of Antibiotics can Modulate Protease Expression and Distribution in *Staphylococcus aureus*

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Staphylococcus aureus infections have been a growing concern in the medical community. Methicillin-resistant *Staphylococcus aureus* (MRSA) is becoming resistant to most antibiotic treatment strategies. Thus, it is imperative that we identify the mechanisms utilized by *S. aureus* to induce host damage. Although MRSA is resistant to many antibiotics, the expression of the virulence factors of *S. aureus* in the presence of antibiotics has not been evaluated. In this study, we hypothesize that the presence of selected antibiotics can alter the transcriptional and protein expression levels of the proteases and other virulence factors of *S. aureus*.

In this study, we analyzed the genetic expression of the protease genes staphopain B (*sspB*), ABR52952.1 (*gcpMB*) and YP_040834.1 (*bskT*) in the presence of sub-inhibitory concentrations of selected antibiotics (chloramphenicol 31µg/ml, kanamycin 15 µg/ml, and carbenicillin 3µg/ml) using RT-PCR of isolated *S. aureus* RNA. Protein expression and distribution of staphopain A (*ScpA*) levels were assessed using ELISA and immunoblot analysis. Total protease activities were quantified using EnzChek protease assay kit. Total protease analysis show that in the presence of carbenicillin, the ATCC *S. aureus* cell-associated protease activities decrease by 14% whereas the MRSA protease activity increases by 3%. In the presence of chloramphenicol, there is a 20% reduction (ATCC) and a 34% reduction (MRSA strain 148) of total cell-associated protease activities. *ScpA* protease expression in the presence of chloramphenicol show a 66% reduction in cell-associated *ScpA* (MRSA strain 148) and a 50% reduction of *ScpA* expression

(ATCC strain). In the presence of carbenicillin, there is a 13% (MRSA 148) reduction and 9% reduction (ATCC) when assessing *ScpA*. Genetic analysis demonstrates that the presence of kanamycin down-regulates the *sspB*, *gcpMB*, and *bskT* protease genes. However, when *S. aureus* is incubated with chloramphenicol, *gcpMB* is down-regulated and *sspB* is up-regulated. Protein expression levels show that chloramphenicol and kanamycin can alter the distribution of *ScpA* resulting in an increase of *ScpA* secretion. Data from this study supports the hypothesis that the presence of selected antibiotics can alter the genetic expression as well as protease levels and distribution of *S. aureus*. Findings from this study can lead us to understand how antibiotics can affect pathogenesis of *S. aureus*, even if they are resistant to antibiotics. [Acknowledgment: This research was funded by a grant from the NSF HBCU-UP Program. Grant #811507]

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Subcategory: Cell and Molecular Biology

Remarkably Similar Viability and Behavioral Characteristics of Temperature Sensitive and Deletion Alleles of the *C. elegans* Gα Subunit Coding *gpa-16* Gene

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The nematode *Caenorhabditis elegans* is a common multicellular eukaryote model with a comparatively simple nervous system. Its small size (<1mm), economical culturing, fast generation time, and availability of mutants in specific genes makes it attractive for research. A temperature sensitive (*ts it143*) allele of the *gpa-16* gene, which codes for a Gα subunit, has been shown to cause laterality reversal. According to our hypothesis, laterality reversal is likely to have neural consequences that can be tracked using specific behavioral assays. Towards this end, we are characterizing a *gpa-16 ts* allele as well as a *gpa-16* deletion mutant (Δ ok2349).

Our experimental focus was on two aspects: (a) viability and (b) behavior of surviving progeny. The rationale for the viability testing is that at non-permissive temperature (25°C) the *ts* mutant has been previously shown to exhibit ~70% embryonic lethality with laterality reversal in about half of the survivors. Progeny embryos were monitored at 15°, 20°, and 25°C to study temperature effects on viability. For behavior, a mechosensitivity-based habituation assay and a chemotaxis-based assay associative learning assay were used to characterize the mutant strains. In all experimentation the wild-type *C. elegans* strain (N2) was used as control. Our results showed that both the *gpa-16* alleles displayed behavioral deficits.

Furthermore, even the *gpa-16* Δ mutants show high embryonic lethality rates only at higher temperatures (25°C, which is the non-permissible temperature for the *ts* mutant). We carried out statistical analyses to ascertain the validity of our results. In conclusion, our results showed that both *gpa-16 ts* and *gpa-16* Δ mutants show statistically identical deficiencies in viability as well as in behavior. These results indicate that the previously characterized “*ts*” allele may not be *ts* in the phenotypes we have studied. Our next set of experiments will be directed towards testing the two mutant alleles in additional behavioral paradigms. The long-term goal of this project includes understanding the molecular mechanisms by which GPA-16 protein interacts with other molecules to exert its biological effects. *[Acknowledgment: We would like to thank NSF (award #0928404) and NIH (INBRE-2P20RR-016472-10) for funding.]*

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Subcategory: Microbiology/Immunology/Virology

Producing Human Monoclonal Antibodies Against RSV Using the Humanized NOD-scid-IL2rynull Mice

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RSV (respiratory syncytial virus) is a virus that has been causing fatal outcomes in the vast majority of the infant and elderly people it infects. Currently, there is no vaccine available to prevent RSV. In these studies we assessed the human immune response to an RSV vaccine candidate and produced human monoclonal antibodies to RSV using humanized NOD-scid-IL2rynull (NSG) mice immunized with RSV-VLP (virus-like particles). We produced hybridomas by taking splenocytes from immunized humanized mice, reconstituted with human peripheral blood lymphocytes (PBL) and fused them with the human myeloma fusion partner HMMA 2.5. One hybridoma from such a fusion, 1B6, was used to produce variable heavy and light (VH and VL) gene segments that could be ligated into immunoglobulin expression vectors suitable for producing a functional antibody. We find we were successful in immunizing the humanized NSG mouse using an RSV-VLP and at producing hybridomas making human antibody. We also ligated the 1B6 VH gene segment into a human H chain expression vector. Our future plan is to express human anti-RSV specific monoclonal antibodies and to test the protective properties of these antibodies *in vivo* and *in vitro*. *[Acknowledgment: NIH-R01-AI-84800-03 grant, Diabetes Research Center grant DK32520]*

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Subcategory: Cancer Research

Inhibition of Akt Signaling of Sutherlandia Extracts in Prostate Cancer Cells

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Dennis Lubahn and Yuan Lu, University of Missouri

Prostate cancer (PCa) is one of the most common cancers in men in the United States. Increasing the Hedgehog (Hh) signaling pathway has been shown to be important in the initiation and development of several types of cancers, including PCa. Hh signaling cross talks with multiple pathways helping to integrate cellular signaling. Akt signaling activity serves as a marker for cell proliferation presumably via p53 inhibition. The inhibition of p53 is known to stimulate growth and Hh activity. Inhibition of Hh signaling has been shown in several xenograft models to inhibit prostate cancer. Thus, botanical compounds that inhibit cancer are potentially able to work via inhibition of the Hh signaling pathway. Our lab's unpublished results show that botanical extracts from *Sutherlandia* are highly potent in inhibiting the Hh signaling pathway and prostate cancer cell proliferation. We therefore hypothesize that *Sutherlandia* extracts are able to inhibit the Hh signaling pathway via inhibition of Akt activity. Method: We treated DU145 and HEK293 cells with different *Sutherlandia* extracts and used western blot analysis to monitor Akt activity by measuring phosphorylated Akt, total Akt, phosphorylated mdm2 and mdm2 concentrations. Results: Ethanol, methanol, ethanol/water and water extracts of *Sutherlandia* are shown to inhibit mdm2 phosphorylation. The *Sutherlandia* ethanol extract inhibits Akt phosphorylation at Ser473. Conclusion: *Sutherlandia* extracts can inhibit Akt activity, thereby helping support the hypothesis that Akt inhibition is the mechanism by which *Sutherlandia* inhibits Hh activity. *[Acknowledgment: This project was made possible by Grant Number P50AT006273 from the National Center for Complementary and Alternative Medicines, the Office of Dietary Supplements, and the National Cancer Institute.]*

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Subcategory: Genetics

The Knowledge of Sickle Cell Disease Among Random Students at a Historically Black College and University, the University of Arkansas at Pine Bluff (UAPB)

Arrica Murphy, University of Arkansas at Pine Bluff

Sederick C. Rice, University of Arkansas at Pine Bluff

Sickle cell anemia is a genetically transmitted disease that affects the red blood cells in the body and is more common in

people with African/Mediterranean heritages. An abnormal type of hemoglobin (Hemoglobin S) causes blood cells to become sickled or crescent shaped, which leads to fatigue, abdominal pain, shortness of breath, increased heart rate, and blindness. In comparison to other diseases, sickle cell disease does not get as much attention, especially on college/university campuses. The goal of this study was to conduct a survey of fifty random students to determine if they knew about sickle cell disease and how to get tested for the sickle cell trait. We used a nine question anonymous survey to get feedback from students in the form of yes/no responses. Preliminary data indicated that (16/25) (64%) of males and (24/25) (96%) of females polled were familiar with sickle cell disease. Male (10/25) (40%) and female (9/25) (36%) student polled indicated if they knew they were carriers of the sickle cell trait. Male (7/25) (28%) and female (10/25) (40%) student polled indicated that they did not know ways they could be tested for the sickle cell disease trait. No males (0/25) (0%) and about half of the females polled (12/25) (48%) knew where to find information about sickle cell disease at UAPB. Both males (18/25) (72%) and females (23/25) (92%) knew where to find information about sickle cell disease on the Internet. The majority of male (25/25) (100%) and female (23/25) (92%) students, polled at UAPB, agreed that more funding should go to sickle cell disease research and education. This study indicated that polled students were familiar with sickle cell disease, but the majority of those students did not know if they were carriers of the sickle cell trait. Data also indicated that both male and female students did not know how to get tested for the sickle cell trait, and did not know where to find information about sickle cell disease at UAPB. Both male and female students polled considered the Internet as a good source for finding information about sickle cell disease, and both groups agreed that more funding should be provided for sickle cell disease research and education. This study will help our research group design more targeted surveys and information campaigns on the importance and availability of sickle cell disease testing and education on the campus of UAPB.

[Acknowledgment: This study was supported in part by a grant from NSF/HBCU-UP awarded to Dr. Mary E. Benjamin, Vice Chancellor for Academic Affairs, University of Arkansas at Pine Bluff.]

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Subcategory: Cell and Molecular Biology

ERK MAPK Activity Coincides with Prostate Cancer Cell PC3 Mesenchymal to Epithelial Transition

Kimberly Myers, Tuskegee University

Prostate cancer is the second leading cause of cancer deaths in men. A large number of men are diagnosed each year with this

cancer. Current therapies for metastatic prostate cancer are not curative and prolong survival by only about a year even in patients with metastatic disease; critically overt metastatic disease is generally resistant to treatments. To understand the mechanism of metastatic prostate cancer survival from treatments will be very helpful to save life. Previous research by Dr. Wells suggests that E-cadherin, as an indicator of the cell phenotype, dictates dissemination and metastatic survival. The inhospitable microenvironment induce them to re-express E-cadherin to make a mesenchymal to epithelial transition (MET) However, it is still unclear the mechanism of MET makes the metastatic prostate cancer cells more resistant to chemotherapies. ERK, PI3K kinase activities are involved in the cells survival. The P38 pathway is responsible for cell death, tumor suppression as well as the development of malignance. Prostate cancer cell lines PC3 were induced and MET with treatment of EGFR inhibitor PD153035 *in vitro*. The correlation between the level of E-cadherin re-expression and cell confluence was detected in this project. Moreover, the level of E-cadherin re-expression with difference induce duration (0, 6, 24, 48 hours) was assayed. The activities of ERK in PC3 cells with the stimulation of EGF before and after MET was also assessed in this project. [Acknowledgment: Drs. Clayton Yates, Bo Ma, and Alan Well.]

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Subcategory: Cancer Research

Obtaining natural substrates of Caspases via N-terminomics

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Proteases occur characteristically in all organisms from simple digestion to signaling complex pathways. Proteases play a vital role in cell signaling cascades by cleaving specific-limited protein substrates. It is imperative to identify and characterize which proteins are substrates to the proteases and what the cleavage sights of the substrates are; this characterization will provide insight into the biochemical mechanisms of a pathway and relevance to other pathways. We have chosen the apoptotic pathway due to the majority of human tumors which are caused by the lost of the ability to undergo programmed cell death (apoptosis), thus allowing neoplastic cells to proliferate. The exquisite cleavage specificity of Caspases (Aspartic Acid specific) allows us to identify protein substrates of the intrinsic apoptotic pathway: first *in vivo* with preferred synthetic substrates, as proof of concept, then *in vivo* with HEK 293 cell lysates. We then separately introduced inhibitors of Caspases 3/7 and 9 to the lysates in order find the specific targets of these individual caspases. We obtained hundreds of putative caspase cleavage

sites through a focused proteomics procedure termed N-terminomics. We filtered the data by high stringency to obtain real world relevant data and referenced found peptide sequences to existing protein databases to reveal the identity and cleavage site of each protein identified. The caspase inhibitor XIAP was found to inhibit Caspases, but we found differential inhibitor capacity of the individual inhibitory domains of XIAP. We plan to further explore the anomalies of XIAP inhibition and apply this N-terminomics approach to T-cells undergoing physiologic activation and apoptosis.

[*Acknowledgment: Fresno State-SBCC Partnership, Cancer Research and Training for Central California, Grant number: 5P20CA138025-02*]

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Subcategory: Cancer Research

Hepcidin, Inflammation, and Obesity: Iron Regulation in Colorectal Carcinogenesis

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Hepcidin, a peptide hormone produced by the liver, constitutes the master regulator of iron homeostasis, allowing body iron adaptation according to metabolic needs. Hepcidin dysregulation leads to iron-related disorders, such as inflammatory diseases and cancers. Recent studies have enabled focused investigation in colorectal carcinogenesis (CRC), the second most common cancer diagnosed in developed countries. Determination of molecular iron biomarkers may provide a less invasive alternative to colonoscopy and guidance toward earlier detection of the 1.2 million new cases of CRC per year. Hepcidin binds to ferroportin (FPN), an iron efflux transporter, causing FPN internalization and degradation. Cancer cells are hypothesized to subvert this physiologic pathway, suggesting that cancer cells sequester iron to stimulate proliferation, thus perpetuating the cancer phenotype. CRC occurs sporadically and environmental factors (i.e., diet) are risk factors. This study proposes the inflammation that accompanies obesity, induces alterations in iron metabolism that reduce hepatic secretion of hepcidin into the blood. A real-time polymerase chain reaction (RT-PCR) assay was developed to determine expression of hepcidin, FPN, and interleukin-6 (IL-6) to evaluate iron status in a study of 20 CRC and 20 control patients, each group with body mass indexes above 25.0. Enzyme-linked immunoabsorbant assays (ELISAs) were performed on serum samples to measure hepcidin and bone morphogenetic protein 2 (BMP-2), a protein involved in bone development cited as a biomarker in related cancers. Diaminobenzidine (DAB) Prussian blue staining was used to

detect iron in colonic mucosa from both groups. ELISAs showed a significant increase in BMP-2 (64.3 pg/mL vs. 0.003 pg/mL) and reduced hepcidin (58.6 ng/mL vs. 96.0 ng/mL) in CRC cases. DAB staining revealed that CRC tissue expressed iron, whereas normal colon tissue did not take up iron. RT-PCR showed increased IL-6 (p-value: <0.05) and reduced hepcidin (p-value: 0.02) expression in CRC cases. These results indicate that circulating iron may be taken up by carcinoma tissue in CRC, thus altering normal iron metabolism. Lower hepcidin levels support iron being sequestered into cancer cells from blood. BMP-2, IL-6, and hepcidin may prove to be novel iron biomarkers for CRC evaluation and individualized therapy. Continued investigation will include a larger case-control population and further biomarker threshold level determination. [*Acknowledgment: This study was supported, in part, by the National Institute of General Medical Sciences of the National Institutes of Health under grant R25GM055052 awarded to Tama Hasson, Ph.D., Director of the Center for Academic and Research Excellence, University of California, Los Angeles.*]

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Subcategory: Genetics

Sequencing DHODH in Persons with Miller Syndrome: Expanding the Spectrum of Mutations

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Miller syndrome is a rare autosomal recessive disorder resulting from mutations in the DHODH gene¹. DHODH encodes the enzyme dihydroorotate dehydrogenase, which is involved in *de novo* pyrimidine biosynthesis. Clinical characteristics of Miller syndrome include craniofacial abnormalities, coloboma of the eyelids, cleft palate, and missing digits on the hands and feet [1]. To broaden the spectrum of causal mutations, DNA samples obtained from two unrelated affected probands were Sanger sequenced to screen for mutations in DHODH. In family 1, the affected individual was a compound heterozygote for a mutation in one of the canonical splice bases of intron 6-7 (c.820+1G>A), and a missense mutation in exon 8 (c.C1036T, p.R346W). DNA samples obtained from both parents of the affected proband were screened using Sanger sequencing, and each parent was found to be heterozygous for one of the DHODH mutations. The c.C1036T mutation has been reported

now in three families with Miller syndrome and functional studies have demonstrated a reduction of DHODH activity by 40%-70% in yeast with this mutation [1,2]. No pathogenic mutations in DHODH were found in family 2. This is the first report of a splice site mutation in a patient with Miller syndrome and further expands the spectrum of causative mutations in DHODH. Next steps include whole genome sequencing of the proband and parents in family 2 to determine if there are mutations in other genes that cause Miller syndrome. References: 1.) Ng.SB.et al.2009. Exome sequencing identifies the cause of a mendelian disorder. *Nat Genet.* 42 (1):30-5. 2.) Rainger.J, et al. 2012. Miller (Genee-Wiedemann) syndrome represents a clinically and biochemically distinct subgroup of postaxial acrofacial dysostosis associated with partial deficiency of DHODH. *Hum Mol Genet.* 21(18):3969-83. [Acknowledgment: University of Washington GenOm Project (3P50HG002360-12S2), and the Genetic and Molecular Basis of Congenital Contractures grant (5R01HD048895-06) to Michael Bamshad, M.D., funded this study].

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Subcategory: Plant Research

Production of Recombinant Thermostable *Pyrococcus furiosus* Alpha-amylase in *E. coli* for Starch Hydrolysis

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Ayalew Ligaba Michael and Bertrand Hankoua, Delaware State University

Starch is a carbohydrate consisting of a large number of glucose units joined by glycosidic bonds. The conversion of starch to glucose during various industrial applications such as bio-ethanol production is performed at high temperatures (above 75°C) under which mesophilic enzymes cannot function. Therefore, highly thermostable enzymes obtained from hyperthermophilic microorganisms (with an optimum temperature of 100°C or above) such as archeal *Pyrococcus furiosus* hold great significance in industrial starch liquefaction and saccharification. Gene sequence coding for *Pyrococcus furiosus* α -amylase has been previously isolated in Adams lab at the University of Georgia. However, recombinant α -amylase has not been produced in *E. coli* to characterize the properties of the enzyme for further utilization in developing transgenic bio-ethanol feedstock such as cassava with self-processing starch. Development of starch with self-processing characteristics via recombinant DNA technologies will help eliminate the cost of adding commercial microbial starch-processing enzymes during bio-ethanol production. In this study, *P. furiosus* -amylase gene was amplified from *Pyrococcus furiosus* genomic DNA and cloned into a protein expression vector (pET-24a (+), Promega) in frame with the polyhistidine tag. The resulting expression vector was transformed into *E. coli* DH5 α then purified for

sequencing. Vector containing the authentic *P. furiosus* -amylase gene sequence was used to transform BL3 *E. coli* cells for protein extraction. The recombinant -amylase protein was purified on Ni-NTA HIS binding columns loaded with HIS binding resins. The activity of the purified protein in hydrolyzing starch from corn, potato and cassava was characterized based on final glucose yield using the Glucose Peroxidase Assay (Sigma). The outcome of this research will provide a foundation for future research in the lab aimed at enhancing starch self-processing ability of bioenergy crops such as cassava. [Acknowledgment: This study was supported, in part, by a grant from NSF HRD #0625289 awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA and NSF-REU Program Grant No. 103971 awarded to Delaware State University, Department of Agriculture, Plant Molecular Genetics and Genomics labs.]

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Subcategory: Cancer Research

Characterizing the Biological Function of Bit1 and TLE1 in Regulating Anoikis in Cancer Cells

Michael Okoronkwo, Southern University at New Orleans

Cancerous cells of epithelial tissue, including the breast, have the ability to survive and undergo metastasis despite detachment from its extracellular membrane (ECM). Normal cells respond to integrin-mediated survival signals while in attachment to the ECM. Once detachment occurs, these cells are triggered for programmed cell death by Bit1. Malignant cells are less dependent on the integrin survival signals. One of the integrins that promotes cell survival is the anti-apoptotic protein, Bcl2. Bit1 was discovered to inhibit Bcl2. TLE1 serves as a survival protein and is an anti-apoptotic agent. In my characterization of the Bit1 protein, I subjected breast cancer cells of cell line MDA-MB 231 to nucleic acid transfection to inhibit the formation of proper Bit1 capability. Mammary epithelial cells of line MCF10A were evaluated with comparative TLE1 expression in untransformed cells and its resultant expression when exogenous TLE1 was introduced into the cell. Extensive theoretical research I conducted allows me to suggest that Bit1 down-regulation will attenuate the apoptotic ability in cell line MDA-MB 231 and TLE1 up-regulation will induce a resistance to anoikis and instead allow malignant cells to survive in the MCF10A cell line.

My findings indicated a consistent suppression in Bit1 presence after treatment of 231 cells with its transfection agent. Untransformed cells of MCF10A indeed displayed suppression of TLE1 in detached conditions. Moreover, forced TLE1 expression by exogenous injection in these cells resulted in resistance to

anoikis. In the anoikis resistant 231 cell line, TLE1 expression was considerably up-regulated following detachment from the ECM. I used western blot in probing for my proteins Bit1 and TLE1. I used transfection agent Lipofectamine to manipulate the genetic expression of Bit1 and TLE1 in the cells. Cell death elisa was a vital assay I implemented in measuring DNA histone fragments recovery as a signal for measure of cell apoptosis. My cumulative research suggests the possibility of Bit1's incorporation as an optional combative therapeutic in silencing malignant cell metastasis. Prospective research should yield interest in studying the most effective method in the deliberate altering of Bit1 and TLE1 concentrations to humans on a molecular level not only for present human cancer patients, but as a preventive therapy as well for the onset of cancer. [Acknowledgment: National Science Foundation]

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Subcategory: Cancer Research

Coordinated Changes on Relative Genetic Expression of Potential Cancer Biomarkers: A Mathematical Network Approach

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 Eney Lorenzo, Mauricio Cabrera-Ríos, and Clara E. Isaza,
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 Jesús A. Rodríguez, Pontificia Universidad Javeriana at Colombia

The search for potential cancer biomarkers using microarray experiments often entails identifying genes with significant changes in their relative expression in healthy and cancer tissues. These genes are deemed potentially important to characterize the illness. It is also important, however, to establish how these genes might interact with each other to contribute to the evolution of cancer. To this end, this work proposes that finding a path of maximal correlation among all genes of interest would lead to a structure capable to guide biological exploration with enhanced precision. Specifically, it proposes to find the path of maximal correlation among the relative changes of expression of important genes through mathematical optimization. The approach makes use of a mathematical network representation and its associated optimization problem known in the literature as the Traveling Salesman Problem (TSP).

In this study, 28 potential cervix cancer biomarkers were analyzed through the proposed approach. The number of potential correlation paths is as high $28! = 3.05 \times 10^{29}$. Posing this problem as the TSP, the highest correlated path was found, resulting in the optimal sequence: [AA488645, H22826, AI553969, T71316, AA243749, AA460827, AA454831, AA913408, AA913864, AA487237, AA446565, H23187, AI221445, R36086, AA282537, N93686, R91078, R44822,

AI334914, R93394, AA621155, AA705112, R52794, AA424344, H69876, H55909, W74657, AI017398, H99699]. The analysis of this optimal path is the next step in this work. The aim is to determine if biological structure and function follows from this mathematical representation and solution. [Acknowledgment: NIH MARC Assisting Bioinformatics Efforts at Minority Schools project 2T36GM008789 NSF Award HRD 0833112.]

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Subcategory: Cell and Molecular Biology

Glycine Transporter 2 and The Role of Its 201 Amino Acid N-terminus

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Glycine is an inhibitory neurotransmitter that is regulated mainly by Glycine Transporters 1 and 2 (GlyT1 and GlyT2). Both of these transporters are essential for life in mammals; mutations in either can lead to hyperekplexia, a neurologic disorder characterized by excessive startle movements. These two transporters have 50% homology, different mechanisms of regulating glycine, and are found in different areas of the central nervous system. GlyT2, like GlyT1, is a Na⁺/Cl⁻ glycoprotein part of the SLC6 family, but unlike the other carriers in this family, it has an extremely long N-terminus (50-80 versus 201 amino acids).

In this study we determine the importance of the role of this N-terminus by expressing a vector containing a version of GlyT2 protein without the 201 amino acid tail into Porcine Aortic Endothelial (PAE) cells (Δ 201); wild-type GlyT2 is also inserted into this vector and transfected into PAE cells (WT) as a control. Western blotting procedures, using an antibody against the carboxyl terminus of GlyT2, are conducted to see the expression of these proteins in each of the cell lines. Comparing this mutant to the wild-type, we conduct immunofluorescence techniques to see if there is adequate folding and trafficking of GlyT2 to the plasma membrane. PAE cells are marked with antibodies against GlyT2 carboxyl terminus and PDI antibody, which targets the lumen of the endoplasmic reticulum. Co-localization of these two antibodies and the absence of GlyT2 fluorescence in the membrane indicate poor trafficking of the Δ 201 when compared to WT GlyT2. Uptake assays using radio-labeled glycine were conducted previously using the Δ 201 and WT cells; results show decreased uptake in Δ 201 cells.

These experiments confirm the importance of the 201 amino acid tail in trafficking or maintaining position in the membrane. Future experiments testing the interactions between the 201 amino acid tail and other membrane proteins will be conducted using pull down assays to know if the N-terminus serves as a membrane anchor. These experiments will improve our

knowledge of GlyT2 and its role in neurologic disorders concerning glycine neurotransmission and transportation. [Acknowledgment: This project was funded, in part, by a grant from NIMH-SC1MH086070 to Dr. M. Miranda and MARC-U-STAR Undergraduate Biomedical Research Training 2T34GM008048 to Dr. K. H. Pannell.]

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Subcategory: Microbiology/Immunology/Virology

Chlamydia Major Outer Membrane Protein (MOMP) Induces High IFN- γ and T-cell Proliferative Responses in Mice

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Chlamydia trachomatis genital infection is a worldwide public health problem. Overall, 4 million Chlamydia cases were reported to the CDC in 2010. Considerable effort has been expended on developing an efficacious vaccine. The murine model of *C. trachomatis* genital infection has been extremely useful for identification of protective immune responses and in vaccine development. Although a number of immunogenic antigens have been assessed for their ability to induce protection, the majority of studies have utilized the whole organism and its major outer membrane protein (MOMP) as vaccine candidates. MOMP is the most immune-stimulatory protein identified to date, but it does not induce sterile protection and at the same time it is reported to be immunosuppressive in nature.

To begin to identify the immune-stimulatory regions with T-cell epitopes, we immunized three groups of mice at two-week interval as follows: (i) Group 1 (PBS + incomplete Freund's adjuvant) (ii) Group 2 (live *C. trachomatis*) (iii) Group 3 (rMOMP + incomplete Freund's adjuvant). Mice were sacrificed two weeks after the last immunization, and purified T-cells isolated from spleens of immunized mice were restimulated *in vitro* with Concanavalin A, UV-inactivated *C. trachomatis* and rMOMP. T-cell samples from mice were analyzed by cytokine ELISA for IFN- γ production and the MTT assay for T-cell proliferation. Our results revealed that rMOMP-stimulated T-cells induced maximum production of IFN- γ and proliferation as compared to the PBS and *C. trachomatis* immunized groups. Studies are ongoing to identify the specific immune-stimulatory regions of MOMP. [Acknowledgment: National Institute of Health]

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Subcategory: Cell and Molecular Biology

Reduction of Fibrosis in Type 2 Diabetes by (-)-epicatechin

Lila Peltekian, California State University Los Angeles

Studies demonstrate that heart disease is among the leading causes of death in Type 2 diabetes (T2D) and is mainly due to the development of fibrosis. Fibrosis is the buildup of connective tissue, mainly collagen, due to cell death, thereby decreasing the contractility of the heart leading to heart failure. In this study we looked at the effects of (-)-epicatechin (EPI) on reducing the progression of T2D and fibrosis *in vivo*. T2D was induced by feeding rats a high energy diet (HED) consisting of 10% lard and 20% glucose mixed with their normal chow. After 4 weeks, a low dose of streptozotocin (30 mg/kg) was given IP to cause partial dysfunction of pancreatic β -cells and suppress insulin secretion. Control animals were maintained on normal chow and received an IP injection of vehicle (water). Animals were also treated with EPI (1 mg/kg/day) or water by oral gavage. Body weights and plasma glucose levels were measured weekly to monitor the onset of T2D. After 12 weeks of HED, hemodynamic measurements were taken to measure changes in cardiac contractility. Tissue was collected for histological and biochemical analysis.

Our results demonstrated that the diabetic animals had significant weight gain (~44%) and increased blood glucose levels (519 mg/dL) compared to control animals (37% and 185 mg/dL, respectively). EPI significantly reduced the increase in weight gain (~33%) and blood glucose levels (351.2 mg/dL) compared to diabetic animals. No differences in hemodynamic measurements were seen. Histological analysis using Masson's trichrome stain showed that diabetic hearts contained more collagen than the control hearts and EPI treated hearts. In conclusion, our results demonstrate the ability of EPI to reduce body weight, plasma glucose levels and fibrosis in T2D. Future experiments include assessing mitochondrial function and oxidative stress levels to evaluate early cellular events, matrix metalloproteinase activity to evaluate the activity of key proteases involved in the development of fibrosis, as well as performing western blots to determine if EPI is modulating the cell death signaling pathway as a means of conferring protection. While differences in cardiac contractility was not detected between any of the groups at this early time point (3 months), cardiac function will be evaluated at a later time point (i.e., 6 months) to determine if EPI reduces cardiac dysfunction that results from fibrosis long term. [Acknowledgment: This study was supported and funded by CSU-LSAMP which is supported by the National Science Foundation under Grant # HRD-0802628 and the CSU Office of the Chancellor.]

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*Subcategory: Microbiology/Immunology/Virology***Elucidation of the PhrA/TprA Signaling System: A Potential Quorum-Sensing System Regulating Pneumococcal Virulence****Amilcar Perez, University of California, Los Angeles**

Sharon Hoover, University of California, Los Angeles

Quorum-sensing (QS) is the ability of bacterial cells to monitor population density and in return affect gene expression. The *phrA/tprA* cassette of *Streptococcus pneumoniae* (SP), a common human pathogen, resembles QS systems found in other Gram-positive bacteria. Consistent with this, TprA was previously found to be a negative regulator of *phrA* expression, and PhrA protein induced its own expression, presumably by antagonizing the activity of TprA. The PhrA protein is predicted to be secreted and cleaved to release a mature peptide from its C-terminal domain, which is then predicted to be imported into the cytoplasm to bind to TprA. Here we removed the C-terminal residues of *phrA* in order to confirm the position of mature peptide. To determine this sequence, we create *phrA* alleles that express C-terminally truncated PhrA proteins. The *phrA* deletion constructs are transformed into a SP strain that contains a *phrA-lacZ* reporter system. In order to test residues vital for PhrA auto-inducing ability, expression levels of *lacZ* of SP cells containing either full-length or a truncated PhrA allele were measured. We witness decreased PhrA-*lacZ* expression in cells containing a truncated PhrA allele as opposed to full-length PhrA. These results suggest that the C-terminal of PhrA does indeed contain the mature-PhrA peptide. Future directions include investigating different media which allow PhrA to be signaled to neighboring cells, a phenotype utilized by all QS systems, but yet to be expressed with PhrA. We have identified this as the most probable phenotype expressed in *in vivo* models but yet to be expressed in *ex vivo* systems. These studies will aid in understanding the mechanism of gene expression controlled by PhrA and TprA and the role of these proteins in mediating a QS signal. *[Acknowledgment: This project was supported, in part, by the Microbial Pathogenesis Training Grant, University of California in Los Angeles and the NIH.]*

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*Subcategory: Cell and Molecular Biology***Experimental Evolution of a Synthetic Yeast Cooperative System****Jose Mario Pineda, University of Washington**

Cooperative interactions are observed at all levels of biological organization. Cooperation facilitates major transitions in evolution such as from unicellularity to multicellularity.

However, the mechanisms behind the evolution of newly-formed cooperative systems are unknown. I have used a synthetic cooperative system termed CoSMO (Cooperation that is Synthetic and Mutually Obligatory) as a model for incipient cooperation to elucidate the mechanisms that facilitate the evolution of cooperation. CoSMO is an engineered yeast system consisting of two non-mating strains, differentially labeled with fluorescence, which rely on direct exchange of distinct metabolites. Evolved CoSMO co-cultures exhibit an improvement in viability, defined as an increased ability to survive reductions in population density. I have determined that this viability improvement is heritable, by measuring the viability of reconstituted evolved CoSMO pre-grown in rich media which allow cells to grow in the absence of cooperation. Furthermore, by mixing an evolved strain with its ancestral partner, I determined that a single evolved cooperator was responsible for community-level viability improvement. I have characterized phenotypic changes in evolved cooperators that contribute to increased viability. Specifically, I quantified changes in metabolite release via bioassays that measure metabolite concentration, changes in growth rate and death rate by flow cytometry, and changes in starvation tolerance through assays that measure ability to survive at low metabolite concentrations. I will perform genome-wide re-sequencing on evolved types to reveal specific mutations responsible for community level improvement. In all cases, I will identify which strategies are used by the cooperators in order to stabilize cooperation in CoSMO. Similar analyses on replicate populations will be performed to quantify the diversity of mechanisms that contribute to improved fitness. Through CoSMO, we will gain insights into how cooperative systems evolve from their early stages. *[Acknowledgment: I would like to acknowledge the National Institutes of Health, the NSF BEACON for the Study of Evolution in Action, the W.M. Keck Foundation, and the Mary Gates Research Endowment for support of my research.]*

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*Subcategory: Cell and Molecular Biology***Influence of Fibronectin on Cardiac Progenitor Cell-mediated Myocardial Regeneration****Mercedes Quintana, San Diego State University**

Mark Sussman, Mathias Konstandin, Natalie Gude, and Grady Gastelum, San Diego State University

Cardiac Progenitor Cells (CPCs) are crucially involved in cardiac repair. Extracellular matrix (ECM) components are also of great importance for cardiac regeneration after myocardial infarction (MI). Knowledge about the influence of ECM on CPC-based repair mechanisms is very poor. Fibronectin (FN), an ECM protein, was studied to understand its influence upon CPC signaling mediated by Pim-1 kinase, a cardioprotective signal

downstream of Akt. Methods: Isolated mice CPCs were treated with FN or bovine serum albumin as control. Viability was measured with flow cytometry under stress and basal conditions. Cell signaling pathways were analyzed using immunoblotting, qRT-PCR and siRNA. Immunohistochemistry has been used for *in vivo* studies after MI in mice. Results: FN inhibits apoptosis and induces proliferation of CPCs in conjunction with induction of Pim-1 expression. Inhibition of Pim-1 results in inhibition of FN induced protection. FN signaling through the $\alpha 5\beta 1$ integrin receptor induces Pim-1 expression. In line with these findings, FN expression correlates with expansion of CPCs after MI *in vivo*. Conclusions: FN promotes proliferation and protection of CPCs through a FN- $\alpha 5\beta 1$ -Pim-1 pathway. Causal contribution of FN for repair after MI is yet to be confirmed by ongoing research of a FN knock-out mouse, which has been successfully created. [Acknowledgment: Funding for this project was provided by the National Institutes of Health/ National Institute of General Medical Sciences (NIH/NIGMS) T34GM08303]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Identification of Endonucleases Within *Clostridium taeniosporum*

Rosana Quintana, Miami Dade College Wolfson Campus

The following project inquires as to whether *Clostridium taeniosporum*, a Gram-positive, anaerobic, rod-shaped, non-toxicogenic bacterium, possesses restriction modification systems that result in degradation of foreign DNA. Specific enzymes, such as restriction endonucleases, mediate this degradation process. The goal of this project is to not only identify all possible candidates involved in this pathway, but also to single out a specific coding region within *C. taeniosporum*'s genome for further isolation and experimentation. For this undertaking, all annotated features in *C. taeniosporum* have been assessed from approximately 80% completed annotations of this genome. Using the bioinformatics software Geneious Pro v. 5.5.3, the annotated features of the enzymes candidates were translated into their corresponding amino acid sequences and a protein BLAST was performed to ensure that genomic sequences annotated were indeed accurate, and contained a complete protein sequence.

Furthermore, information was gathered to determine the endonucleases' phylogenetic relationships to other protein families and therefore to be able to obtain distinguishable features and/or domains that would aid in the selection process of our unique candidate. A total of six endonucleases were

found within three different scaffolds of *Clostridium taeniosporum*. When closer examined, however, it can be determined that three of the proteins are in fact overlapping each other, therefore only the largest two of the three proteins has been selected for further examination. Further studies will then focus on these endonucleases and transfer from pure computer analysis into the "wet-lab" environment. A PCR will be performed to isolate the genes for these enzymes and clone into an expression vector within *E. coli*, which would contain a His-tag to facilitate their purification. The cloned proteins will then be expressed and purified by affinity chromatography using the His-tag. [Acknowledgment: National Science Foundation Advanced Technological Education Program, the STEM-TRAC Program and the Miami Dade College School of Science] Faculty Advisor: Edwin Gines Candelaria, egnines@mdc.edu

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Subcategory: Cell and Molecular Biology

Ultrastructure Changes in the 3xTg-AD Brain tissue in Alzheimer's induced mice

Uttam Rasaily, University of the District of Columbia

Alzheimer's Disease is a brain disorder caused by the deposition of extracellular amyloid plaques that affects a person's ability to function normally. It is an aging disorder, which usually begins after the age of 60. It is a slowly progressing disease, which first affects the parts of the brain that controls thought, memory and language. As time passes, this disease gets worst, and the patient will eventually die from this disorder. Some researchers have indicated that amyloid plaques are formed within the neurons, while others cite that this plaque forms between nerve cells. Further there is a possibility that plaque may also be formed in the neuroglia, which are cells that provide support for neurons.

It is our intent to examine the brain tissue of an organism that has Alzheimer's disease to determine the exact location of these amyloid plaques. We hypothesize that the differences in site location described by investigators may indicate that plaque formation is prevalent in all three areas. We began this study by obtaining brain tissue from 3xTg-AD mice that have been injected with genes (APP^{swe}, Taup301L, PS1M146V), which triggers Alzheimer's disease. The brain tissue was prepared for light and transmission electron microscopy. The tissue was fixed in 2% glutaraldehyde buffered with 0.1 sodium cacodylate for 1 hour and post-fixed in osmium tetroxide buffered with 0.1M sodium cacodylate for 3 hour and further processed for routine electron microscopy. Thick sections of 1000nm were sectioned for light microscopy and thin sections of 60nm for electron microscopy. The 3xTg-AD brain tissue, showed several defective vesicles associated with endoplasmic reticulum, abnormal mitochondria with small segments of amyloid plaques as

compared to the normal appearance of clear vesicles, intact endoplasmic reticulum and normal appearing mitochondria in the healthy brain tissue. Our data indicate that amyloid plaque formation is found mainly in the cytoplasm of the cell, however, it is a strong possibility that there may be intercellular plaque formation between neurons and other parts of the brain. A further explanation may be that the intracellular plaque may leave the cells through some mechanism of exocytosis and enter the intercellular spaces between the neurons as the disease progresses. There also may be location specificity, since our focus was limited to the cerebral cortex. However, other parts of the brain will be examined in future studies. [Acknowledgment: NIH/NCI-5R25CA129035NSF/HBCU-UP-HRD-0928444]

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Subcategory: Microbiology/Immunology/Virology

Development of Photocrosslinkable Class I pMHC Monomers for Detecting Antigen-Specific T Cells

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Recently Xie et al., (2012) have developed a method that allows the labeling of antigen-specific T cells with monomeric peptide-Major Histocompatibility Complex molecules (pMHC), and which also reveals important aspects of the T cell activation process. This is based on the generation of pMHC complexes able to be crosslinked by ultraviolet irradiation ('photocrosslinkable' pMHC ligands) acting on a 4-azidosalicylic acid (ASA) group on the peptide adjacent to the recognition sequences. These pMHC ligands can be used to detect T cells with excellent specificity and efficiency. However, studies with pMHC class I ligands are far more challenging, since the peptide is bound to the MHC differently, with no flanking residues and thus an ASA on the peptide can interfere with T cell receptor (TCR) binding. In order to generate functional pMHC class I monomers able to detect pMHC class I-restricted TCRs in humans, we have adopted two distinct approaches to developing a new generation of photocrosslinkable pMHC class I ligands.

In one approach, we incorporated an ASA group on the peptide through an 8-residue extension. Such addition prevents the bulky ASA group from directly interfering with the pMHC-TCR recognition sites. The second approach relied on designing a pMHC class I ligand where the ASA moiety was attached to sites on the MHC molecule instead of the bound peptide. This allows for the incorporation of peptides in their native form. Seven recombinant HLA-A*0201 complexes were generated with a cysteine residue at different sites, and then modified with ASA to produce photocrosslinkable HLA-A*0201 molecules. Further work needs to be conducted where a cytomegalovirus (CMV)-derived peptide is loaded onto the HLA-A*0201 molecules using a peptide exchange method. Ultimately, flow cytometry will

enable to determine which photocrosslinkable CMV/HLA-A*0201 monomer is the most efficient at staining CMV-specific CD8 + T lymphocytes in human peripheral blood mononuclear cells. In conclusion, we generated the precursors to a technology that allows staining of T cells specific for peptides bound to MHC class I molecules. This photocrosslinkable pMHC class I ligand will provide insight into the TCR dynamics of T cell activation and synapse formation in specific T cell populations. [Acknowledgment: This study was supported by a grant from the NIH Minority Access to Research Careers-Undergraduate (MARC) Program and the 2012 Amgen Scholars Program at Stanford University, School of Medicine.]

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Subcategory: Cell and Molecular Biology

Investigating the Role of RBM4 in the Expression of ULBP-1, an NKG2D Ligand

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Benjamin Gowen and David Raulet, University of California, Berkeley

NKG2D is an activating immune receptor found on natural killer cells, and some T-cell subsets, which binds to a family of cell-surface proteins. Stressed, transformed or virally infected cells, such as cancer cells, frequently express NKG2D ligands at high levels, while normal cells show little to no expression of these ligands; therefore, a natural killer cell will destroy an abnormal cell it recognizes via the NKG2D receptor. In order to further understand the regulation of NKG2D ligand expression, we are studying the human NKG2D ligand ULBP-1. A genetic screen of a human cell line identified RNA-binding motif protein 4 (RBM4) as a potential regulator of ULBP-1. Thus, our goal is to determine if RBM4, and/or RBM4 isoforms that arise as a result of alternative-splicing, are involved in ULBP-1 regulation. RBM4 is a ubiquitously expressed protein which plays a role in the alternative splicing of pre-mRNA, translation, and RNA silencing.

We previously isolated a clone of cells in which the RBM4 gene was inactivated by insertion of a retroviral gene trap. We hypothesized that restoring RBM4 expression would also increase ULBP-1 expression. To test this hypothesis, we expressed RBM4 or its isoforms in this cell line with a tetracycline-inducible retroviral vector. In our experiments, we observed a modest increase in ULBP-1 expression when we restored RBM4 expression. We also saw a similar result with ncCoAZ, an alternative splicing product of RBM4. Future experiments will consist of determining if RBM4 has a similar effect on ULBP-1 in other cell lines and investigating the mechanism by which RBM4 acts on ULBP-1 gene expression. We would also like to determine if stressed cells use this mechanism to increase their level of ULBP-1 expression. If we confirm that RBM4 regulates ULBP-1, it is possible that RBM4

can serve as a target for cancer therapy drugs.

[Acknowledgment: NSF REU Program in Cell, Developmental, and Evolutionary Biology at the University of California, Berkeley; NSF AGEP Program]

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Subcategory: Cell and Molecular Biology

Possible Heat Shock Protein Involvement in Preconditioning Neuroprotection Due to Resveratrol and Low Ethanol

Breanna Ryan, Dillard University

Resveratrol is shown to be protective against brain neurons, and in preconditioning experiments it is protective against serious toxic insults in brain cultures. Heat shock proteins are proteins that can protect cells from injury or insult, and can increase when the cell is stressed. Heat Shock Protein 70 is responsible for the proper folding of proteins and the prevention of stress damage to cells. The proteins may inhibit the ability of Amyloid Beta to assemble into toxic oligomeric complexes. Amyloid Beta is a neurotoxic peptide that becomes microscopically visible in the form of senile plaques in the brain of some older people. Excessive accumulation of amyloid-beta peptide in cortical brain regions is one of the main causes of neurodegeneration in Alzheimer's disease. Some studies of older people who drink wine moderately show that they may have a lower risk of Alzheimer's disease.

The purpose of this research is to see if the preconditioning above with ethanol and resveratrol might increase cell culture levels of HSP70, a neuroprotective protein. Sprague-Dawley rat pups (7-10 days old) were cold-anesthetized and decapitated. The cerebella were taken, dispersed, and cultures made on poly-L-lysine coated 12 well plates for 7-10 days, with media changes every 3 days. The cultures were preconditioned with ethanol and/or resveratrol for 3 days. The groups sampled were a control (media only), 10mM of ethanol, 5 uM of resveratrol, and 10mM and 5uM of resveratrol and ethanol combined. Protein concentrations were done on the samples to determine how much protein was to be loaded in the wells for western blotting. It was found that HSP70 was significant in the combination of resveratrol and ethanol. The p value of the control was less than 0.001, and the p value vs. ethanol was less than 0.05. The N value was 4-5.

Based on these results, it is possible that HSP70 may play a role in protection against Amyloid Beta. This could mean that HSP70 has a role in protection by moderate wine consumption against Alzheimer's disease. HSP70 has been used in many previous forms before this research, and have shown to provide protection. Future studies could also be done *in vivo* with

transgenic mice that over-express Amyloid Beta to see if HSP70 still protects with the combination of ethanol and resveratrol.

[Acknowledgment: This study was supported, in part, by a grant from National Science Foundation awarded to Abdulla Darwish, Ph.D., Dean for the College of Arts and Sciences, Dillard University.]

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Subcategory: Cell and Molecular Biology

Tracking and Modeling Time Evolution of IRF3 and NF-kB in the Signaling Processes During Viral Infection

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"IRF3 and NF-kB: Transcription factors acting in a coordinated way under double stranded RNA stimulation" is ongoing research by Dr. Kimmel and his research group at Rice University, UTMB Galveston, and at IPPT in Poland. The overall research goal was to build a system model analyzing the signaling pathways during protein synthesis, using data from cell-population experiments and single-cell experiments. While the processes of protein synthesis are well established, fewer details are known about the signaling processes within the innate immune system during a viral infection. An understanding of these signaling processes is essential, among others, to the development of cancer treatments aiming to manipulate protein synthesis.

The primary aim was to reconcile the statistical data from the experimental research (shown in the system model) with a computational model of the regulatory module involving IRF3 and NF-kB. We gathered statistical data from a number of single-cell experiments. To extract the statistical data from the single-cell experiments, two software tools were employed primarily in the study: CellTracker and R programming. The first component of the methodology involved tracking the A549 human epithelial cells from the single-cell experiments on two different light frequency channel. [Channel 1 focused on "Nuclear Factor Kappa-light-chain-enhancer of Activated B Cells" (NF-kB; green) and Channel 2 focused on "Interferon Regulatory Factor 3" (IRF3; cherry).] To model viral infection, cells were electroporated and a chemical analog of viral double-strand RNA (polycytidylic acid; PCA) was introduced into the cells. Cells in the single-cell experiments were assigned to three treatment groups: cells that were not exposed to PCA (control), cells exposed to 5µg of PCA, and cells treated with 50µg of PCA. Using CellTracker, the time series of intensities of the luminescence of the green or cherry-labeled proteins in entire cells, in the cytoplasm and in the nucleus, as well as the nucleus to cytoplasm ratio were tracked and recorded. The main

difficulty was to monitor that CellTracker stayed on target, in presence of cell movement. The second component of the methodology was generation of graphical analyses of the cells' intensities. Under the three experimental regimes, the analyses of the cells' intensities showed moderate oscillations over the 14 hour period of time. *[Acknowledgment: This research was funded by the Cancer Prevention & Research institute of Texas Summer Undergraduate Program in Computational Cancer Biology, Training Grant Award RP 101489.]*

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Subcategory: Physiology and Health

CD1 and C57BL6 Mice Show Strain and Gender Specific Differences in Behavioral Phenotypes

Pingdewinde Sam, San Francisco State University

As mice are commonly used for modeling human diseases, it is important to understand baseline behavior that may be in part determined by strain and gender. The objective of this research was to phenotype the two commonly studied strains of mice at UCSF; namely CD1 and C57BL6 that are typically selected to model neurological-based diseases. We hypothesized that these mice show unique, strain and gender dependent phenotypes.

To test that hypothesis, behavioral assessments were conducted in 32 mice (8 males and 8 females/strains) and consisted of evaluating motor performance on a Rotarod and positional preference in an open field. Rotarod performance was evaluated two times daily over a period of 3 days while open field testing was conducted one time only. All mice were randomized and the experimenter was blinded to strain and gender to insure unbiased assessment. Data were analyzed by two way repeated measures ANOVA. While both strains showed similar patterns of motor learning, based upon Rotarod performance, CD1 females performed significantly better on this task than CD1 males.

We next evaluated preference of mice for the center or the periphery of an open field, with the former suggestive of a lesser degree of anxiety. There were no strain/gender differences with regard to preference for the periphery of the open field. However, we found gender differences in time spent in the center of the open field in C57BL6 mice with males showing a greater percentage of time than females. In addition, there were strain differences in this measure with C57BL6 mice showing greater time spent in the center than CD1 mice.

Together, this study identifies unique gender and species-specific behavioral phenotypes. These findings emphasize the importance of genotype and gender when considering studies that address behavior in rodent models of neurological diseases.

[Acknowledgment: This work was supported by NIH grant 5R25GM050078-13, Neurobehavioral Core for Rehabilitation Research at the University of California San Francisco.]

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Subcategory: Biomedical Engineering

Analysis and Capabilities of a Mobile Potentiostat

Nicklas Sapp, Norfolk State University / National Aeronautics and Space Administration

A potentiostat is an instrument used in chemical and biological tests using the fundamentals of electrochemistry to collect data. This instrument has been applied as a sensor of reactions in biological systems. Currently, potentiostats are limited to lab use across the world and cost in the upward range of ten to twenty thousand dollars. Our goal was to construct a smaller, mobile potentiostat that is significantly cheaper for field use and potential space exploration. The CheapStat1 device outlined the design and test experiments for our own portable potentiostat. Our mobile potentiostat was assembled using soldering techniques and programmed to perform cyclic voltammetry, linear sweep voltammetry, and AC voltammetry. Cyclic voltammetry analysis was performed on dilutions of potassium ferricyanide (K₄Fe(CN)₆) and ascorbic acid (vitamin C) by the commercial potentiostat, ElectroChemical Work Station Model 600 D Series Serial #A2220, and compared to our mobile potentiostat. The oxidation/ reduction reaction of diluted samples of over-the-counter acetaminophen was monitored using linear sweep voltammetry. Quantitative analysis of each result demonstrated an analogous direct relationship between the substance concentration and current output in measurements taken by the mobile potentiostat and commercial potentiostat. Ideal comparative trends were obtained from the mobile potentiostat, demonstrating it has the same basic functionality necessary for use as an effective biosensor. These comparable measurements lay the foundation for further improvements on the mobile potentiostat. In conclusion, for quantitative purposes the mobile potentiostat is comparably functional to the commercial potentiostat. Further investigations include testing done with a proper covering, and changing the working electrode and varying the experimental conditions to simulate possible field situations.

[Acknowledgment: This project was funded by NASA-NSTI program]

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Subcategory: Nanoscience

Development of a Sodium poly(4-styrenesulfonate) Doped Polypyrrole Electrode for Calcium Detection

Anita Scales, Norfolk State University

Electrochemical sensors involve the use of a potentiostat device to detect biological and physiochemical analytes. Previously, carbon nanofibers (CNF) were used as electrodes in a variety of biosensors. CNFs are defined as cylindrical nanostructures made of graphene layers and come in a variety of lengths and diameters. There are several electrically conductive polymers, such as polyaniline and polypyrrole, and dopants, such as PSS and Tiron, that have been used to detect specific ions. Use of these polymers can be combined with CNF electrodes to enable ion detection for lab-on-a-chip applications. In this project, polypyrrole was used as the conductive polymer and a PSS dopant was used to bind calcium ions. The polymer coated CNFs were characterized through cyclic voltammetry and scanning electron microscopy. Several parameters such as polymerization time, voltage, and dopant concentration were evaluated. In the future, a chip will be developed to monitor astronaut health while they are deployed on missions. The chips will be able to detect a variety of ions including calcium and potassium, to name a few. [Acknowledgment: This project was funded by NASA Student Technology Internship program.]

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Subcategory: Genetics

Time Travel with Apples: Accelerating Breeding Using Biotechnology

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Nathan Tarlyn, Amit Dhingra, and Kate Evans, Department of Horticulture, Washington State University

Apple seedlings take five to seven years to flower and fruit. Being able to shorten the time to flower will accelerate breeding and allow faster evaluation of fruit characteristics. Genetic modification can be employed to induce early flowering in apples that will effectively reduce the generation time. To facilitate the application of biotechnological approaches in apples, it is important to have methods for *in vitro* manipulation. The domestic apple variety 'Royal Gala' was used as a model to establish and confirm the reliability of a previously described agrobacterium transformation protocol. Also, explants from elite selections derived from crosses in apples were collected from the WSU Apple Breeding Program in

Wenatchee, WA. These explants were surface sterilized and aseptic cultures were established to provide a source of plant material for future transformation experiments. Reliable transformation protocol genes to induce early flowering can be introduced into elite selections which will reduce generation time. Pollen from these transgenic intermediates can be used for subsequent crosses, and once the desired genotypic constitution is achieved, the transgene can be segregated out leaving a non-transgenic selection. This will ultimately shorten the time for development of desirable apple varieties.

[Acknowledgment: This study was supported, in part, by a grant from NSF HRD HBCU-UP and DBI REU-Site Programs awarded to Dr. Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University.]

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Subcategory: Physiology and Health

The Effects of Second- and Third-Hand Cigarette Smoke Exposure on the Levels of Plasma Glucose and Insulin Using Swiss Webster Mice

Reema Shakir, California State University Stanislaus

Cigarette smoke is a mixture of chemicals, the majority of which have detrimental effects on the body at the physiological and cellular levels. The effects of chronic cigarette smoke exposure on hormone secretions are mediated by the pharmacological action of nicotine and other toxins found in cigarette smoke. Exposure to cigarette smoke can be first-, second-, or third-hand. First-hand cigarette smoke (FHS) is the inhaled smoke from a burning cigarette. Second-hand cigarette smoke (SHS) is exhaled smoke from a burning cigarette and smoke from the filter or mouthpiece end of a cigarette. Third-hand cigarette smoke (THS) is often smelled but not seen after tobacco has been smoked. THS encompasses the environment in which smoking has occurred as well as the chemical residues that coat all indoor surfaces such as walls, carpet, and furniture.

The specific aim of this study is to investigate the effects of SHS and THS exposure on carbohydrate metabolism. Carbohydrate metabolism will be assessed by measuring plasma glucose and insulin levels. We hypothesize that SHS and THS exposure will have an increase in plasma glucose levels, a decrease in insulin levels. Mice were randomly divided into experimental (SHS and THS) and control groups. The experimental mice were exposed to either second- or third- hand cigarette smoke once a day, five days a week, for 37 weeks. The animals were fed and weighed daily. Blood was drawn biweekly for plasma glucose and insulin determination. Plasma glucose was measured using a glucose meter. The levels of insulin were determined using ELISA (Enzyme-linked immune sorbent assay). The food intake and

weight gain are lower in the experimental groups while plasma glucose are higher for long term SHS exposure compared to THS and control groups. There is no significant difference in the plasma insulin levels between the control and experimental groups. Long-term SHS exposure has a greater effect on the glucose metabolism than THS. For future experiments we would extend the length of exposure to cigarette smoke.

[*Acknowledgment: This study was supported by Central Valley Math and Science Alliance, Research Scholarship Creative Activity, and Louis Stokes Alliances for Minority Participation; all at CSU, Stanislaus.*]

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Subcategory: Cell and Molecular Biology

Induction of Intestinal Epithelial Differentiation *In Vitro* and *In Vivo* by Schlafen 3 Adenoviral Transfection

Mandy Shelby, Tuskegee University

Surgical procedures and prolonged fasting are often associated with intestinal dysfunction resulting in lack of proper nutrient intake. Treatment of patients that encounter this problem is typically the administration of nutrients via total parenteral nutrition (TPN). Unfortunately, there are patients that suffer from complications resulting from TPN and eventually lead to fatality. We have previously reported that Schlafen 3 promotes enterocytic differentiation *in vitro*. We hypothesize that Schlafen 3 will promote enterocytic differentiation in rat intestinal epithelial cells *in vivo* as well. In this study, Schlafen 3 was overexpressed by intraluminal injection of a Schlafen 3 adenovirus vector, and the resulting intestinal areas of the intestines where Schlafen 3 was expressed evaluated. Schlafen 3 was expressed through the proximal and distal portions of the intestines at different levels. Induction of enterocytic differentiation by Schlafen 3 was examined *in vivo* and *in vitro*. Levels of dipeptidyl peptidase, villin, and sucrose-isomaltase were measured as markers of differentiation and associated with expression of Schlafen 3. Schlafen 3-adeno-GFP-virus was highly up-regulated in transfected Caco-2 cells. Markers of differentiation and Schlafen 3 expression were analyzed using qRT-PCR and gel electrophoresis. Understanding the function of Schlafen 3 may help identify mechanisms involved in mucosal function and their eventual manipulation. This can help improve the intake of nutrients and enteral function, increasing survival rate and alleviating symptoms in disorders such as mucosal atrophy. [*Acknowledgment: Summer Research Opportunities Program at Michigan State University.*]

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Subcategory: Cell and Molecular Biology

Cloning and Expression of enzymes involved in the biosynthesis of the fluorescent protein phycoerythrin

Angel Shulterbrandt, University of New Orleans

Christina M. Kronfel and Wendy M. Schluchter, Department of Biological Sciences, University of New Orleans

Phycobiliproteins (PBPs), comprised of alpha and beta subunits, are highly fluorescent proteins in cyanobacteria that are used for photosynthesis and are ideal research candidates for the biotechnological application of fluorescent markers and probes. Phycobilisomes (PBS), the light-harvesting complex in cyanobacteria, exhibit unique fluorescent properties due to the attachment of bilins to specific cysteine residues in PBPs by bilin lyases. The genes *cpeS* is a known bilin lyase involved in attaching PEB to Cys-80 (1), and the gene *cpeF* is hypothesized to be a bilin lyase involved in the ligation of phycoerythrobin (PEB) to the beta subunit of phycoerythrin (PE). PE contains PEB ligated to 4 Cys within the protein. This study focuses on the cloning and expression of *cpeS* and *cpeF* in an expression vector to test whether they have bilin ligation activity.

In this study, both *cpeS* and *cpeF* were cloned in the same expression vector pCOLA-Duet. The clone CpeS/CpeF/pCOLA was confirmed via sequencing. The CpeS/CpeF/pCOLA construct was then used for expression of CpeS and CpeF proteins within *E. coli* using the empty vector as a negative control and *cpeS*/pCOLA and *cpeF*/pCOLA as positive controls. Both proteins appear to be expressed and soluble in *E. coli* when coexpressed together using SDS-PAGE analysis. These two genes will be co-expressed with the beta subunit of PE (*cpeB*) and the bilin synthetic genes *ho1* and *pebS* cloned in other Duet Vectors. Co-expressing these five proteins within *E. coli* should allow for the formation of a fluorescent Histidine-tagged CpeB subunit if the enzymes are active.

The ultimate goal of studying the roles of bilin lyases is to characterize the biosynthetic pathway for phycobiliproteins. This research can be applied toward the use of these fluorescent probes in cancer research and other biotechnological applications. References: Biswas et al.2011. Characterization of the Activities of the CpeY, CpeZ, and CpeS Bilin Lyases in Phycoerythrin Biosynthesis in *Fremyella diplosiphon* Strain UTEX481. *J. Biol. Chem.* 286, 35509-35521. [*Acknowledgment: This study was supported, in part, by grant MCB-0843664 from the National Science Foundation awarded to Dr. Schluchter.*]

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Subcategory: Ecology

The Identification of Rotifers In the Tidewater Region

Bonita A. Simmons, Norfolk State University

Rotifers are microscopic aquatic invertebrates that make up the phylum *Rotifera*. The objective of this study was to identify and classify the rotifers in the Tidewater region, as they have been identified but not classified by freshwater biologists and ecologists in this area. Sampling was carried out in domestic containers of accumulated rainwater in Chesapeake and Suffolk, in both an open water and bog/swamp area of the Norfolk Botanical Gardens and Harbor Park. Samples were taken into the lab at Norfolk State University and allowed to settle in plastic and glass containers undisturbed. After sediments had accumulated, they were removed using plastic pipettes and dropped onto glass slides and secured with plastic cover slips. Specimens were then observed under various magnifications using a compound light microscope and identified using W.T. Edmondson (1959) and Wallace, Segers, Ricci, Nogrady (2006). Six rotifers were identified up to their generic level from collections made in the Chesapeake, Norfolk, and Suffolk areas. The rotifers belonged to the genera *Philodina*, *Adineta*, *Lecane*, *Lepidella*, *Asplancha*, and *Keratella*. Four of the six rotifers described belonged to the Class *Monogononta*, while the other two belonged to the Class *Bdelloidea*. No specimen observed belonged to the Class *Seisonidea*. No specimens were identified from the Harbor Park sample. [Acknowledgment: Funding for this research was provided by STARS Summer Research program and the National Science Foundation (Grant number : 0714930).]

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Subcategory: Ecology

What Matters to a Mouse: Habitat preference in *Zapus princeps*

Jennifer Smith, Humboldt State University

Riparian, or streamside, habitat is particularly important in conservation, as they are often "biodiversity hotspots." Understanding the ecology and interactions within such an environment can offer insight into conservation strategies of it and its inhabitants. Several jumping mice species, including the threatened *Zapus hudsonius preblei* and *Zapus princeps*, are common in riparian habitat. These two species are parapatric, and share similar habitat requirements. It is unclear how extreme this *Zapus*-riparian habitat association is, nor why it exists. In this study I examined the habitat preference of *Zapus princeps* (western jumping mouse) on a fine-scale in the East

River Valley, Gunnison, CO. I tested the hypotheses that 1) jumping mice would exhibit preference for riparian habitat within a 40-meter wide area, 2) movement between adjacent drier habitats and riparian habitat would occur and 3) the presence of water, not vegetative cover, determines *Zapus princeps* distribution. I compared live-trap success rates in three different habitats (riparian, intermediate and dry) occurring within a 40-meter wide area. I marked the mice uniquely to indicate the habitat in which they were first trapped. I compared trapping success between two different microhabitats (wet/cover vs. dry/cover) to investigate why *Zapus* prefers mesic areas. I also used historical trapping records on permanent grids to determine long-term patterns of *Zapus* captures with vegetation and proximity to water. *Zapus princeps* was captured more frequently in riparian areas. *Zapus* preferred to move within and between wetter habitats. The historical study found a negative relationship between trap success and distance from water. There was a trend but no significant difference in captures between microhabitats.

These results offer further understanding into the ecology of *Zapus* and riparian habitat. This insight may particularly benefit the management of *Zapus hudsonius preblei*. The results reveal a strong preference for mesic habitat exists, even when drier habitat is less than 40 meters away. Furthermore, the data suggest water itself is a limiting factor. In further studies, it would be interesting to examine *Z. princeps* distribution on a temporal gradient. Being a hibernator, it is possible the diet of this mouse varies from the beginning of summer to end. It's possible this diet variation affects habitat preference. [Acknowledgment: National Science Foundation, Research Experience for Undergraduate program.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Search for New Biofuel Microbes: Isolation of Thermophilic Microbes from Soil

Alexis Solis, Bowie State University

Ravi Barabote, University of Arkansas, Bowie State University

The objective of this project was to isolate microorganisms that efficiently degrade lignocellulose from ambient soils. Continuous inflation of gas prices all around the world has motivated researchers to develop alternative sources of fuels to replace the current ones that supply energy. Bioethanol is a form of renewable energy that can be produced from agricultural feedstock and is mainly produced by the sugar

fermentation. If lignocellulose in cell walls can be released and converted to ethanol efficiently, bioethanol could eventually be commercially produced from wood, straw and waste materials. Two different soils were sampled, one from the University of Arkansas Fayetteville and one from Wilson Park, Fayetteville. Microorganisms from the two soils were isolated at three different temperatures: room temperature (~25°C), 37°C, and 50°C, using lignocellulose-containing growth media. The results showed several fungal and bacterial colonies growing at 50°C. This suggested that thermophilic cellulolytic microbes can be isolated from ambient soils. *[Acknowledgment: NSF]*

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Subcategory: Genetics

Testing the Efficacy of Monocot and Viral-derived Promoters using Green Fluorescent Protein Reporter Gene in Transgenic Tobacco

Wendy Stegall, Fort Valley State University

Pooja Santapuram, Sinilal Bhaskaran, Chandrakanth Emani, and Shivendra Sahi, Western Kentucky University

The success of plant genetic engineering or plant genetic transformation is dependent on stable integration, desired level of expression, and predictable inheritance of the introduced transgenes. In majority of the genetic transformation protocols, the cauliflower mosaic virus-derived CaMV 35S promoter has been widely used as a promoter in transformation vector constructs owing to its property of constitutive expression that enables it to express in all parts of the plant system. Plant derived promoters have also been used in genetic transformation, but there are very few reports of testing their efficacy across plant species to compare their efficiency with the 35s promoter. The present study compares the efficiency of the 35s promoter with a monocot plant derived maize ubiquitin promoter in transforming a dicot plant, tobacco utilizing the jelly fish green fluorescent protein gene as the reporter system. In conclusion, the GFP gene expression was observed at cell and whole plant levels in transformed plants indicating the use of the monocot plant-derived ubiquitin promoter in tobacco, a dicot plant. Results from the study will contribute towards suggesting the routine usage of plant-derived promoters in generating transgenic plants. *[Acknowledgment: This study was supported, in part, by grants from NSF HRD HBCU-UP awarded to Dr. Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University and NSF REU-Site Program, Western Kentucky University.]*

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Subcategory: Microbiology/Immunology/Virology

The Role of Antimicrobial Lipids: Potential Novel Innate Immune Factors Preventing Intrauterine Infections

Jazma Tapia, California State University Los Angeles

Edith Porter, California State University Los Angeles

Innate immunity provides first line defense against infectious diseases. Host derived lipids, including cholesteryl esters, have emerged as key effector molecules of innate immunity. Mother-to-child transmission of HIV and other infectious disease agents, such as *Listeria monocytogenes* (LM), pose high risks to unborn babies. Fetuses are surrounded by two unique layers providing protection: amniotic fluid (AF), the clear liquid in the amniotic sac, and vernix caseosa (VC), a lipid-rich wax-like substance that appears late in term prior to labor. Our collaborators have recently discovered that AF contains antibody-independent, innate anti-HIV factors. However, the molecular source of their antimicrobial properties is unknown. We hypothesized that AF and VC-derived lipids have anti-LM and anti-HIV activity.

Collection of AF and VC under full IRB approval during C sections without blood contamination was obtained by our collaborators. Liposomes were prepared from total lipid extract via sonication under heat. Light microscopy revealed successful generation of liposomal structures. Thin layer chromatography, with visualization in iodine vapor, demonstrated up to 40% recovery of lipids. The liposomal lipid profiles were comparable to the lipid distribution in the original material. We conducted 3h colony forming unit assays employing LM in mid-logarithmic growth phase in a buffer consisting of 10 mM NaPi (pH 7.4), 140 mM NaCl, and 4% of 1 × TSB. Three of five AF liposomal preparations exhibited antibacterial activity resulting in up to 64% growth inhibition, compared to the assay growth control. In contrast, the VC liposomal preparations tested did not exhibit anti-LM activity. This may have been due to a relative paucity of phospholipids in VC possibly impeding delivery of antimicrobial lipids.

Our preliminary data suggests that lipids in AF have anti-LM activity. We will reassess the anti-LM activity of VC after phospholipid supplementation, and we will then examine the anti-HIV activity of AF and VC lipids. Our efforts may lead to the identification of novel factors preventing transplacental infections and may have significant clinical applications in fetus protection *in utero*. *[Acknowledgements: 2012 Howell-CSUPERB Scholars Award, MBRS-RISE GM61331, NSF CSU-LSAMP HRD-0802628, and NIH 1SC1GM0969161, and to Azadeh Farzin, Yvonne Bryson, Kym Faull, and Bonnie Ank for providing AF and VC samples and helpful discussions.]*

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Subcategory: Genetics

Epigenetic Effect of Paternal High Fat Diet and Exercise on Offspring Susceptibility to Glucose Intolerance in Mice

Reatna Taylor, Johnson C. Smith University

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The purpose of the research was to determine if exposure of male mice to exercise or a high fat diet would modify the susceptibility of offspring to obesity or glucose impairment. Male C57 black mice were divided into three groups: control (10% fat), high-fat (60% fat), and exercise (10% fat diet with exercise wheel). Control females were used for breeding purposes, and two subsequent generations were bred and assigned either a control or high fat diet. Glucose metabolism and body composition were measured using a Glucose Tolerance Test (GTT) and MRI respectively. Metabolic chambers were also used to assess additional parameters such as energy expenditure, motor activity, as well as food and water consumption. At 16 weeks of age, mice were sacrificed, and tissues were collected to evaluate methylation patterns and protein expressions. Analysis revealed that exercise father offspring (EFO) gained more weight compared to fat-father offspring when challenged with a high fat diet, suggesting a diet induced epigenetic modification originating from the founder father. However, in the second generation this effect began to fade. Further examination of target proteins within tissue samples will offer deeper insight into the possible mechanisms responsible for such metabolic variation between progeny. [Acknowledgment: Partially funded by HBCU-UP]

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Subcategory: Plant Research

Antibiotic, Allelopathic, Antimitotic and *In vivo* Cytotoxicity of Ethno pharmacologically selected Medicinal Plants from the Dominican Republic

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Maria T. Laux and Manuel A. Aregullin, Cornell University

In the Caribbean, the use of plants for medicinal purposes is extensive. Five Dominican Republic medicinal plant species were collected and their organic extracts were prepared for study. The extracts were screened for their allelopathic, anti-mitotic, antibiotic, as well as their cytotoxic properties. Allelopathic studies using a seed germination assay showed that the isopropanol extract of *Cymbopogon citratus*, *Rauwolfia nitida* and *Chiococca alba* had a 100% growth inhibition activity at the

concentration tested and the methanol extract of *Chiococca alba* was also active and possessed 100% growth inhibition at the concentration tested. The brine shrimp assay, the test for cytotoxicity, exhibited 57%, 72%, and 90% mortality rates at a 25 μ L, 50 μ L, and 75 μ L dosage of a *Chiococca alba* methanol crude extract, respectively. *Rauwolfia nitida* methanol plant extract showed weak to moderate antibiotic/antifungal inhibition activity against the gram-positive bacteria *Escherichia coli* and *Pseudomonas aeruginosa*, and against the gram-negative bacteria *Listeria monocytogenes* and *Staphylococcus aureus*. The *Cymbopogon citratus* methanol extract displayed weak inhibition against *Staphylococcus aureus*. This study suggests that *Chiococca alba* has a high potential for its utilization as a cancer treatment as well as an herbicide. [Acknowledgment: MHIRT program at Cornell University, NIH.]

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Subcategory: Microbiology/Immunology/Virology

Identification of the Origin of Replication of Gram-Positive Anaerobic Bacterium *Clostridium taeniosporum*

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James R. Walker, Scott P. Hunicke-Smith, and Alexandra Blinkova, University of Texas, Austin

Clostridium taeniosporum is a Gram-positive, nonpathogenic, and anaerobic bacterium isolated from the Crimean lake silt. It is a close relative to the toxigenic *Clostridium botulinum* Group II strain, with approximately 98% similarity. *Clostridium taeniosporum* is unique in forming ribbon-like endospore appendages that are present even in the best of conditions (Lyer AV, 2008). *Clostridium taeniosporum*'s genome is approximately 3,452,763 Kbs in length, subdivided by sequencing and assembly into 18 scaffolds of various sizes. Analysis of scaffolds 1 to 12 was performed using bioinformatics tool Ori Finder to locate specific dnaA boxes and putative oriC sites and indicative genetic markers. Each scaffold was submitted individually, sixteen times, to match each of the different consensus bacterial DnaA boxes present in the indicator bacteria: *Escherichia coli*, *Chlamydiae*, *Prochlorales*, *Synechococcus*, *Haemophilus*, *Nocardia*, *Mycoplasma*, *Bradyrhizobiaceae*, *Burkholderia chrII*, *Burkholderia chrIII*, *Dehalococcoides*, *Flavobacteriaceae*, *Helicobacter*, *Nitrobacter*, *Thermotoga*, and *Vibrio chrII*. The query was matched against the oriC regions database, My SQL (DoriC) for searching of the dnaA boxes. Results identified scaffold 10 to have the highest amount of dnaA boxes and three putative ori regions. These results indicate that the origin of replication may be located in scaffold 10. Indicator genes in addition to dnaA, such as dnaN, parA, gidA, and recF were also

found using Ori Finder in this scaffold. Protein homology analyses also performed using protein BLAST confirmed the presence of these different proteins in said scaffold. The latter result seems to confirm the hypothesis that the origin of replication in *C. taeniosporum* may be localized in scaffold 10. This project has provided a fine structural analysis for a putative replication origin in *C. taeniosporum*. [Acknowledgment: National Science Foundation]

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Subcategory: Cell and Molecular Biology

Role of Chromatin Insulator Elements in HSV-1 During Latency and Reactivation

Donique Thorpe, Dillard University

Monica Ertel, Amy Cammarata, and Donna Neumann, Louisiana State University Health Science Center

The Herpes Simplex Virus-1 is capable of establishing latency inside its host. During the latent stages of the infection only the latency associated transcript, the LAT gene, is expressed while the remainder of the genome is repressed by epigenetic mechanisms. This organization indicates the presence of functional insulator elements in HSV-1. Recent research has subsequently shown that the LAT gene is flanked by a CTCF binding motif (annotated B2), that has been characterized as an insulator with enhancer blocker and silencer activities. In addition to this CTCF binding motif, there are six other CTCF binding motifs in the HSV-1 genome, none of which have been characterized as insulators to date. The objective of this research project is to determine whether the remaining six CTCF binding motifs of HSV-1 are capable of insulator functions, such as enhancer blocking and/or silencing functions. To meet the goals of our objective, we have designed and constructed several reporter plasmid constructs containing the core CTCF binding domains and ~500 bp of HSV-1 sequence flanking each domain to assess the ability of each CTCF binding domain to act as an enhancer blocker to the LAT. To test the silencing ability of each core CTCF domain, additional constructs were generated with ~100 bp deletions of only the reiterated CTCF binding sequences. These reporter constructs were transfected into rabbit skin cells and the luciferase activity measured in a dual reporter assay. Our results show that at least one other CTCF binding motif (annotated B6) acts as an insulator to the LAT during latency in HSV-1. Future research includes developing recombinant DNA constructs which lack the core repeats then phenotype it in rabbits to determine changes in viral pathology. [Acknowledgment: LBRN projects were supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number P20GM103424 and by the Louisiana Board of Regents Support Fund. The content is

solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or Louisiana Board of Regents.]

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Subcategory: Plant Research

Characterization of Xylem Sap Components Associated with Pierce's Disease Tolerance

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Pierce's Disease (PD) is one of important diseases that limit the cultivation of grape in the southeast US. The disease is caused by the bacterium *Xylella fastidiosa*, which is spread by a sharpshooter that feeds on the plant, and then injects the bacterium into xylem of the grapevine. Once the bacterium infects the plant, the plant xylem vessels are clogged which restrict the plant from water and nutrients and eventually leads to death. The present study was aimed to identify unique xylem sap proteins present in different grape cultivars that exhibit different degree of tolerance to PD. Xylem Sap was isolated from several varieties of grape cultivars filtered, and its proteins were extracted using acetone precipitation. Proteins were then used to perform one-dimensional gel electrophoresis. The results showed a wide variation in the xylem sap composition among the cultivars. Using proteomic approaches, we found significant differences within the Muscadine genotypes as well as between Muscadine and Florida Hybrids. Also pH values were obtained from both species to analyze any significant variations in the pH values. [Acknowledgment: This study was supported by the National Science Foundation, Award number 1156900. Also special thanks to Dr. Virginia Gottschalk, Dr. Ramesh Katam Devaiah Kambiranda, Sheikh M. Basha.]

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Subcategory: Cell and Molecular Biology

CLIP1 as a Candidate Gene for repro29 Male Infertility: Complementation Testing with Clip1tm1Gal

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Finding genes important for sperm development and

understanding their function will help us understand the underlining causes of human infertility. The repro29 mutation is a recessive mutation that causes complete male infertility due to defects in late sperm development. repro29 is a genetic mutation that was originally generated by the ReproGenomic ENU Mutagenesis Program at the Jackson Laboratory. The main goal of this project is to determine the gene that causes infertility in the repro29 mutant mouse strain. Gene mapping using meiotic recombination techniques has narrowed the known candidate gene region on Chromosome 5 to 0.29 Mb; this region includes four known genes: Clip1, Zcchc8, Rsrc2, and Kntc1.

We hypothesize that Clip1 is the gene responsible for defective sperm development in repro29 testes. Clip1, a CAP-GLY domain containing linker protein that is a microtubule associated protein, is the best candidate gene because a knockout mouse strain carrying the Clip1tm1Gal shows defective spermatogenesis and reduced fertility (Akhamanova et al., 2005, *Genes Dev* 19, 25 01-2515). We obtained the Clip1tm1Gal mice from the Netherlands and performed a complementation test with repro29 mice. Male mice carrying both the Clip1tm1Gal and repro29 mutations were characterized to determine if they had defective spermatogenesis by analyzing epididymal sperm for motility and morphology. Genetic complementation testing with Clip<1tm1Gal> indicates that it is not allelic which showed normal sperm and indicated that repro29 mice did not have a mutation in Clip1. *[Acknowledgment: This research is supported by grants from the NSF Western Alliance to Expand Student Opportunities (S2009ur0024/S09UR016 Antonio Garcia, PD) and the NIH/NCRR NM-Idea Networks of Biomedical Research. Rodrigue Dikuba, Carlos Garcia, Daniel Gutierrez, and Sean Lujan were an enormous help in collecting these data.]*

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Subcategory: Ecology

Function of Songs in the Orange-Billed Sparrow (*Aurremon aurantiirostris*): Evidence for Sex-Role Convergence

Josephine Tupu, University of Hawaii Hilo

Birdsong is a model system for animal communication studies. Recent studies about passerine vocalization have mainly concentrated on temperate regions where sex roles are distinct and males dominate the territory. In temperate areas the males are the signaler and females are solely receivers. However in the tropic regions, sex roles may be reversed between the two sexes and passerine species provide a great opportunity to address the idea that sex roles have converged for this tropical species. In this study we investigated functions of female's song in Neotropical Orange-billed sparrow (OBSP). We found OBSP at

different territories in Las Cruces Biological Station, Coto Brus, Costa Rica and recorded their songs or responses before and after playback. During our experiment, we examine the role of both male and female OBSPs in their territories. We hypothesize that female OBSPs sing for the same reason as males by conducting three simulated territorial intrusions (female, male and duet playbacks). However, the overall results showed that the males sing more than females do in response to all three playback types. They both appear to sing for the same function - territorial defense. This research is unique and very interesting to understand how communication between birds is very important in relation to their territories and their mates. *[Acknowledgment: National Science Foundation, Organization of Tropical Science, Native American and Pacific Islander Research Experience Program, Keaholoa STEM Scholars Program]*

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Subcategory: Cell and Molecular Biology

Transport Regulating Proteins in Lipid-Droplets of *Drosophila melanogaster* Embryos

Sarah Y. Valles, University of California

Drosophila melanogaster embryos contain lipid droplets at all stages of development, which are moved along microtubules. As development proceeds, the droplets undergo distribution changes, due to altered transport. In phase I, the droplets move bi-directionally, with no net transport. At a second phase there is net plus-end transport, and the droplets on average move towards the center of the embryo. In phase III the average transport of the droplets reverses, moving toward the embryo periphery. How these changes in transport are controlled is unknown, but droplet-bound proteins certainly contribute to the process.

My research describes the search for changing droplet-bound proteins—proteins that change their state of phosphorylation or the amount of protein localized to the droplet. To identify such proteins that are good candidates for key regulators of the changing transport, we collect embryos from a wild type strain of *Drosophila melanogaster* embryos, OrR, at either one or four hours of age. We then homogenize the embryos and purify lipid droplet proteins through the use of a sucrose gradient and ultracentrifugation. We find the concentration of lipid-droplets using a Bradford protein assay to get the desired amount of ~500µg. We then clean the lipid droplet pellets and re-suspend them to visualize the droplet-bound proteins using 2-D gel electrophoresis analysis. The first dimension of the gel separates the proteins by pI (on a 3-10 pH IPG strip) after 12 hours of rehydration and 35,000 V-hrs. The second dimension further

separates them by size after one hour of running the gel at 49C in 1x SDS Running buffer on a 10% polyacrylamide gel. The gels are then compared to gels from different stages of the embryo's development, looking for spots (proteins) which have moved over (phosphorylation) or increased/decreased in amounts. These changing proteins are then excised from these gels, and identified with mass spectrometry. The identified candidates will then be ranked by potential importance, in part by cross-referencing with published reports on factors that affect droplet position/size, etc., in other contexts. The results from this experiment are a critical step in understanding regulation of transport, relevant for many disease-related processes. [Acknowledgment: University of California, Irvine]

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Subcategory: Genetics

***Plasmodium Vivax* Transmission Dynamics and Superinfection Prevalence in the Peruvian Amazon**

Alberto Vasquez, University of California, San Diego

Malaria causes 300- 500 million clinical cases and over one million deaths each year. *Plasmodium vivax* is the most widespread of the human malaria parasites and is the predominant cause of malaria in Central and Southeast Asia and South America. Very little is known about the biology of *P. vivax* except that parasite populations are extremely genetically diverse in each endemic area. The dynamics of *P. vivax* transmission have a large impact on the disease burden in an endemic area and regions with complex transmission dynamics allow parasite strains to more easily recombine. This recombination creates new hybrid parasite strains that could lead to the emergence of drug resistance and enhanced virulence.

In order to investigate the transmission dynamics in the region around our field site in Iquitos, Peru, we genotyped parasite strains from the 2008 transmission season at the merozoite surface protein-three alpha (msp-3 α), a highly variable surface antigen. Nested-PCR followed by restriction fragment length polymorphism analysis at msp-3 α allows us to identify the number of dominant haplotypes as well as the prevalence of super infection in the Peruvian Amazon. We investigated the clonality of the 47 parasite samples. Using the Hha1 RFLP results, the sum of the DNA fragments after digestion was compared to the size of the original amplification product (1,895 bp). Samples where the sum of the digestion products was significantly greater than the expected size of the amplification product were considered polyclonal. Seventeen of the 47 samples were polyclonal (34%). The polyclonal samples were spread across ten genotype groups. These results were

indicative of the presence of some diversity in the area and correlate with results previously obtained from the Brazilian Amazon and immediate surrounding area. Identifying all clones in the area will allow us to determine the number of dominant haplotypes in Iquitos. The acquired data will then be useful in attempting to model the transmission dynamics in the Peruvian Amazon. Understanding the clonality of infection will help us identify certain loci as epidemiological markers to aid in the development of area-specific treatments. [Acknowledgment: McNair Scholars Program, National Science Foundation]

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Subcategory: Plant Research

Species Authentication and Validation of *Actaea racemosa* (Black Cohosh) by DNA Barcoding in Alabama, North Carolina, Maryland and Virginia

Akinola Vaughan, Bowie State University

This research was conducted to authenticate and validate *Actaea racemosa* using a molecular DNA barcoding method based on PCR amplification and sequencing of rDNA and chloroplast DNA. It is aimed at developing a facile and reliable approach for the rapid genetic identification of plants so that black cohosh in the market is not adulterated and to ensure the quality of this medically and economically important botanical dietary supplement on the market. Black Cohosh is widely harvested for use as a dietary supplement for vasomotor menopausal symptoms. A key issue involving the safe and effective use of black cohosh is the accurate analysis of the authenticity of plants in the field. The PCR-amplified DNA sequences from a variety of plant stocks ranging from specimens grown from USDA certified germplasm, collected from Alabama, North Carolina, Maryland and Virginia, certified by harvesters, and purchased from a spectrum of nurseries and natural plant suppliers from Alabama to Massachusetts, were compared to corresponding sequences from authentic *A. racemosa* and other members of the *Actaea* species in GenBank. 74 accessions were analyzed and the BLAST searches indicated that 63 accessions matched the authentic DNA sequence from *Actaea racemosa* by >99%. The 11 remaining accessions matched DNA sequence from *Actaea podocarpa* by >98%. This result reflects the inaccuracy of identifying *Actaea racemosa* by morphology because its close congeneric (*Actaea podocarpa*) cannot be morphologically distinguished. DNA barcoding has proven to be a more reliable method in *Actaea racemosa* authentication. [Acknowledgment: Computer Science Department, Bowie State University, Dr. Ed Eisenstein, Institute for Bioscience and Biotechnology Research.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Venus Flytrap Biomechanics: Forces in the *Dionaea muscipula* Trap

Chrystelle L. Vilfranc, Oakwood University

Alexander G. Volkov, Oakwood University

Many plants have the ability to alter their physical characteristics and become shape-changers with a low turning radius, long endurance, and high speed. Biomechanics of morphing structures in the Venus flytrap has attracted the attention of scientists during the last 140 years. We believe the driving force of the closing process is most likely due to the elastic curvature energy stored and locked in the leaves, which is caused by a pressure differential between the upper and lower layers of the leaf.

Our results enable us to explore new types of highly efficient natural osmotic motors and electrically controlled morphing structures with optimum performance. Understanding these principles will provide further understanding of plant physiology and biomechanics in plants and living organisms alike. We have developed new methods for measuring all these forces involved in the hunting cycle. We made precise calibration of the piezoelectric sensor and performed direct measurements of the average impact force of the trap closing using a high-speed video camera for the determination of time constants. The new equation for the average impact force was derived. The impact average force between rims of two lobes in the Venus flytrap was found equal to 149 mN, and the corresponding pressure between the rims was about 41 kPa. Direct measurements of the constriction force in the trap of *Dionaea muscipula* was performed during gelatin digestion.

This force increases in the process of digestion from zero to 450 mN with maximal constriction pressure created by the lobes reaching to 9 kPa. The insects and different small prey have little chance to escape after the snap of the trap. The prey would need to overpower the “escaping” force, which is very strong and can reach up to 4 N. In the future, we wish to continue to further explore the phenomena of intercellular and intracellular in this unique plant. *[Acknowledgment: This study was supported, in part, by the National Science Foundation HBCU-UP Program under Grant No. HRD 811507 and by the U.S. Army Research Office under contract/grant number W911NF-11-1-0132.]*

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Subcategory: Cell and Molecular Biology

Molecular Tools for Visualizing Sensory Structure Development

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Molly Harding, Matthew McCarroll, and Alex Nechiporuk, Oregon Health and Science University

The goal of this experiment was to develop a molecular tool to observe sensory organ development in zebrafish (*Danio Rerio*). Thus, we theorized that a 7.5 kilobase portion of the Fgf10 promoter would be sufficient to drive expression of a fluorescent protein, in a pattern that reflects endogenous expression of the Fgf10 gene. We amplified a 7.5 kilobase portion of 5' untranslated region (UTR) immediately adjacent to the transcriptional start site using Polymerase Chain Reaction. We cloned the fragment into the p5' multiple cloning site vector and subsequently, we recombined the newly generated promoter vector, p5'MCS-Fgf10UTR, with the protein vector, pME-nls-mCherry, and p3'E-polyA into the destination vector, pDestTol2pA2. Next, we injected the product vector into claudinB:GFP (transgenic) embryos, allowed the embryos to develop until 24 hours post fertilization, and then imaged using a confocal microscope. As expected, there was nls mCherry expression in the otic vesicle (ear) and olfactory bulb (nose) of the claudinB:GFP embryo, two known domains of fgf10 at this developmental stage. Nevertheless, fgf10 expression was not present in the lateral line primordium, a domain also familiar to fgf10 expression. This is likely due to critical regulatory regions missing in the 7.5 kB Fgf10 promoter, consequently, inhibiting expression in all of the desired organs. This data suggests that the cloned 7.5 kB portion of the fgf10 was able to partially recapitulate the endogenous expression of the fgf10, therefore partially supporting our initial hypothesis. Overall, this new instrument will prove useful in future studies aimed to elucidate the mysteries that underlie sensory organ development.

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Cytotoxicity and Antibacterial Properties of Medicinal Plants in Dominican Republic

Charles Waller, Bowie State University

Anne Osano and Maria Laux, Bowie State University

Many people in the Dominican Republic use medicinal plants to treat diseases because of the vast majority of different plant species found on Hispaniola. The objective was to study five plants native to the Dominican Republic namely *Roystonea hispaniola*, *Mentha spicata*, *Ricinus communis*, *Cecropia schrebriana*, *Myricanthes fragrans*. Isopropanol and methanol extracts of the plants were used to study their antimutagenic, cytotoxicity, cell division and allelopathic properties. We conducted a Sea urchin Assay to see if any of the plant extracts stop cell division. The results showed inconclusive; more trials should be performed. We conducted a Brine shrimp assay, which used brine shrimp and tested the cytotoxicity effects of each plant extract mixed with methanol and Isopropanol. The results showed most of the brine shrimp survived, except in the *Myricanthes fragrans* which killed almost all of the brine shrimp. The next Assay was a Seed Germination Assay, which we used to see if the plant extracts have any allelopathic effects on cucumber seeds. Based on the results, all of the seeds grew, which means none of the plants have allelopathic effects. We then conducted an Antimicrobial Assay which was to find any antimicrobial properties the plants might possess. We tested the plant extracts against *E.Coli*, *Pseudomonas aeruginosa*, *Listeria monocytogenes*, *Staphylococcus aureus*, and *Saccharomyces cerevisiae*. We looked at how strong the plant extracts were at inhibiting microbial growth. *Myricanthes fragrans* showed strong inhibition toward all the microbes we tested, which means it has some antibiotic activity. Also *Cecropia schrebriana* showed some inhibition which means it could also possess some antibiotic activity.
[Acknowledgment: Cornell University]

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Subcategory: Microbiology/Immunology/Virology

A Study of Oral Rinses on the Microflora of the Mouth

Catherine Wanko, University of the District of Columbia

Dental caries, one of the most common oral health problems, are caused by the complex microbial community that inhabits the various surfaces of the normal mouth. However, one of primary causes of dental caries is a gram positive bacterium, *Streptococcus mutans*. This bacterium, with the capability of transforming carbohydrates into lactic acids, most recently has been related to heart disease. In this study, there is an attempt to examine the effectiveness of the following 5 commonly known oral rinses: Listerine Total Care, Scope, 1.5 % Hydrogen Peroxide, Crest Pro-Health, and Listerine for children, on the destruction of *S. mutans* and other oral cavity residing microorganisms. The organisms were obtained from swabbing the mouth of a volunteer who had refrained from brushing or using any oral rinses for a period of 24 hours. Swabs that had

been taken from the mouth were used to streak blood agar plates. The plates were incubated for approximately 24 hrs at 37°C in an incubator. Several different colonies of bacteria were generated from the blood agar plates. From each of the different colonies, several tests were performed to identify the different organisms: crystal violet and Gram stains, and Acid Fast tests. Additionally, bacteria from each of the different colonies were grown in nutrient broth in culture tubes for 24 hours at 37°C. Gram stains and Acid Fast tests indicated that each of the selected colonies were gram positive microorganisms. From the culture tubes, bacteria were taken for routine transmission electron microscopy and for bacterial lawn formation. The lawns were made by pouring the nutrient broth containing the bacteria on blood agar plates. Paper discs, soaked in one of the 5 oral rinses, were placed on these bacterial lawns. A control disc soaked in distilled water and one soaked in an oral rinse were placed on the bacterial lawns (only 2 discs per plate). The zones of inhibition surrounding the oral-rinse soak disc were measured in millimeters. The zone of inhibitions under each product after 48 hours of inhibition were as follows: Listerine C, 7 millimeters (main ingredient sodium fluoride 0.02% and 0.01% of fluoride ion); Scope, 4 millimeters, (main ingredient 13% WT% of alcohol); Crest Pro-Health, 2 millimeters (Cetylpyridinium chloride 0.07%); 1.5% Hydrogen Peroxide, 2 millimeters; Listerine for children, 3 millimeters (sodium fluoride 0.02 and 0.01% of fluoride ion). Using the indicated test, the only colonies identified w
[Acknowledgment: Supported by a grant from NIH/NCI # 5R25CA129035-04 and NSF STEM Center - NSF/HBCU-UP - HRD-0928444]

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Subcategory: Cell and Molecular Biology

Mitochondrial Function in Axotomy-Induced Axon Degeneration

Nickolas Wheat, University of California, Los Angeles

Axon degeneration is a common endpoint for multiple neurodegenerative diseases, including diabetic neuropathy, stroke, and traumatic injury. Although mitochondrial mechanisms regulating cell body death are well understood, their role in axon degeneration is largely unknown. Uncoupling mitochondrial oxidative phosphorylation leads to decreased production of reactive oxygen species and adenosine triphosphate. Our hypothesis is that mitochondrial oxidative phosphorylation instructively regulates axon degeneration. Our lab has developed a model to study axon degeneration in live zebrafish using laser axotomy (axon severing). Axon degeneration after this type of injury is called Wallerian degeneration and is conserved throughout vertebrates and invertebrates. Time lapse movies of axotomized zebrafish axons

using confocal microscopy were created before and after uncoupling oxidative phosphorylation using two techniques: treating zebrafish embryos with a chemical mitochondrial uncoupling agent or overexpressing mitochondrial uncoupler protein-2 (UCP2) with specific enhancers that drive expression of this protein to sensory neurons. Surprisingly, preliminary results suggest that uncoupling oxidative phosphorylation has no effect on the rate of Wallerian degeneration. However, further experiments are underway to test more rigorously whether oxidative phosphorylation inhibits the rate of axon degeneration. Understanding how mitochondria are involved in Wallerian degeneration may identify mechanisms involved in other forms of axon degeneration. *[Acknowledgment: The undergraduate research performed in this study has been funded by the California Alliance Mentoring Program, as well as the Initiative for Maximizing Student Diversity, University of California, Los Angeles.]*

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Subcategory: Genetics

Isolation and Identification of Novel Bacteriophages from Durham, NC

LaManuel White, North Carolina Central University
Ebony Wilson, North Carolina Central University

Bacteriophages are viruses that infect bacteria, meaning that a bacterial host was needed for this experiment to take place. Four soil samples from various locations in Durham County, NC were used in this experiment (Cornwallis, Garrett Road, Hope Valley, and Martin Luther King, Jr. Parkway). These soil samples were chosen because they are local surface water sources that are contributors to the Neuse River Basin. The samples were processed by using an enrichment protocol and *M. smegmatis* as the host for the bacteriophage. The plating of the enriched samples was done multiple times to ensure plaques were consistently present. Spot tests were performed on the plaques to ensure quality and reliability of the samples. Purification of the samples was done by a series of ten-fold serial dilutions, followed by harvesting of the sample by a high-titer lysate. Three out of the four samples produced plaques. Following isolation and purification of the bacteriophages, the next steps will include the isolation and DNA restriction of the phage genomic DNA for analytic processing and sequencing. *[Acknowledgment: This research was supported by LSAMP and the Howard Hughes Medical Institute Precollege and Undergraduate Science Education Program]*

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Subcategory: Cancer Research

***Biomphalaria glabrata*: The Expression of FREP 3 on Mated and Selfed NMRI and BS90 Snail Strains**

William Wiggins, University of the District of Columbia
Carolyn Cousin, University of the District of Columbia

Biomphalaria glabrata is a freshwater mollusk that is the intermediate host to the *Schistosoma mansoni*, a flatworm that causes the disease schistosomiasis. This disease is prevalent in Central Africa, Asia, and South America and is 2nd only to malaria on its destructive impact on mankind. *B. glabrata* are hermaphroditic snails that will mate or self-fertilize. Disrupting the lifecycle of *S. mansoni* will stop schistosomiasis from occurring. Our interests are in two different snail strains, BS90, a resistant snail, and NMRI, a susceptible snail line. It has been postulated that there is a connection between reproduction and the immune response. A protein that is found exclusively in mollusks is known as fibrinogen related protein. This is a defense protein which is believed to play a role in innate defense of these freshwater mollusks. Past research suggests that the protein binds to the sporocysts of *S. mansoni*. It is hypothesized that the protein attacks the sporocysts and prevents it from reaching maturity in the hepatopancreas of snail. It was of interest to us to determine the level of protein expression in FREP 3 (fibrinogen related protein) in mated and selfed BS90 and NMRI strains. The albumen gland (the source of nourishment for the fertilized eggs) and hepatopancreas were excised from BS90 (resistant) that were both mated and one selfed. The same protocol was performed with NMRI (susceptible) snails. Both the albumen gland and the hepatopancreas were then processed for immunocytochemistry at the light and electron microscopic levels to show the expression of FREP 3 in both snail lines in the albumen gland as well as in the hepatopancreas. The primary antibody used was anti-FREPS. The preliminary results showed that the BS90 strain showed an increase in FREP 3 compared to the NMRI strain. This will then enable further research on the role that reproduction plays on the susceptibility in the BS90 cell line and NMRI cell line to *S. mansoni*. *[Acknowledgment: This study was supported, in part, by a grant from Cancer Academy NIH/NCI 5R25CA129035 STEM NSF/HBCU-UP-HRD-0928444.]*

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Subcategory: Cell and Molecular Biology

Do MVM Non-structural Proteins Induce a Cell Cycle Block?

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Parvoviruses are small icosahedral viruses with single-stranded DNA genomes that infect many animal species including humans. Infection of mouse (murine) cells by the parvovirus minute virus of mice (MVM) causes DNA damage that results in a block to cell cycle progression at a point prior to mitosis. Knowing that MVM infection causes this halt in the cell cycle, we asked the question - what component of this virus creates the block? MVM's two most important proteins, other than the capsid proteins, are NS1 and NS2 (nonstructural protein). Does NS1 cause the block, or NS2, or a combination of both? Using the pINDUCER lentiviral system, the lab had earlier constructed murine cells that can express NS1, NS2, or both upon induction using a doxycycline -regulated promoter. By inducing these cells with doxycycline at different time intervals, we can determine when the proteins are expressed. We have characterized these cell lines following induction to determine the kinetics of MVM protein expression, and also the cell-cycle status following expression in order to determine the role of the MVM nonstructural proteins in blocking the cell cycle. In conclusion, it was observed that non-structural protein (NS1) induced a cell block expression in murine cells. *[Acknowledgment: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, Fort Valley State University.]*

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Subcategory: Physiology and Health

Intrapulmonary Arteriovenous Anastomoses Regulate Pulmonary Vascular Pressure During Exercise

Juan Wilkins, Elizabeth City State University

Henry Norris, Tyler Magnum, Randy Goodman, and Andrew Lovering, University of Oregon

Intrapulmonary Arteriovenous anastomoses (IPAVA) are large diameter pathways with radii at least 5 times the size of pulmonary capillaries. In accordance to Poiseuille's law, resistance to blood flow is inversely proportional to the radius of the blood vessel to the fourth power ($R = \alpha/r^4$). Essentially large diameter IPAVAs may offer lower resistance pathways for blood flow, and therefore may prevent excessive rises in pulmonary artery systolic pressure (PASP) during exercise ($P=Q/R$). Kovacs et al. 2012 demonstrated that pulmonary vascular resistance during exercise increases with age. This may be possible due to a failure of older individuals to direct blood flow through IPAVAs. The purpose of this study was to determine if large diameter IPAVAs play a role in pulmonary vascular pressure regulation. We hypothesized that (1) IPAVA blood flow would decrease as age increases and that (2) pulmonary artery systolic pressure (PASP) would increase as IPAVA blood flow (bubble scores) decreased. Subjects were recruited and a series of

variables such as bubble score, pulmonary function test, pack history, and other various factors were measured. The subjects were then brought into the lab, placed on a resistant exercise bike (ergometer) and hooked up to an IV containing a saline bubble solution. Each subject was fitted on the bike to the most comfortable position and then exercise began after a warm-up protocol. Subjects exercised, the results were recorded, blood was taken, and saline was pumped into the body by different lab members on each job. To see if these anastomoses are open, an echocardiographer monitored the heart through the duration of the trial. Cardiac output was also measured by echocardiography during the trials. This process is called saline-contrast echocardiography and is a very effective method to measure how big the anastomoses are. A bubble score is given (0-5) to the subject based on how many bubbles are seen going through the left ventricle of the heart during exercise. It was concluded that IPAVA blood flow decreases with age which leads to a rise in PASP. Also as IPAVA blood flow increases, PASP decreases, and IPAVA blood flow is dependent on vascular pressure as well as vascular flow. Why these areas tend to close as you get older needs to be further researched. *[Acknowledgment: [This research was funded by NIH Grant # R25GM082808. I would also like to thank Dr. Andrew T. Lovering and the lab for giving me this opportunity to work along side them.]*

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Subcategory: Microbiology/Immunology/Virology

Investigating the Anti-bacterial Effects of Diallyl Disulfide

Amber Williams, Winston Salem State University

It is quite evident that the era of antibiotics is slowly but surely coming to a close. Antibiotic resistance is one of the world's most pressing health problems. Antibiotics were once the first line of defense against bacterial infections, and now they are beginning to become ineffective. In addition, there are also a number of side-effects, such as allergic reactions, associated with various antibiotics. Therefore, there is a need for alternatives to traditional antibiotics. This study attempts to examine the effectiveness of diallyl disulfide (DADS) as a natural antimicrobial alternative to antibiotics. DADS is an oil-soluble allyl sulfur compound found in processed garlic. Previous studies have indicated that DADS does have some antimicrobial activity against several human concerned medical pathogenic bacteria and fungi. We hypothesized that DADS would be effective at killing various bacteria. In this study, the antimicrobial properties of DADS (25ug) against four bacteria (*E. coli*, *B. subtilis*, *S. aureus*, *P. aeruginosa*) were evaluated. Its effectiveness was compared to gentamycin (10ug), ampicillin (30ug), tetracycline (30ug), and erythromycin (15ug). The

findings of this study point to DADS as having selective antimicrobial activity. The Kirby-Bauer susceptibility test provided preliminary data that *S. aureus* and *B. subtilis* were marginally susceptible and susceptible to DADS, respectively. The Broth dilution method was also used and provided more definitive data, indicating that DADS worked as well as Penn-Strep in inhibiting *B. subtilis* growth. However, when DADS and Penn-Strep were used in combination to inhibit *B. subtilis*, there was a decline in effectiveness. Surprisingly, DADS worked significantly better than Penn-Strep in inhibiting the growth of *S. aureus*. When DADS and Penn-Strep were used in conjunction, they had a positive synergistic effect, and yielded the most effective results. Despite this data being very preliminary, the results are promising and warrant further study. This research is important because it addresses the ability of DADS, as well as the possibility of other natural agents, as being valuable adjuvants or even replacements for many commercially available antibiotics. [Acknowledgment: National Science Foundation HBCU-UP Grant #HRD-0927905, US Department of Education Title-III CCRAA, HBCU Grant WSSU Professional Development Grant.]

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Subcategory: Genetics

Complementation of a *Chlamydomonas reinhardtii* Low Oil Mutant Strain

Milton Williams, Fort Valley State University

Christoph Benning and Bensheng Liu, Michigan State University

Chlamydomonas reinhardtii is a species of microalgae used in laboratories as a model organism for genetic and biochemical studies. Due to its sequenced genome, it is an ideal candidate for genetic manipulation and can provide more information into the use of microalgae as a feed-stock for bio-diesel. Triacylglycerol (TAG) is a type of lipid which has a higher energy density compared to ethanol and carbohydrates. It is able to be converted into bio-diesel and can be introduced directly into engines with little treatment. Studies have shown that under certain stresses, such as nitrogen deprivation, *chlamydomonas* accumulates high levels of TAG. *Chlamydomonas* strain A10 is a mutant strain with roughly 7K base pairs missing from its genetic sequence due to the random insertion of plasmids. Three genes are impacted in A10, leading to a low oil phenotype and a growth rate estimated to be half that of the wild type strain. Using glass bead transformation, we performed the complementation of 2 mutated genes in A10 respectively as well as determined lipid phenotypes of the mutant compared to wild type algae. [Acknowledgment: This study was supported, in part, by grants from NSF HRD HBCU-UP awarded to Sarwan Dhir,

Ph.D., Director of the Center for Biotechnology, Fort Valley State University.]

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Subcategory: Plant Research

Somatic Embryogenesis and Plant Regeneration from Hypocotyl and Leaf Explants of Alfalfa

Shericka Williams, Fort Valley State University

Key'Erra Rozier and Sarwan Dhir, Center for Biotechnology, Department of Plant Science, Fort Valley State University

Medicago sativa L. is a flowering legume of the pea family Fabacea. For centuries, alfalfa has served as forage for cattle and as medicine to heal digestive tract disorders and arthritis. The development of an efficient plant regeneration system for Alfalfa is essential for the production of large scale planting material and precondition for genetic manipulation. We investigated direct and indirect formation of somatic embryogenesis in Alfalfa. Direct somatic embryogenesis, which is rather rare, was achieved in culture of 2-week-old hypocotyl explants on Murashige and Skoog (MS) medium supplemented with 1.0 mg/l 2, 4-dichlorophenoxyacetic acid (2, 4-D) and 0.5; 1.0; and 1.5 mg/l kinetin and or Thidiazuron (TDZ). Initial induction of embryogenic callus was achieved on MS supplemented with very low concentrations of 2, 4-D (0.05 mg/l and 0.1 mg/l). Indirect somatic embryogenesis from leaf sections was obtained on MS supplemented with 0.05 or 0.1 mg/l 2, 4-D. We examined various stages of somatic embryos (globular, heart, torpedo, cotyledonary). More embryos per explant were produced through the indirect pathway (23-25) than through the direct pathway (14-19). The number of embryos produced was high. There is a potential for recurrent, repeated or secondary somatic embryogenesis, possibly an unlimited source for mass propagation and ideal for synthetic seed production in this species. Plant regeneration was achieved on half-strength MS medium without any hormones. [Acknowledgment: This study was supported, in part, by a grant from NSF BDI REU-Site Program awarded to Sarwan Dhir, PhD, Director of the Center for Biotechnology, Fort Valley State University.]

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Subcategory: Cell and Molecular Biology

Lung Fibrosis: How the Matrix Affects Cell Function in Mice

Annechael Wood, University of Minnesota

Lindsay Godin and Angela Panoskaltis-Mortari, University of Minnesota

Recent evidence suggests that endoplasmic reticulum stress enhances the development of lung fibrosis in the lungs following Bleomycin injury (Lawson, 2011). Whole lung decellularization of fibrotic lungs would allow investigation of how the matrix affects cell function. We first verified that endoplasmic reticulum stress enhances lung fibrosis. We administered two drugs (Tunicamycin and Bleomycin) with PBS as a control vehicle intratracheally to mice, measured the changes in pulmonary function, processed and analyzed lung sample histology. For the Tunicamycin injections, control mice were given a 10% DMSO solution, while a 20 ug/mL in 10% DMSO dose was provided intratracheally. After 2 days of recovery, 0.05U/50uL Bleomycin was administered to the mice, with PBS given as a vehicle control. Pulmonary function tests were performed on all mice using a Flexi-vent ventilator, with resistances, compliances, and total lung volume measured by manufacturer software. The mice lungs were then harvested and frozen in OCT, sectioned, and stained using Hematoxylin and Eosin to visualize the lung structure, and Trichrome staining for collagen. Using GraphPad software InStat, statistical analyses compared the differences among the two groups with a standard t-test. P-values <0.05 were considered significant.

The dynamic resistance and Newtonian Resistance were greater in the drug group than the PBS mice. This shows that the drugs changed lung function. The compliance and static compliance in the Bleomycin/Tunicamycin mice was lower than in the control, which indicates that the lungs injected with the Bleomycin / Tunicamycin are stiffer. The total lung capacity of the drugged mice was much lower than the control mice due to the tissue damage observed in the fibrotic lungs of the Bleomycin/ Tunicamycin mice. High resistance and low total lung volume and changes in lung histology, verifies that the drugs caused fibrosis which lead to stiffening of the lungs. For future research, collagen content will be measured in all samples by a hydroxyproline assay; cell culture will be done by infusing standard lung cell lines (A549 and fibroblasts) into treated fibrotic /control decellularized lungs. RNA analysis and real time PCR will also be performed. [Acknowledgment: NIH RO1 HL108627 02]

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Subcategory: Cell and Molecular Biology

Human Lung Counter Receptors for Siglec-8 and Siglec-9

Woldegebriel Yeibyo, University of District of Columbia
Ronald L. Schnaar, Yadong Wei, Steve Marquis, Anabel Gonzalez Gil, and Huifeng Yu, Johns Hopkins University

Inflammation, attack by white blood cells, is carefully controlled by positive (activating) and negative (inhibiting) signals. Members of the siglec family of glycan binding proteins (sialic acid-binding immunoglobulin-like lectins) are expressed selectively on subsets of inflammatory cells, and may contain immune inhibitory intracellular domains that function to limit inflammation. As such, Siglecs are adhesion and signaling receptors on cells in the immune system. Siglec-8 is expressed on allergic inflammatory cells like eosinophils, mast cells and basophils involved in asthma, while Siglec-9 is expressed on monocytes, neutrophils and certain T cells involved in COPD (chronic obstructive pulmonary disease). Studies using human inflammatory cells and animal models support the hypothesis that specific glycan counter-receptors in the lung engage Siglec-8 and Siglec-9 to damp ongoing inflammatory responses. We are studying Siglec-8 and Siglec-9, expressed on eosinophils and neutrophils respectively, that inhibit ongoing inflammation in the lung. Eosinophils are major contributors to the pathology of asthma and neutrophils to the pathology of COPD. This project aim was to express Siglec-8-Fc and Siglec-9-Fc in HEK293T cells and test their binding in a glycolipid-based ELISA. Siglec-8-Fc bound very specifically and profoundly to 6 sulfo sialyl LacNAc and Siglec-9-Fc bound with broader selectivity to 6 sulfo sialyl LacNAc, GT1b and GD1a specifically as compared to the other plated glycans. Hence, to probe for siglec counter-receptors, soluble engineered Fc-chimeric forms of Siglec-8 and Siglec-9 will be highly effective. [Acknowledgment: Marc U Star Honors Program.]

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Chemistry & Chemical Sciences

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Expression of a G-Protein Coupled Receptor in a Cell-Free Expression System

Rodney Ballard, University of Arkansas at Pine Bluff

One hurdle in the determination of protein structures is the ability to produce large quantities of pure protein. This problem is compounded when the protein in question is an integral membrane protein. Integral membrane proteins require large volumes of culture (up to 24 liters) and yield lower quantities of properly folded protein. The purpose of our investigation is to determine if a cell-free expression system, one that will produce protein in a "test-tube", is a feasible substitute to large cell culture. We used the MembraneMax Expression system, from Invitrogen, to generate a carboxyl terminally histidine tagged bacteriorhodopsin, a member of the G-protein coupled receptor family. If bacteriorhodopsin is produced and folded properly,

the protein expression system will turn pink in the presence of trans-retinal. We isolated expressed bacteriorhodopsin using metal affinity chromatography and analyzed protein fractions using SDS-PAGE electrophoresis. We encountered difficulties in observing the protein on our initial protein gels. To observe the protein fractions collected, we concentrated each fraction prior to SDS-PAGE electrophoresis or loaded a larger sample onto the gel. We determined that concentrating the collected fractions or loading larger volumes of the protein fractions to larger protein gels provided sufficient protein for visualization. Further optimization of growth conditions and analysis will be essential before applying this technology to other integral membrane proteins. We thank Rachel Johnson, Mandy McBroom, and Chuma Okeke for helpful comments and technical support. *[Acknowledgment: Supported by 2010 UNTHSC Seed Grant and McNair Scholars Program]*

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Subcategory: Nanoscience

The Coordination of [Fe₈] Complexes with Estrogen

Allen Benson, Delaware State University

Estrogens constitute a group of compounds, named for their importance in the estrous cycle of humans and other animals. Estrone, estradiol, and estriol are three major naturally occurring estrogens in females. There are two different forms of estrogen receptor: α and β . The α -estrogen receptor is found in breast cells. In breast cancer cases, 70 percent of estrogen receptors are over expressed. Conjugates of estrogens with [Fe₈(μ -4-O4)(μ -4-R-pz)₁₂Cl₄] complexes [Fe₈], which have been shown to have good Magnetic Resonance Imaging (MRI) contrast agent properties, may be used as a MRI contrast agents, targeted to breast cancers (pz = pyrazolato anion, R = H and Cl). In our initial effort to prepare such conjugates, we carried out reactions of [Fe₈] with estrone, the simplest of the estrogen family. The UV-Vis and NMR spectra of the reaction products are consistent with coordination of 1-4 of estrone groups to [Fe₈] via their phenol functions. Single crystals of the conjugate are awaiting crystallographic characterization. Future work will include the optimization of reaction conditions to maximize yield and *in vitro* biological assays to test the binding ability of the conjugates to estrone receptors. Also, the same work will be extended to include estradiol and estriol. *[Acknowledgment: This research was supported by the MARC Program through the University of Puerto Rico.]*

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

The Use of UV/VIS Spectroscopy, Multivariate Curve Analysis, and Datan in the Study of Hg+2 Coordination to 4-Thiolated Uracil (4TU)

Kiersten D. Bethea, North Carolina Agricultural and Technical State University

Organism intoxication by organic and inorganic mercury has been shown to cause significant effects on its cells including the cell's level of RNA, and the RNA base composition. 4-thiolated uridine (S4U) is one of the naturally-occurring nucleoside modifications in the tRNAs of most organisms. Previous studies have shown that this compound coordinates strongly to heavy metals. Other studies have shown that Hg+2 tightly binds to tRNA when it contains S4U. Thus, an organism's exposure to Hg+2 could have significant toxic effect on its tRNA molecules. This study carefully examined the 4-thiolated uracil (4TU) coordination to Hg+2. The coordination was monitored in 1/1 (v/v) water/acetonitrile using UV/vis, electrospray ionization mass spectrometry. MATLAB was used to calculate the number of species in solutions, and to calculate the UV/vis spectrum of the 4TU/Hg+2 complex. Mass spectrometric study of 4TU/Hg+2 coordination indicates the simultaneous formation of 1/1 (M+2 + L- ML+ ; K1) and 2/1 (ML+ + L ML2+ ; K2) complexes. The simultaneous formation of the two complexes and the dominance of the 1/1 complex in the latter steps of the titration suggest that K1 > K2, which is consistent with the previously reported coordination of Cd+2 and Ni+2 to S4U. The +1 charge on the 1/1 and 2/1 complexes implies that in the 1/1 complex, 4TU is in the R-C-S- (L-) tautomeric form, and in the 2/1 complex, one 4TU is in the R-C=S (L) tautomeric form and the other is in the R-C-S- (L-) form (Figure 1). UV/vis data were acquired using constant-volume, constant [Hg+2] method. Using UV/Vis data and Datan program, logK1 and log K2 values were calculated to be 5.743 and 4.75, respectively. 2-thiolated uridine (S2U) is also one of the naturally-occurring nucleoside modifications found in the tRNAs of most organisms. S2U plays an important role in the binding of tRNAs to the ribosomal RNA which is an essential event in protein synthesis. Previous studies have shown that S2U also coordinates strongly to heavy metals. Consequently, an organism's exposure to Hg+2 could have significant toxic effect on its tRNA molecules and could result in a disruption of the protein synthesis. In future studies, the coordination of 2-thiolated uracil (2TU) to Hg+2 will be carefully examined and results will be compared with those of 4TU data. *[Acknowledgment: This study was supported, in part, by a grant from NSF awarded to HBCU-UP/Talent-21,2012.]*

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*Subcategory: Cell and Molecular Biology***Gut Inflammation: Interactions Between Serotonin and Estrogen****Widler Casy, Lindenwood University**

Various observations *in vivo* using murine models illustrate that in serotonin transporter knock out (SERT KO), female rats tend to develop sub-clinical inflammation, which can result in visceral hypersensitivity. The aim of this research is to investigate the reasons why sensory nerves tend to respond differently to the excess of serotonin and estrogen between wild type (WT) and SERT KO rats. Enterochromaffin cells (EC cells) are critically important in vertebrates as they produce about 90% of the serotonin (5-Hydroxytryptamine or 5-HT) within the human body. 5-HT is an important molecule due to the fact that it helps regulate a multitude of functions in the body. Accumulation of 5-HT around the mucosa due to the removal or mutation of SERT can result in serious gastrointestinal issues. As the level of serotonin increases, the potential for inflammation in visceral organs tends to also increase. Measuring the expression level of Tumor necrosis factor (Tnf) alpha is going to be important as an indicator of inflammation. Previous literature indicates that there were certain G-protein-coupled receptors that are located in the membrane of the EC cells which once activated, can trigger the secretion of 5-HT to take place. A fluorescent microscope was used in order to detect the expression of EC cells after being stained. Slices of intestinal tissues from SERT KO rats were obtained and labeled as a way of identifying whether inflammations were present. Based on the results which were obtained, it was concluded that there is not a statistical significant difference between the numbers of 5-HT containing cells between the groups which were being tested. Also, the groups with the SERT KO seemed to express higher levels of inflammation than the WT's groups based on the Tnf alpha results. The results of this experiment will provide further insight into understanding the interaction between sex hormones and serotonin to hopefully enable future development of treatments for gastrointestinal track disorders. [Acknowledgment: Michigan State University Department of Pharmacology and Toxicology 2012 Summer Research Opportunity Program.]

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*Subcategory: Chemistry (not Biochemistry)***Design, Synthesis and Study of Ferrocene-Based Supramolecular Helicates****Jessica Cole, Claflin University**

The study of metalla supramolecular chemistry has increased within the past few decades because of their interesting chemical properties, such as optical, magnetic, catalytic, electrochemical, and host-guest interactions. Possible uses of metalla supramolecular assemblies are gas storage, gas purification, gas separation, ion exchange, catalysis, light harvesting, drug delivery, magnetism, conductivity, sensors, and energy conversion. Building metalla supramolecules, such as helicates, with identical metal centers is fairly easy, but when synthesizing supramolecular assemblies with mixed valence metals or metal centers, the task becomes challenging. We have developed a new ligand, in which two ferrocene moieties are connected to a pyridine ring through two β -ketoenol linkers. In this presentation, we will describe the synthesis of a new ditopic organometallic ligand, 3,5-bis(1-ferrocenyl-prop-3-enol-1-one) (pyridine) (H2L3,5), and its reactions with gallium(III) and indium(III) to form new polynuclear/heterobimetallic triple stranded helicates M2(L3,5)2 [M = Ga or In]. The ligands have demonstrated a potential in constructing triple helicates with or without channels depending on the synthetic protocol or crystallization condition. This presentation highlights the different isolated polymorphs whose composition varies with the amount of guest molecules. We are exploring the possibility of isolating single chiral isomers of the new helicates and studying their cytotoxicity. References: 1. Cui, F.; Li, S.; Jia, C.; Mathieson, J. S.; Cronin, L.; Yang, X.-J.; Wu, B. *Inorg.Chem.* 2012, 51, 179. 2. Riis-Johannessen, T.; Bernardinelli, G.; Filinchuk, Y.; Clifford, S.; Dalla Favera, N.; Piguat, C. *Inorg. Chem.* 2009, 48, 5512. 3. Gwengo, C.; Iyer, R.; Raja, M. *Crystal Growth & Design.* 2012, 12, 49. 4. Raja, M.; Iyer, R. G.; Gwengo, C.; Reger, D. L.; Pellechia, P.; Smith, M.; Pascui, A.E. *Organometallics*. Submitted for publication. [Acknowledgment: Funding from Department of Defense ARO Grant number #59042-CH-REP and NSF-HBCU-UP.]

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*Subcategory: Plant Research***Bio-Activities of Medicinal Plants in the Dominican Republic****Meryl Collins, Bowie State University**

In the Dominican Republic, medicinal plants are used for treatment of many diseases and illnesses. Plants with known traditional medicinal uses for skin infection were used in these studies. Antimicrobial activity of isopropanol and methanol extracts from the plants *Tabebuia obovata*, *Aloe vera* L., *Catalpa longissima*, *Guineensis elaeis* (African Palm), and the *Sessuvium Portulacastrum* (Sea Purslane) were tested using *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Listeria monocytogenes*, and *Saccharomyces cerevisiae*. The Brine Shrimp bioassays for toxicity of the same plants were done while the sea urchin embryo assay was used to study the ability

of plant extracts to inhibit cell division. The Cucumber seed germination assay tested allelopathic effects of the plant extracts. Methanol extract of *C. longissima* and Isopropanol extract of *T. obovata* showed strong antimicrobial activity with skin infection causing bacteria *Staphylococcus aureus*. While the brine shrimp assay with Isopropanol extracts showed very low toxicity in most of the extracts, the toxicity increased with increase of concentration in *T. obovata*, *C. longissima* and *S. Portulacastrum*. In the brine shrimp bioactive assay with methano, there was a 7% higher mortality rate than with isopropanol. All extracts had no allelopathic activities in the seed germination assay. *Sessuvium Portulacastrum* methanol extract showed the least growth. In the sea urchin assay, each extract showed an increase in cell division with increase in concentration. Aloe Vera L. showed the highest rate in cell division with a 59% increase. *T. obovata* and the *C. longissima* showed high toxicity in brine shrimp which could lead to anti-cancerous abilities. [Acknowledgment: National Institute of Health]

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Subcategory: Plant Research

Identification and Characterization of Plant Endophytes Isolated from Black Cohosh and Ramp

Dominique Covington, Virginia State University

Endophytes are organisms, often fungi and bacteria, which reside in between the tissues of plants. These relationships vary from being symbiotic, where both the plant and endophytes depend on one another for survival, to borderline pathogenic. Because much is not known about the endophytic species that exists in plants other than a few grass species, this current study is aimed at identifying and characterizing species of endophytes isolated from two species of mountain plants.

Based on the results of our experiments thus far, it has been discovered that in the first species of mountain plants (Black Cohosh), SH-2 flower, SH-2 leaf, ST-1 stem, HO-1 root 4-1, and ST-1 leaf may contain the same species of endophytes, while CH-2 root 3 and HO-1 root 4-2 each contained unique species. For the second species of mountain plants (Ramp), R2-3 root and R2-1 root, R1-1 stem and R2-2 root, R2 flower and R3 flower contained the same species of endophytes, while R1-FL flower, R2-1 root, and R2-3 root each contained a unique species of endophytes. The next stage of our studies would be to send each unique endophytic species in for sequencing and one representative sample from each group of endophytic species that were found to be the same.

Once this is done, we will be able to accurately identify and characterize the species of endophytes that can be found in each type of mountain plant. [Acknowledgment: Funding for this research was provided by the National Science Foundation.]

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Subcategory: Cell and Molecular Biology

Cell Culture of HEPG2 on Immobilized Growth Factors to Simulate *in vivo* Environment

William Dade, North Carolina A&T State University

Debasish Kuila, Kandace V. Womac, and Karshak Kosaraju, North Carolina A&T State University

Researchers have shown that delays in drug toxicity screening and the cost of the screening itself cost drug developers over a 100M USD. The quest for better ways of accomplishing drug toxicity screening and food pathogen detection has led scientists to look at alternatives like the use of mammalian hepatocytes. Using self assembled monolayers (SAMs) on indium tin oxide (ITO) as cell culture platforms is a promising area of *in vitro* cell culture studies that is gaining popularity. This is mainly due to the transparent and conductive nature of ITO. Also, the ability to assemble different groups of ligands in a specific pattern on ITO is a major advantage of this technique. In this research 3-Aminopropyltriethoxysilane (3-APTES) was used as a linker to deposit gastrin releasing peptides (GRP) on ITO. The resulting SAMs was used to grow HepG2 cells in an attempt to investigate the proliferative properties of APTES-GRP on ITO. Results from cells seeded for 48, 72 and 96 hours indicated that, HepG2 cells grown on GRP proliferated better than in the cell culture dish (polyethyleneterephthalate). This knowledge can be used in the future to grow adequate cells for drug toxicity screening and also for the development of biosensors for food pathogen detection. [Acknowledgment: HBCU - UP Talent 21 program at North Carolina A&T State University through the National Science foundation.]

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Subcategory: Chemistry (not Biochemistry)

Analysis of Conformational Influences Within (2R,3R)-Butanediol

Zoila M. Estrada, California State University, Stanislaus
Michael D. Drake, California State University, Stanislaus

(2,3)-Butanediol is a simple polyol with two different isomers: the meso isomer and the racemic isomer. We examined (2R,

3R)-butanediol in different solvents and investigated its conformational preferences to determine the conformational influences present in (2R,3R)-butanediol. (2R,3R)-butanediol serves as a model molecule to understand the conformational influences in more complex compounds such as proteins. Some conformational influences we investigated are steric bulk, intramolecular hydrogen bonding, Coulombic attraction/repulsion, solvent effects, the polarity of the conformer versus polarity of the solvent, and hyperconjugation. This project primarily aimed to understand possible occurrence and effect of hyperconjugation between vicinal hydroxyl (OH) groups, which are present in (2R, 3R)-butanediol. Hyperconjugation is an interaction between sigma bond electrons and a vicinal, coplanar anti-bonding sigma orbital, which is thought to increase the stability of the system. The methodology employed was ¹H NMR and ¹³C NMR on (2R, 3R)-butanediol in different solvents. Then, we simulated the experimental spectrum on gNMR to extract the coupling constants. We used the Altona equation in order to correlate the coupling constants with dihedral angles, thereby determining the conformation of the compound. [Acknowledgment: NSF-LSAMP Grant #HRD-0802628]

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Subcategory: Chemistry (not Biochemistry)

Synthesis, Structural Characterization and Toxicity of Triorganotin Chloride Adducts With Picoline N-oxides

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Organotins, compounds that contain at least one Sn-C bond, express various biocidal activities. The toxicity of organotins has been found to be a function of the number of organic groups attached to the tin atom, as well as to the nature of the organic group. It is well documented that triorganotin compounds have the highest biocidal activities. The hypothesis is to confirm that the adducts are TBP with co-planar phenyl groups, and they are effective against bacteria. The adducts were synthesized by reacting triphenyltin chloride with the ligands 2, 3, and 4-picoline N-oxide, in a 1:1 molar ratio. The structures of the products were deduced using IR and NMR spectroscopies. In addition, X-ray crystal studies were used to confirm the structures in the solid state. Stock solutions of the adducts were prepared in ethanol while the bacteria was grown in nutrient broth. 20 μL of *E. coli* stock solution was added to the desired concentration of the triorganotin adduct, placed in a heated water bath at 37°C, and shaken for 24 hours. The absorbance of each concentration was measured using a Unico® 1200

spectrophotometer at 600 nm. Each concentration was done in triplicate with positive and negative controls. The LC50 values were then calculated using a linear regression technique. IR data show the formation of a Sn-O bond indicating adduct formation. Based on similar compounds, the structure of the adduct is most likely trigonal bipyramid with co-planar phenyl groups. The structure was confirmed by X-ray crystal studies. Also, ¹H and ¹³C NMR data are in agreement with the proposed structure. In addition, the ¹¹⁹Sn data indicated that the adduct dissociated in solution. Preliminary bacterial screening indicates that the triphenyltin chloride adducts are effective against the gram negative bacteria *E. coli*. Future studies will involve screening the compounds on a gram positive bacteria, such as *Bacillus subtilis*. [Acknowledgment: Financial support from the Science, Technology, Engineering, and Math (NSF/HBCU-UP - HRD-0928444) Program at the University of the District of Columbia.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Development of A Behavioral Model to Assess Chemosensation in Daphnia Magna

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Chemosensation is the ability of an organism to detect chemical cues in their environment. The water flea *Daphnia* change behavior and morphology in response to environment cues. With the sequencing of the *Daphnia* genome, this makes them a model organism for understanding gene-environment interactions. While genome mining has identified putative gustatory receptors in *Daphnia*, it remains to be determined whether these genes produce receptors with similar functions and behavioral outcomes. The aim of this study was to develop a behavioral model for testing chemosensation in *Daphnia*. Five models of different area and volumes, three with 3 chambers and two with 2 chambers, were tested to determine whether *Daphnia* showed a preference or aversion to the different chambers. From these studies, *Daphnia* showed equal number of entries and equal amounts of time in each chamber of the smaller 3 well T- and Y-shaped models. The *Daphnia* also showed similar entries and time spent in the 2 well linear models. The T-shaped 3 well model was used to test chemosensation to peppermint oil in *Daphnia*. Interestingly, the *Daphnia* showed a size-dependent change in avoidance of the well that contained peppermint oil. The medium and large *Daphnia* spent significantly less time in the chamber containing peppermint oil compared to the 2 control chambers. The small *Daphnia* spent similar time in the well with and without peppermint oil. These findings suggest age dependent

expression of chemoreceptors in *Daphnia*. Furthermore, these findings develop a novel model for testing the behavioral correlates of chemosensation in *Daphnia*. [Acknowledgment: HBCU-UP]

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Subcategory: Cancer Research

The Development of a New Method that Measures the Bio-distribution of Lanthanide Ions in Mouse Tissue Using NMR Spectroscopy

Sandra Gonzalez, University of Arizona

The attractiveness of magnetic resonance imaging (MRI) as an imaging modality results from visualizing soft tissues at high image resolution, good coverage of the entire body and low side effects due to the lack of ionizing radiation. However, the use of MRI involves overcoming poor sensitivity and poor contrast. The development of contrast agents improves the MRI signal in some organs, and the signal difference between signal-enhanced and unenhanced organs improves image contrast. Nonetheless, these lanthanide-based contrast agents can stay in the body for long periods of time, especially in patients with poor kidney function, sometimes leading to Nephrogenic Systemic Fibrosis. Preclinical studies of new MRI contrast agents require tissue samples to be analyzed to validate MRI results, typically using inductively coupled plasma mass spectrometry (ICP-MS) to determine the bio-distribution of the agent in different organs.

However, this method of analysis requires several days and the cost per sample is usually quite high (~\$50/sample). We propose nuclear magnetic resonance spectroscopy (NMR) as an alternative analytical tool to detect contrast agents in tissue samples. Lanthanide ions create a unique magnetic susceptibility that causes a shift in the NMR frequencies that are emitted by the sample. This shift, or "delta value," is proportionately related to the concentration of lanthanide ions in a chemical sample. However, the best method for preparing a tissue sample for this type of NMR analyses is not known. In our study, we compared several methods for preparation of mouse kidney and liver tissues samples for NMR analyses.

These methods compared the recovery of lanthanide ions from kidney and liver tissues with water and nitric acid, using combinations of heating, sonication, and filtration. We found that our most precise method used nitric acid and sonication, which resulted in $93 \pm 7\%$ recovery of thulium lanthanide ions. This level of recovery is sufficient for evaluating the bio-

distribution of MRI contrast agents, and provides a rapid and low-cost alternative to ICP-MS analyses. [Acknowledgment: This study was supported, in part, by grants from Dr. Mark D. Pagel and the MARC Program]

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Subcategory: Cancer Research

Synthesis, Characterization and Preliminary *In Vitro* Studies of Melanoma Cells with Mixed-metal Binuclear Ruthenium(II)-Vanadium(IV) Complexes

Michelle Gordon, University of the Virgin Islands / University of Southern Mississippi

Photodynamic therapy (PDT) is a new non-invasive procedure to inhibit the growth of many different kinds of cancer. PDT involves photosensitizers, which is a drug that once illuminated with light, causes chemical reactions to kill the cancerous cells in the specific area that is being illuminated. Due to the drawback that PDT can only penetrate through one centimeter of cells, it is most popular in treating skin cancer. Some FDA approved drugs used in PDT, such as porphyrins, are extremely toxic to non-cancerous cell lines.

The National Cancer Institute reported that 76,250 new cases and 9,180 deaths have thus far been recorded in the United States for 2012. {5, 1,4-Bis(1,10-phenanthroline-5-ylsulfanyl)butane-2,3-diol, (phen2DTT)}, {8, [VO(sal-L-trypt)H₂O]}, and {7, 1,6-Bis(1,10-phenanthroline-5-ylsulfanyl)hexane, (phen2S2C6)} were used as precursors to produce the new binuclear metal complexes {3, [Ru(pbt)₂(tpphz)VO(sal-L-trypt)](PF₆)₂•4H₂O}, {4, [Ru(pbt)₂(phen2DTT)VO(sal-L-trypt)](PF₆)₂•3H₂O} and {6, [Ru(bpy)₂(phen2S2C6)] } by reaction with respective mononuclear transition metal compounds. The chemical and structural properties of these compounds were characterized by elemental analysis, ESI-MS, FTIR, UV/Vis, 1H NMR spectroscopy. The photosensitizing properties of complexes 3 and 4 along with the control cobalt complex Na₄[Co(tspc)OH₂]₂ were examined with two cell lines--cancerous C32TG melanoma and normal, adult, non-cancerous dermal fibroblast in dark conditions. Compounds 3 and 4 exhibited inhibition of cell growth of both cell line cultures, which indicates that these compounds are promising new photosensitizers that will be utilized in PDT in the near future. [Acknowledgment: MS INBRE]

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*Subcategory: Chemistry (not Biochemistry)***Tris(triphenylphosphine)Rhodium(I) Chloride-Catalyzed Dehydrocoupling of Diphenylmethylsilane with Primary Aliphatic and Aromatic Amines****Renisha V. Henderson, University of Virgin Islands / Southern Illinois University**

Colleen Scott and Narsimha Sattenapally, Southern Illinois University

Catalytic investigations of a compatible tertiary diphenylmethylsilane with primary aliphatic and aromatic amines were employed to create silylamines. Tris (triphenylphosphine)Rhodium (I) chloride catalyst (Wilkinson's Catalyst), Palladium on Carbon were proven by ¹H-NMR to successfully dehydrocouple diphenylmethylsilane with sec-butylamine, while Manganese Pentacarbonyl Bromide after 24 hours of reacting showed no sign of product, according to ¹H-NMR. It was proven that Tris(triphenylphosphine)Rhodium (I) chloride dehydrocouples at a faster rate than Palladium on carbon. Therefore, Wilkinson's Catalyst effectively cross-dehydrocouples tertiary diphenylmethylsilane with aliphatic: n-BuNH₂, Sec-BuNH₂, C₆H₆NH₂, PhNH₂, and PhCH₂NH₂ to yield various silylamine compounds. The stability of the Si-N bonds were tested when contacted with deuterium oxide and revealed a highly favored Si-O bond. Primary aliphatic amines due to the strong nucleophilicity, rate of reaction was found to be greater than its anilines analogues. Since only tertiary diphenylmethylsilane was used, additional experiments are currently in practice to dehydrocouple secondary silanes with primary amines in the presence of Wilkinson's Catalyst to study its stereoselectivity. [Acknowledgment: The National Science Foundation under grant DMR-0552800; the Materials and Technology Center, the Department of Chemistry and Biochemistry, the Office of the Vice Chancellor for Research, the College of Science, and the College of Engineering at SIUC.]

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*Subcategory: Microbiology/Immunology/Virology***The Effects of Osteopathic Lymphatic Pump Techniques on Blood Leukocyte Numbers in Rats with Lung Disease****JaNise Jackson, Texas Southern University / University North Texas Health Science Center**

Lyndsey Harden, Artur Schander, Caitlin Creasy, Courtney Mckee, and Lisa Hodge PhD, University North Texas Health Science Center

The ability to fight off foreign infection in the body is determined by the immune system. Lymphatic Pump

Techniques (LPT) were created by doctors of osteopathic medicine to enhance lymph flow in distinct areas of the body. The treatments are meant to assist in the removal of cellular wastes, toxins, and bacteria from interstitial fluid. Previously, members of the lab demonstrated that LPT reduced lung bacteria in rats with pneumoniae and the reduced numbers of solid lung tumors in rats with cancer. The purpose of this project was to determine if this LPT-mediated clearance of disease was related to increased immunity. In project 1, rats were infected intranasally with Streptococcus Pneumoniae, a bacterium that infects the upper respiratory tract. Twenty-four hours following infection, rats received no treatment (control), four minutes of light touch under anesthesia (sham), or four minutes of LPT under anesthesia, for three consecutive days. On day four post-infection, blood was measured for immune cells. In project 2 rats were intravenously injected with MADB106 tumor cells, a cancer that forms tumors in the lungs. Rats received control, sham, and LPT as above for seven days. On day eight post tumor injection, blood was measured for immune cells using a Hemavet cell analyzer. There were no differences in immune cell number in the blood between control, sham, or LPT in either project. Our results show that LPT is protective in the lungs of rats with either pneumoniae or lung cancers, but this effect is not associated with blood leukocyte numbers. [Acknowledgment: This research was supported by National Institutes of Health Grant R01 AT004361(LMH) and the American Osteopathic Association Grants AOA 10-11-609 and AOA 06-11-547 (LMH). NSF-REU program.]

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*Subcategory: Chemistry (not Biochemistry)***nBuLi Me₂S=CH₂ Mediated Novel C1 Homologation of Aryl Epoxides****Amber James, University of Mississippi**

Recently, our research group has discovered a novel carbene-mediated chemical transformation of styrene oxide into 2-phenyl-2-propen-1-ol. That is, the use of a 1:1 mixture of n-butyllithium (n-BuLi) and lithioacetonitrile (LiCH₂CN) in tetrahydrofuran unexpectedly converted an aryl epoxide into a one-carbon homologated allyl alcohol (up to 80% yield) in an unusual regioselective manner (manuscript in preparation). This homologation is unique and potentially useful for organic synthesis; however, the proposed reaction mechanism indicates that the reaction also produces a toxic cyanide ion at the elimination step. This undesired side-product greatly hinders further practical investigations. In order to avoid the formation of the cyanide ion, our group sought an alternative "cyanide-free" reagent. Dimethylsulfonium methylide, Me₂S=CH₂, is a well-known homologating reagent for various reactants, and the expected by-product is only dimethyl sulfide. Since the reagent is usually prepared under basic conditions, we assumed that,

like LiCH₂CN, the reagent should be compatible with n-BuLi and applicable to our established C1-homologation system. As anticipated, a series of styrene oxides tested in the presence of a 1:1 mixture of n-BuLi and Me₂S=CH₂ successfully underwent the homologation reaction (~50% yields as of today). Further optimization studies of this greener approach (e.g., reaction temperature and time, choice of solvent, additives, etc.) are currently underway. *[Acknowledgment: The study was supported, in part, by a grant from NSF awarded to Dr. Takashi Tomioka, University of Mississippi.]*

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Subcategory: Chemistry (not Biochemistry)

Observation of Structural Changes of Methamphetamine, Phenobarbital, Cocaine, and Marijuana under UV Irradiations and Elevated Temperatures

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Stephanie Barrow, LaFaith Phillips, Lindsay Sampson, and Harvey J.M. Hou, Alabama State University

Illicit drugs and their impurities, “forensic drug impurity signature,” contain vital information for tracing their origin of manufacture and pathway of distribution, which can be used to provide links in crime scene investigations and law enforcement. The effect of diverse environmental conditions, including light, temperature, pH, and bacteria, on the controlled substances is one essential way for the production and generation of their impurities. In this work, we investigated the responses of methamphetamine, phenobarbital, cocaine, marijuana, and diazepam to the UV irradiations and elevated temperatures by UV-vis spectrometry. Methamphetamine, phenobarbital, cocaine, marijuana, and diazepam have a high potential for abuse and are among the top list in illicit drug cases in the United States. We observed that methamphetamine, cocaine, and phenobarbital caused the increase of an absorption peak at 960 nm in aqueous solutions (including acidic, neutral, and basic conditions) with different kinetics upon UV treatment. The lifetimes of the 960-nm peak appearance were between 23.1 to 42.6 min depending on the drugs. Similarly, the elevated temperatures induced the increase of the 960-nm peak in the case of marijuana.

These observations may be explained as two possibilities: (a) Chemical structural changes of these drugs occur under UV irradiations and elevated temperatures, and (b) A novel unknown compound from the drugs is produced. Alternatively, the appearance of the 960-nm peak may be due to the interaction between drug and water molecules. This idea is supported by the absence of the 960-nm peak when the drugs were examined in organic solvents (ethanol and chloroform). It

has been reported that pure water has an absorption peak at 970 nm.

There are three types of water molecules in nature: strongly bounded water, weakly bounded water, and free water. The interaction between water and other molecules including proteins and small organic compounds in nature affects the 970-nm absorption peak in different ways. The observation in this work may be associated with the formation of novel chemical structure between drugs and water. Gas chromatograph with mass spectrometry analysis under the identical or similar experimental conditions may provide specific information to distinguish among the three scenarios. *[Acknowledgment: This study was supported by the Alabama State University and National Science Foundation HBCU-UP program]*

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Subcategory: Chemistry (not Biochemistry)

Efficient Calculations of Thermodynamic Properties of Hydrogen Bonding Complexes

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Angela Tartt, Central State University

Daqing Gao, Central State University

Accurate electronic binding energies of intermolecular interactions can be obtained based on CCSD(T)/CBS or MP2.X methods. However, little effort has been devoted to accurately evaluate thermodynamic parameters such as interaction enthalpy and Gibbs free energy which govern the stabilities of real biological and chemical systems at certain temperatures. This is partly due to a lack of experimental data of molecular interaction enthalpies and Gibbs free energies. Recently, Leszczynski and co-workers introduced a protocol for calculation of intermolecular interaction enthalpy and Gibbs free energy within 1 kcal/mol of experimental accuracy. The two-step procedure was developed with consideration of computational demand and chemical accuracy. The method involves counterpoise corrected B3LYP/cc-pVTZ geometry optimization and frequency calculation, followed by single point MP2 calculation and extrapolation to complete basis limit. We applied this economical procedure to the calculation of the intermolecular interaction enthalpies and free energies between protonated 1,4-butanediol and 1,3-butanediol with one, two, and three water molecules. This work includes an extensive conformational search of the two flexible molecular systems by a Monte Carlo method based on MMFF force field and HF/6-31G(d) calculations. We will compare both Boltzmann weighted and non-weighted (based on the lowest energy conformer) binding enthalpies and free energies at 298 K and 1 atm to experimental data from mass spectroscopy. *[Acknowledgment: This research is supported by a HBCU-UP grant from NSF awarded to Dr.*

Daqing Gao, Central State University, Wilberforce, Ohio. This research is also supported by Ohio Supercomputer Center]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Characterization of Monocarboxylic Acid transporter and Organic Anion Transporter in the Blood Brain Barrier

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The delivery of therapeutic drugs to the brain continues to be a challenge for the pharmaceutical industry. The blood-brain barrier (BBB) regulates the influx and efflux of a wide variety of substances, and remains the major obstacle in the delivery of drugs to the central nervous system (CNS). Various strategies have been devised to circumvent the BBB in order to increase drug delivery to CNS. The purpose of this work was to assess the potential mechanistic pathways present at the BBB in bovine microvessel endothelial cells (BBMECs). The following transporters were characterized in the BBMEC cell culture system: a) the monocarboxylic acid transporter, b) the organic anion transporter). Western Blot analysis was employed to demonstrate the presence of each transporter. These transporters were characterized by assessing the uptake and permeability properties of known substrates. To assess the functionality of each transporter uptake, experiments were performed in the presence/absence of known metabolic inhibitors of the transporters. Competitive uptake and permeability experiments were also performed for each. The experiments demonstrate that all of the transporters are present and actively functional in the BBMEC system. These transporters offer alternative routes for delivering therapeutics to the brain that may exhibit poor brain/CNS bioavailability. [Acknowledgment: Grant support: NIH INBRE Grant P20 RR-16460, INBRE Program]

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Subcategory: Chemistry (not Biochemistry)

pH Effects on Structure and Morphology for Cobalt (II) 2,9-Dimethyl-1,10-Phenanthroline Sol-Gel Material Hybrids

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Colleen Taylor and Massimo Bertino, Department of Chemistry and Physics, Virginia State University and Department of Physics, Virginia Commonwealth University

A previous study (Taylor and Watton) was replicated with some modifications to determine the factors that initiate the formation of particulate morphology as a function of pH from several $[\text{Co}(\text{DMP})]^{2+}$ doped sol-gel combinations (DMP = 1,10-2,9- dimethylphenanthroline). Elevated amounts of hydroxide concentrations achieve higher loadings of metal complexes that bind to silica surfaces because deprotonated surface hydroxyls make better Lewis bases than their protonated counterparts. Higher concentrations of base can simultaneously cause a loss of the desirable transparency of the material due to particulate formation. This morphology change is thought to result from larger particulate size formation driven by an increase in condensation rate relative to hydrolysis rate for the sol-gel process itself. It is unknown if this observation is also due to the presence of a metal complex that binds to the surface. Therefore, we are testing the hypothesis that this effect is due to the binding of surface complexes in addition to the sol-gel material/ hydroxide rate effect. Using $[(\text{Fe}(\text{phen})_3)]^{2+}$ (phen = 1,10-phenanthroline) which should not act as a Lewis acid and bind to the surface, we are examining the results under similar experimental conditions. Preliminary results indicate that the effect is a combination of both factors. The pH effect of the complex itself may counteract that of the base. More experiments are needed to elucidate the factors that control morphology. Raman spectroscopy was performed to see if any material structure changes could be detected. $[\text{Co}(\text{DMP})]^{2+}$ /sol-gel samples all showed a Si-O peak around $1050\text{-}1100\text{cm}^{-1}$, but it was evident to see another set of peaks around $1450\text{-}1500\text{cm}^{-1}$ which is believed to be the octahedral and/or tetrahedral peaks of the $[\text{Co}(\text{DMP})]^{2+}$ complex. This is thought to be the first example of Raman spectroscopy to demonstrate a symmetry conversion of a metal complex in a silica material. [Acknowledgment: Virginia State University, Virginia Commonwealth University]

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Subcategory: Chemistry (not Biochemistry)

Assessment of Density Functional Theory Models in Evaluating Chemical Reaction Energies and Barrier Heights

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Daqing Gao, Central State University

Accurate values of chemical reaction energies and barrier heights are essential in understanding thermodynamical properties of chemical processes. Recent study of several approaches for obtaining accurate reaction energies and barrier heights from post Hartree-Fock electronic structure calculations by Truhlar and co-workers suggests that both the gold standard MP2/CBS and CCSD(T)/CBS methods should be used with careful selection of appropriate basis sets. However, it is not feasible to

perform CCSD(T) level calculations in many real chemical processes for practical chemists. A new composite protocol, M2.X, which was introduced by Riley and Hobza and co-workers, can produce CCSD(T) level energy differences with dramatic decrease use of computational resources. Here we present our M2.X calculations on the reaction barriers and energies of several decarboxylation reactions, including acetone catalyzed decarboxylation of aminomalonate. The goal of this research work is to assess a number of density function theory models with different moderate basis sets such as 6-311+G(2df,p) in comparison with the accurate wave function-based calculations. Some of the DFT methods include B3LYP, M06, M06-L, M06-2X, HTCH, B3P86, B3PW91, B971, wB97X. Useful information will be obtained about the applicability and the development of semiempirical DFT models over the past 15 years.

[Acknowledgment: This research is supported by a HBCU-UP grant from NSF awarded to Dr. Daqing Gao, Central State University, Wilberforce, Ohio. This research is also supported by Ohio Supercomputer Center.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

An *In Vitro* Assessment on the Effect of Diruthenium-Allopurinol as a Potential Anti-Cancer Agent in Michigan Cancer Foundation -7 (MCF-7) Breast Cancer Cells

George Lewis, Texas Southern University

Jamie Renfro and Bobby Wilson, Texas Southern University

Past novel anti-cancer drugs containing the platinum (Pt) metal as the central atom have been clinically recognized as being unsuccessful in cancer treatment. These platinum-based drugs are administered during chemotherapy treatment to cancer patients. The “down fall” of these chemotherapy drugs is that they destroy the surrounding normal cells (tissue) during the treatment process. This is attributed to platinum-based drugs being insoluble. Ruthenium complexes offer the potential of reduced toxicity, a novel mechanism of action, non-cross resistance and a different spectrum of activity compared to platinum containing compounds. Ruthenium organometallic complexes form monofunctional adducts with guanine in DNA *in vitro* and have a cytotoxic anti-cancer activity spectrum in preclinical models that suggests a lack of cross-resistance with the platinum-based pharmaceutical drug, Cisplatin. The synthesis of Diruthenium with Allopurinol (ALP) and its activity toward the Mammalian cancer cell line (MCF-7) and Basal Epithelial cell line was presented in past cancer research findings.

Research efforts were successful in the synthesis and characterization of the Diruthenium-Allopurinol (Ruthanol)

complex using the UV-Visible in which spectral graphs yielded identifying peaks at 291, 301, and 642 nm(s). Identifying peaks from the FT-IR were at 1698 nm and 1699 nm. The mass of the compound was identified and determined as 665 (m/z) using the Bruker Microflex Daltonics TOF-MALDI instrument. The cytotoxicity level in the MCF-7 cell line at 104 was 73% at 75 mM; whereas, the percent viability in the Basal Epithelial Cell line was 80%. MCF-7 cells are non-invasive and the tumors remain where they originate; the MDA-MB 231 cells are selected for the current study. The MDA-MB 231 cells are highly invasive, and they are capable of metastasizing throughout the body. Preliminary cell culturing of the MDA-MB 231 cell line, administration of the above mentioned drug complex and Neutral Red Assay analysis in the current screening study provides experimental evidence to classify “Ruthanol” as an anti-metastatic drug. [Acknowledgment: This research was funded, in part, by a grant from NSF awarded to Dr. Bobby Wilson, Director for the Department of Chemistry, Louis Stokes Alliance for Minority Participants, Houston, TX, 2012.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

T2 Viral DNA Stability

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For many years, people have been curious about the G-quadruplex guanine-rich DNA structure connection with cancerous cells. It is believed to either signal gene silencing or the production of cancerous cells in the regulation of gene expression. While G-quadruplex is being highly researched, very little research is being conducted on i-motif. In a regular strand of DNA, the base pairs, guanine and cytosine, naturally bind to each other. If G-quadruplex is present during the growth of cancerous cells, then i-motifs are expected to be present when DNA splits. If one strand of DNA forms a g-quadruplex, then the other strand can form an i-motif (Fig.1). The idea behind studying i-motifs more closely causes researchers to believe there may be a link between i-motifs and cancerous cells that could lead to more beneficial medicine and treatments for cancer patients. 5-hydroxymethylcytosine (5hmC) is a DNA base found in the regulation of gene expression in mammalian embryonic stem cells. Another organism known for many years to have 5hmC is the T2 baculo-virus, which infects bacteria only. The T2 DNA is cytosine-rich, which forms an i-motif structure under slightly acidic conditions. We examined an i-motif in DNA taken from the T2 genome. The i-motif structure formation was monitored by various tests such as UV spectroscopy, Circular Dichroism spectroscopy and temperature melt to determine

when the structure was stable or melted. We then compared the bacteriophage structure to eukaryotic DNA from the human c-myc promoter to see if they share similar folded structures. We found that the human c-myc promoter was three times more stable than the T2 i-motif. In future studies, more testing of the i-motif structure will be run to gain better knowledge of it. *[Acknowledgment: This research was supported by the Ronald E. McNair Research Program, University of Mississippi, Oxford, MS, 2012.]*

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Subcategory: Chemistry (not Biochemistry)

Amelioration of Rhabdomyolysis-induced Kidney Failure in Mice Using Metal Complexes

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Rhabdomyolysis is a common clinical and biochemical syndrome that may result from a large variety of diseases, trauma, or toxic insults that damage the integrity of the sarcolemma of skeletal muscle, leading to the release of potentially toxic muscle cell components into the circulation. This may result in potential life-threatening complications of acute renal failure that needs urgent preventive measures to eliminate or reduce the condition.

Since rhabdomyolysis is mediated by reactive oxygen species (ROS), the new antioxidant metal complexes of salicylate and aminothiols derivatives would be useful in scavenging the ROS. Two specific aims were accomplished in this study: synthesis of several metal-complexes and cytoprotective activity of the metal complexes in kidney injury in mice. The focus was on ligands, which have or contribute to cytoprotective activity. The ligands from the substituted salicylate and aminothiols were examined. Also the assessment of cytoprotective activity of metal chelates *in vivo*. The stable water-soluble compounds with the highest antioxidant and cytoprotective activities were tested for cytoprotection against rhabdomyolysis-induced kidney injury in mice. Our data suggest that the cytoprotective properties of these compounds are due both to the ROS-scavenging properties of the ligands and the ability of the chelates to deliver complex to cells. ZnRibCys is more effective in reducing rhabdomyolysis injury as shown by the results of measurement of BUN and serum creatinine. Intracellular zinc is cytoprotective, in part due to its ability to inhibit ROS and endonucleases (DNA fragmentation). These metal complexes may be useful as agents in preventing rhabdomyolysis-induced kidney injury. *[Acknowledgment: The project described was supported by NIH Grant Number P20 RR-16460 from the IDeA*

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Subcategory: Biomedical Engineering

Nanofiber Alignment of Electrospun Polyurethanes

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Tearing of ligaments and tendons are common injuries that affect many athletes and young people. Certain synthetic polymers can be formed into nanofibers and assembled into specific structures that may possess mechanical properties similar to natural ligaments and tendons. Polyurethanes have been used as grafts in the suturing of ligaments due to their biocompatibility (Doroski et al. 2007). This research focuses on increasing the tensile strength of electrospun Biospan[®] and Hydrothane[™] polyurethanes by varying the rotational speed of the collector.

A typical electrospinning device consists of a grounded collector, a high voltage power supply and a capillary, usually a needle, filled with a polymer solution (Fong et al. 1999). The polymer solution jets out of the tube and elongates until it dries and reaches the collector (Reneker et al., 2000). Biospan[®] was dissolved in DMAc at 17% wt./vol. Hydrothane[™] was dissolved in a 1:1 mixture of THF and DMF at a concentration of 20% wt./vol. Polymer solutions were electrospun by ejecting them from a syringe charged at +20kV onto a spinning metal can, charged at -20kV, at a distance of 22 cm. The rotational speed of the collector was varied at three different speeds (850 RPM, 3300 RPM or 6500 RPM) for each solution. Samples were dried and tensile testing was conducted along the vertical and horizontal axis of collection.

A separate sample was prepared for SEM and viewed using an LS-10 Electron Microscope. SEM images show random alignment of fibers at 850 RPM, semi-alignment at 3300 RPM, and complete alignment at 6500 RPM. This correlates with an average vertical tensile strength of 7.3 MPa for 850 RPM, 11.8 MPa for 3300 RPM, and 25.2 MPa for 6500 RPM. Horizontal tensile strength decreased with increased vertical strength.

The data obtained indicates that collector high rotational speed promotes fiber alignment. This results in enhanced mechanical properties along the direction of fiber collection (vertical axis) but in a detriment of the mechanical properties in the axis perpendicular to fiber collection (horizontal). Using biomaterials such as Biospan[®] and Hydrothane[™] along with improved electrospinning techniques shows a promising future for

ligament prosthesis. Future experimentation will be done to improve the properties of the fiber bundles as a whole structure by attempting to resemble the architecture of ligaments and tendons as well as improving horizontal strength of the material by possible use of proteins or adhesion molecules.

[Acknowledgment: This project was supported by a grant from the NSF-LSAMP program. I would like to express gratitude to Dr. Cristina Villalobos for securing funding and Dr. Javier Macossay for his management of such funds.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Electrotonic and Action Potentials in the Venus Flytrap

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Alexander G. Volkov and Chrystelle L. Vilfranc, Oakwood University

The Venus flytrap has been studied since the nineteenth century. Scientists were not only intrigued by the rare beauty of this plant, but were also attracted to its mobility. Action potentials do not penetrate to the lower leaf, but we found small electrical potentials in the lower leaf of the Venus flytrap, which resemble graded potentials. We hypothesized that these graded potentials were electrotonic potentials that would be found in the lower leaf. The information gained from this experiment can be used to gain further knowledge about the intracellular and intercellular communications that are within plants. To understand the nature of these electrical potentials in the lower leaf, we have measured their dependence on the distance from the midrib. Amplitude of these electrical potentials decreases exponentially with distance and can be described by this equation: $U = a \cdot \text{Exp}(-b \cdot \text{Distance})$ with parameters $a = -7.7812 \text{ mV}$, $b = 0.5638 \text{ cm}^{-1}$.

Based on our analysis of the data that we collected, we concluded that these graded potentials were indeed electrotonic potentials. Electrostimulation of the lower leaf by a square pulse with amplitude of 4.4 V induces propagation of electrotonic potential in the lower and upper leaves and action potential in the trap, which induces the trap closing. Action potential can propagate from mechanosensitive trigger hairs in the upper leaf to the midrib and does not penetrate to the lower leaf. We plan to further investigate fast electrical communication in the Venus flytrap during environmental changes. [Acknowledgment: This study was supported, in part, by the National Science Foundation HBCU-UP Program. Grant No. HRD 811507 and by the U.S. Army Research Office under contract/grant number W911NF-11-1-0132.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Comparative Proteomics of EPM Horses versus Normal Horses Using 1D Gel Electrophoresis

Martika Moss, Florida A&M University

Equine Protozoal Myeloencephalitis, or EPM, is a central nervous system progressive disease that is potentially fatal and affects approximately 1% of horses. It is caused by an infection of the nervous system as a result of a bacterium crossing the blood-brain barrier. The disease can damage any region of the brain or spinal cord and can encompass a wide array of symptoms ranging from mild lameness to sudden seizures. The causative agent, an Apicomplexan protozoan, *Sarcocystis neurona*, has been identified as the most common cause of EPM, however *Neospora hughesi* has also been related to a small number of cases. Although EPM is considered a treatable disease if it is caught early, the treatment is not exact since the only response is using antibacterial drugs on the affected horse.

In this study, proteins from the cerebral spinal fluids extracted from both normal and affected horses are compared using 1-D gel electrophoresis. The samples were first introduced to Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) in order to separate the proteins by their molecular weight. The gels were then stained with comassie blue in order to be photographed. After the image was acquired, the gels were analyzed using Quantity One Analysis software and selected gel bands were chosen to be excised. Once excised, gel bands were taken for tryptic excision and blotted onto MALDI-TOF plates. The plates were then to be taken and analyzed using lasers that ionized the charges, providing data on the different masses acquired. By comparing the acquired mass with standard corresponding mass, the gels were able to be used to compare the proteomics of horses with or without EPM. Samples were also taken of other diseases such as HIV, or influenza. The lanes were compared based on their trace amounts as given by the analysis software. Of the many different samples, there were apparent differences in the proteins from affected horses in reference to their location on the gels which in turn meant that proteins that were supposed to be the same had varying molecular weights. By reading the bands across, it was noted that some proteins had higher trace quantities than others. By reading each band across the lanes, it could be determined which bands were most likely connected to horses with Equine Protozoal Myeloencephalitis more so than a different disease. Using this data, the search for an appropriate protein marker for the disease can continue. [Acknowledgment: FGLSAMP Florida A&M University]

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*Subcategory: Materials Science***The Effect of High Altitude ofnThermo-Responsive Biomaterials****Clayton Murray, Morehouse College**

High altitude conditions provide an environment that contains little oxygen and free radical molecules. Thus, exposing polymers to high altitude conditions may allow researchers to understand how polymers will behave at high altitudes for developing biomaterials for space exploration. In this study, poly (N-vinyl-caprolactam) [PVCL] is a biocompatible temperature-responsive material that changes configuration in response to temperature; it does not undergo hydrolysis and is more hydrophobic at temperatures less than 37°C, and more hydrophilic at temperatures greater than 37°C. Our experiment involved combining PVCL with ascorbic acid (vitamin C)[PVCL-AA] to try to circumvent the oxygen radical damage produced at high altitudes. The goal of this project was to determine if adding ascorbic acid to PVCL would reduce free radical production at high altitude (low temperatures and oxygen). Our hypothesis is that by exposing the samples of PVCL mixed with ascorbic acid, the free radical concentration would be reduced at high altitudes. We have tested our hypothesis using colorimetric guided inquiry experiments using the FRAP and ORAC assay. Upon temperature change, we noticed PVCL-AA exposed to 70,000 ft captured more free radicals than our PVCL control at 25°C and 37°C. *[Acknowledgment: This work was funded by the Morehouse Wide Initiative for Sustainable Energy (HBCU-UP/ACE 1043330) and the Howard Hughes Medical Institute.]*

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*Subcategory: Chemistry (not Biochemistry)***Synthesis of Immobilized Bronsted Acidic Ionic Liquid on Silica Gel as Catalyst for the Hydrolysis of Cellulose****David Oguoma-Richards, Savannah State University**

Shuqian Xia and Yuanyuan Liu, Tianjin University, Tianjin, P.R. China

The hydrolysis of cellulose into biofuels has become a global interest in today's scientific research. Many ways have been developed to come up with the most Total Reducing sugars (TRS) yield from the hydrolysis reaction. In recent years, Bronsted acidic ionic liquids have been used as solvent or acid catalyst for conversion of saccharides into valuable chemicals. In this study, immobilization of the Bronsted acidic ionic liquids has become necessary because we need to separate the catalyst

from the solvent and reduce amount of ionic liquid used. We used two methods to immobilize acidic ionic liquids on silica gel as solid catalyst to promote the hydrolysis of cellulose.

First method was immobilization of IL-1 on silica gel by sol-gel method and the second immobilization of IL-2 by radical polymerization. Two of Six SO₃H – functionalized Bronsted acidic ionic liquids were efficient for hydrolysis of cellulose, with maximum TRS yields over 85% at 100°C. From previous work, the most important factors investigated influencing the hydrolysis products were the hydrolysis condition, such as temperature, acidic ionic liquid dosage, reaction time and the purity of solvent [BMIM]Cl. Later, we fermented these products to produce the ethyl ethanol or get HMF (5-hydroxymethyl furfural) straight from the hydrolysis of cellulose which can be used as a final product. *[Acknowledgment: National Science Foundation-MAGEC-STEM Plus Program.]*

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*Subcategory: Chemistry (not Biochemistry)***The Synthesis and Characterization of Chalcones for Use as Chemopreventives****Lauren Peace, North Carolina Agricultural and Technical State University**

Cancer is defined as the uncontrolled growth of malignant cells. It is one of the leading causes of deaths in today's society. The statistics show that one in four deaths in the United States is caused by cancer. Because of unsatisfactory treatment options for many cancers there is a need to develop novel preventive approaches for this malignancy. One such strategy is through chemoprevention by the use of non-toxic dietary substances and botanical products. In order to facilitate this need, we are synthesizing a plethora of methoxy and boronic chalcones using aldol condensation. Chalcones are of interest to us because of their diversity, ubiquity in nature, and electronic structure. We believe that when these compounds are coupled with boronic acids, they will be more potent as chemopreventives than their methoxy counterparts. The goal of our research is to synthesize and characterize several different methoxy and boronic chalcone ethers and to determine the chemopreventive activity of these compounds. The chalcones were made using alkoxybenzaldehydes that were converted from hydroxybenzaldehydes using the Williamson ether synthesis.

Thus far, we have found that the percent yields for these reactions ranged from 17% to 50%. The newly synthesized chalcones were characterized via ¹H and ¹³C NMR. The future works for this research would be to test these compounds to

determine their chemopreventive and cytotoxic activity on various cancer cell lines and tumors. *[Acknowledgment: We would like to acknowledge the NIH #5P20CA138018-04 and NSF HBCU-UP/Talent-21 #1036299 for funding this research.]*

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Subcategory: Materials Science

Characterization of Poly(lactide-b-butadiene-b-lactide) Multiblock Copolymers

Sean Pickthorn, St. John's University

Intaek Lee and Tessie Panthani, University of Minnesota

Recent advances in polymer sciences have led to an increase in research in sustainable materials. Our efforts intended to produce a toughened biorenewable multiblock copolymer. Polylactide has been noted to be produced by sustainable practices but is limited because of its poor mechanical properties. To improve the brittle behavior of polylactide, preparation of polylactide-b-polybutadiene-b-polylactide multiblock copolymers were synthesized with a fixed weight of dihydroxyl polybutadiene (~3000 and ~2000g/mole series) and variable volume percent (50-90%) of both semicrystalline poly(L-lactide) and amorphous poly(D,L-lactide). Producing a multiblock copolymer intended to strengthen the mechanical properties by increasing bridging and looping chain conformations over several microdomains in block copolymers. Initially, triblock copolymers were synthesized with a ring opening polymerization and characterized. Toluene diisocyanate (TDI) and terephthaloyl chloride (TCL) were used to couple the triblock copolymers to form multiblock structures.

Characterization of these products was accomplished by differential scanning calorimetry, small angle X-ray scattering, ¹H-NMR spectroscopy, size exclusion chromatography, dynamic mechanical analysis, and tensile testing, leading to an extensive set of thermal and mechanical properties of both the triblock and multiblock copolymers. The data collected indicated a controlled product with a clear enhancement of mechanical properties of polylactide. Trends were associated with the weight percent of polylactide, and this can be used in future work as we explore other aspects of this material. This research can be continued by experimenting with other blending options, measuring other aspects of the toughness of the material, and investigating other coupling agents to initiate the multiblock synthesis. *[Acknowledgment: This research was supported by funding from the NSF awarded to the Center for Sustainable Polymers, University of Minnesota, Minneapolis, MN.]*

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Subcategory: Chemistry (not Biochemistry)

Microfluidic Centrifugal Disc Extractions via White Silica Pellets

Anahis Rincon, California State University Los Angeles

Large amounts of samples are used in research to conduct experiments. These experiments are time consuming and many times the samples are run separately. The 8 chamber, glued silica pellet Microfluidic Centrifugal Disc (CD) is a method in which 8 simultaneous separations can be performed at once. This method has many advantages; really fast analysis times, low sample volumes, ease of portability, low waste generation, low cost/disposability, and possibility of integrating several analytical steps in a single disc. A 5 layer CD was designed with an inlet (where the solution is inserted), middle pellet holder (which retains the vitamin B12), and an outlet (where the separated solution is collected). Four different materials were used to fabricate the CD: (Cyclic Olefinco-polymer (COC), Pressure sensitive adhesive (PSA), and Poly methyl methacrylate (PMMA). The layers are light making the CD able to run at high frequencies. Layer 1 is COC which contains an inlet and outlet hole. Layer 2 is Clear PSA film with an inlet hole connected to a channel that ends at a hole of diameter of 3.20mm. Layer 3 is PMMA with an inlet reservoir, middle hole (3.20mm diameter) that holds the silica pellet, and outlet reservoir. Layer 4 is white PSA with a 3.20mm pellet hole connected to the outlet chamber via a channel. Layer 5 is COC and it seals the bottom of the CD. Using diluted vitamin B12, 130µL of solution was inserted in the inlet of the CD. The white silica pellet is about 3.20mm in diameter, hydrophilic, and very porous retaining the B12 particles within it. Via a centrifuge the solution travels from the inlet through the channel, forced through the secured glued silica pellet, and out to the outlet. The results showed that the best retention attained was a 49.6% retention, analyzed by ultraviolet spectroscopy. Further work is required before the product is ready for general laboratory use. For future experiments Layer 2 of the CD should be white PSA in order to secure a stronger bond, and glue that does not dissolve in methanol is recommended. Once optimized the use of gold monolith silica pellets can be developed for protein separations in bio-analytical applications. *[Acknowledgment: The International Research Experiences for Students (IRES) program (funded by the National Science Foundation [NSF]) and The Irish Separation Science Cluster, Dublin City University. National Science Foundation, OISE-0850443, IRES - Ireland: Applications in the Chemical Separations Sciences; PI; 8/1/09-8/31/12. CSU-LSAMP is supported by NSF under Grant No. HRD-0802628]*

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Subcategory: Chemistry (not Biochemistry)

Interfacial Polymerization of Bisphenol A Tetrachlorocyclotriphosphazene Monomers to Synthesize Poly (arylene ether sulfone) Hybrid Copolymers. Part 1- Monomer Synthesis

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Susan Ramos Hunter, Vanderbilt University

Tiffany Thompson, Vaughn Franklin, and Natalie Y. Arnett, Fisk University

Queen Stevenson, Martin Luther King Academic Magnet School, Nashville, TN

The purpose of this research was to synthesize bisphenol-A (BA) based tetrachlorocyclotriphosphazene (BATCCP) hybrid monomers to serve as precursors for disulfonated cyclophosphazene poly(arylene ether sulfone) (PAES) hybrid copolymers for use in proton exchange membranes in fuel cells (PEMFCs). BATCCP monomers were prepared by reacting hexachlorocyclotriphosphazene (HCCP) monomer with bisphenol A monomer (1:2 ratio) at 100°C using an interfacial procedure. The interfacial reaction was carried out in a water/toluene system with the assistance of a phase transfer catalyst, tetraoctylammonium bromide (TOAB). The reaction time was varied from 15 minutes to 24 hours leaving behind an orange adhesive solid. The introduction of HCCP into the PAES backbone will introduce additional reactive sites to allow post modification of the copolymer to occur. By subsequently incorporating various functional groups through the reactions of the chlorine on the HCCP could improve proton conductivity at relative low humidity or provide sites for controlled cross-linking to reduce swelling. Four identical reactions were studied: fifteen minutes, two hours, four hours, and twenty four hours. The rate of formation of BATCCP was found to be dependent on the amount of time the reaction was allowed to proceed. The percent yield of the reaction increased from 19.6% to 32%. The products of each reaction were characterized using proton nuclear magnetic resonance spectroscopy (¹HNMR), phosphorous NMR (³¹P NMR) and Matrix Assisted Laser Desorption/Ionization (MALDI). Generation of BATCCP was confirmed in as little as fifteen minutes. ¹HNMR analysis confirmed the successful addition of Bis A to HCCP due to appearance of a chemical shift peak at 7.16 ppm. The production of BATCCP monomer was illustrated by ³¹P NMR by the presence of chemical shifts at 23.7 and 14.1 ppm relative to the unsymmetrical BATCCP. The presence of hydrolysis associated with the BATCCP monomer was also confirmed by ³¹P NMR by the appearance of a peak at -1 ppm. However, MALDI showed that hydrolysis was due to the presence of unreacted HCCP and not hydrolytic instability in the BATCCP monomer. This was confirmed by a comparison of the BATCCP monomer washed and unwashed several times with 5 mL fractions of deionized water. The washed BATCCP showed no hydrolysis peaks on the ³¹P NMR. MALDI also showed that the

highest fraction % of pure BATCCP collected (82%) was obtained at 15 minutes. MALDI confirmed the formation of unknown side products at 24 hour reaction time. Future research to improve the synthesis of BATCCP monomers using different phase transfer catalyst, different ratios of BATCCP to HCCP, and different solvent systems are currently underway.

Additionally, the separation of BATCCP from side products will also be investigated so that formation of the disulfonated cyclophosphazene poly(arylene ether sulfone) (PAES) hybrid copolymers from the pure monomer can be carried out. [Acknowledgment: This study was supported by a grant from NSF/HBCU-UP Research Initiation Award No. HRD-1137573] and Quality Education for Minorities Network awarded to Natalie Arnett. Ph.D., Assistant Professor of Chemistry and Director of Graduate Studies in Chemistry, Fisk University, Nashville, TN 37208.]

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Subcategory: Chemistry (not Biochemistry)

Synthesis and Characterization of Polyamide Polyetheramide Block Copolymers for Reverse Osmosis and Nanofiltration

Jameison Rolle, Fisk University

Polyamide (PA) membranes are the most commercially available reverse osmosis (RO) membranes due to their high salt rejection (>99.9%). A drawback of PA membranes, however, is the susceptibility of these membranes to degrade in presence of 1 ppm of free chlorine at the amide site along the polymer backbone. To improve the chlorine stability of the polymers, secondary diamines and amine terminated polyethylene glycol will also be investigated to prevent the possible chlorine attack on amidic nitrogen. The goal of the present studies was to determine if the use of secondary diamines (JEFFAMINES®) will prevent chlorine attack on amidic nitrogen in JEFFAMINE-based polyamide membranes without sacrificing properties for high capacity desalination. The JEFFAMINE polyetheramines provide increased flexibility, toughness, low viscosity, and low color. In the present studies, we specifically prepared polyamide polyether amide (PAPEA) copolymers by varying the ratios of JEFFAMINES® ST-404 and JEFFAMINES® ED-600 introduced into the polymer backbone of different aromatic polyamides via interfacial polymerization. Thus, different aromatic diamines (such as xylylene and p-phenylene diamine) were dissolved in the aqueous phase and reacted with diacid chlorides in the organic phase. The PAPEA polymers described in this research are STmPAPEA and STpPAPEA, prepared from JEFFAMINE ST-404 and terephthaloyl chloride with either meta (m)-phenylene or p-phenylene diamine, respectively. Solubility test in solvents showed complete insolubility in several polar aprotic solvents.

Fourier transform infrared spectroscopy (FTIR) results confirm the polymer synthesis based on the appearance of the N-H peak at 3400 and C=O peak at 1640 cm^{-1} . Differential Scanning Calorimetry (DSC) showed the presence of two glass transition temperatures (T_g) for all the polymers studied confirming the block copolymer chemical structure. Thermogravimetric analysis (TGA) showed that PAPEA polymers prepared from ST-404, p-phenyl diamine, and terephthaloyl chloride displayed the highest decomposition temperature, 261.24 °C. Future research to improve the solubility is currently being investigated using m-phenylene diamine, and isophthaloyl chloride to introduce more amorphous character in the polymers. Preliminary data has shown increased solubility in dimethylsulfoxide (DMSO) and dimethylacetamide (DMAc). A phase transfer catalyst has also been introduced to improve the molecular weight of the polymer. [Acknowledgment: NSF/CREST Center at Fisk University and the Center for Layered Polymeric Systems at Case Western Reserve University]

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Subcategory: Nanoscience

Tunable Band Gap in Gold Intercalated Graphene

Michael A. Roundtree, Morehouse College

Indra Sapkota and John Hall, Morehouse College
Xiao-Qian Wang, Clark Atlanta University

We investigate the electronic characteristics of gold-intercepted epitaxial graphene under a perpendicularly applied electric field. Evolution of the band structure of intercalated epitaxial graphene as a function of the bias is investigated by means of density-functional theory including interlayer van der Waals interactions. Our results indicate that gold intercalated epitaxial graphene can lead to tunable band gap with the applied bias, which is important for future device applications.

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Subcategory: Chemistry (not Biochemistry)

Crossover between Triangular and Hexagonal Structure for Nitrogen-Carbon Cages

Carrie Sanders, Alabama State University

Nitrogen cage N24 is known to energetically prefer an elongated structure with triangles whereas carbon cage C24 prefers the well-known fullerene-like structure with only pentagons and hexagons. The two types of three-coordinate cages differ because sp^2 -hybridized carbon prefers the near-planar geometry afforded by a spheroid, but sp^3 -hybridized nitrogen prefers nonplanarity and the tight curvature of a cylinder. A previous study on cages of N22C2 showed that the incorporation of two carbon atoms narrows the energy gap between cylindrical and spherical structures. In the current study, additional C2 units are incorporated into nitrogen cages to determine how many carbon atoms are required to make the fullerene-like hexagonal form preferred over other structures. Theoretical calculations with various methods are used to determine the energetics of various cage isomers. [Acknowledgment: NSF/HBCU-UP]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

The Cytotoxicity of *Commiphora Myrrha* on MCF-7 Cells

Arkeen Simmons, Elizabeth City State University

About one in eight women (12 %) will develop breast cancer over her lifetime. Since 2011, an expected 230,480 new cases of breast cancer were expected to be diagnosed in women in the United States. Nearly 2,140 new cases of breast cancer were expected to be diagnosed in men since 2011 with a man's lifetime risk of breast cancer as approximately 1 in 1,000 according to breast cancer.org. Breast cancer is originated from breast tissue, located in the inner lining of milk ducts or the lobules. The purpose of this study is to analyze the cytotoxicity screening of MCF-7 breast cancer cells on the essential oil from the traditional Egyptian plant, *Commiphora myrrha*, using a MTT-based cytotoxicity assay. MCF-7 cell line is a plural effusion from human mammary gland adenocarcinoma (breast tumor). MTT is a yellow water-soluble tetrazolium dye that is reduced by living and not dead cells to a purple formazan product that is insoluble in aqueous solutions. The traditional Egyptian plant purposes of *Commiphora myrrha* include the treatment for infections of the wounds and bring the healing process to a rapid pace. Methods: Cytotoxicity of the MCF-7 breast cancer cells was done according to, standard MTT-based cytotoxicity assay techniques according to protocol. MCF-7 breast cancer cells were cultured according to standard protocol. Results: *Commiphora myrrha* had a 100% mortality rate at concentration of 100ppm, 100% killing at 50 ppm and 41.5±14.6 mortality at 20 ppm. *Commiphora myrrha* (myrrh) essential oil showed remarkable *in vitro* cytotoxic activity against MCF-7 in a dose-dependent manner, with an IC50 of 24.9±5.2 ppm. [Acknowledgment: NIH-RISE: R25GM08280]

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Subcategory: Chemistry (not Biochemistry)

Highly Efficient Synthesis of Tropane Skeletons

Robert A. Smitherman, Winston Salem State University

N-acyldihydropyridines are versatile synthetic intermediates and have been applied in the synthesis of biologically significant entities, such as natural products and drug molecules. Several methodologies have been developed to prepare these systems, such as addition of a Grignard reagent to an N-acylated 4-methoxypyridinium salt followed by an acidic hydrolysis and aza-Diels-Alder reactions using imines and Danishefsky's dienes. These intermediates have been utilized in the synthesis of fused ring systems by the intramolecular reactions of enones with nucleophilic moieties, which are connected to the nitrogen. However, no study has been done on the formation of bicyclic ring systems using similar systems. It has been envisioned that the rigid ring system could be accessed by the reactions of properly functionalized tethered groups with enones. In principle, the ring closure could be induced via intramolecular C-C bond formation under various conditions, namely: a) nucleophilic additions, b) cycloadditions (e.g. [2+2], [3+2], [4+2]), c) organometallics. This novel strategy will rapidly provide the rigid bicyclic ring systems, which will be further elaborated to access structurally challenging alkaloids as well as their analogs for biological studies. [Acknowledgment: NSF]

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Subcategory: Chemistry (not Biochemistry)

Phytoremediation of Lead Contaminated Water using Edible Fruits and Vegetables

Charne' Thomas, Dillard University

Lead is a toxic and naturally occurring substance with documented neurotoxin, toxic, and long-lasting adverse health effects globally. Lead exposure can cause impaired physical and mental development in children. Exposure to high lead levels affects the intestinal tract, kidneys, joints and reproductive system in adults. Over the last decade, considerable research has focused on developing cheap and effective solutions for the treating of contaminants in soil and water. Phytoremediation technique has shown promise in the mitigation of organic contaminants and petroleum hydrocarbons. We hypothesize that the edible fruits and vegetables will effectively remove the lead from the contaminated water. Thus, this study evaluates

the removal of 1300 PPM of lead from contaminated aqueous solution using supernatants from aqueous extracts of red and white grapes (*Vitis vinifera*), lime (*Citrus aurantifolia*), Mustard Green (*Brassica juncea*), Spinach (*Spinacea oleracea*), Collard Green (*Brassica Oleracea*), Bitter leaf (*Vernonia Amygdalina*), Carrot (*Daucus Carota Sativus*), Red, Green, and Yellow Bell Pepper (*Capsicum Annuum*), tomatoes (*Lycopersicon esculentum*) and Control (Lead and water). After shaking triplicate reaction mixtures of 1300 PPM of aqueous lead solution and each substrate for 22 hours at room temperature, lead removal by the substrates were analyzed by EPA Method 6010, using Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES). Results suggest that the order of lead removal is Collard Green (99.8%) >, Spinach (98.7%) > Carrot (95.5%) > Mustard Green (98.2%)> Green Bell Pepper (97.8%) > Yellow Bell Pepper (97.75%) > White Grape (96.7%)> Red Bell Pepper (94.28%) > Red Grape > 93.5 % > Tomatoes (84% > Bitter Leaf (61%). The study concludes that extracts of edible plants can effectively remove lead from contaminated water. As a future study, we will test different types of contaminants such as Aluminum, as well as mixtures of contaminants, and different edible fruits and vegetables. [Acknowledgment: This study was supported, in part, by a grant from LSLAMP awarded to Abdwalla Darwish, Ph.D., Dean of Natural Science at Dillard University, New Orleans, LA 70122.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Development of an On-The-Go Breakfast Waffle

Jerry Thomas Jr., Alabama A&M University

Jennifer Allen, Marilyn Hawkins, Jelisa Thomas, Josh Herring, and Martha Verghese, Alabama A&M University

Breakfast is known as the most important meal of the day; however, it is also the meal most often missed. Consumers today lead busy lives and need meals that fit their lifestyle. The objective of this research was to develop a portable, on-the-go breakfast waffle that contains a good source of protein, vitamins, and minerals needed to start the day. Convenience and nutrition of the waffle delivers a complete meal consisting of bacon, scrambled eggs, and cheese. The analysis of protein was conducted using the Kjeldahl method, whereas the Soxhlet method was applied to determine the lipid content in the waffle. When compared to two all-fruit versions of the convenient meal, consumer preference testing showed that 76% of the respondents preferred the savory flavor of the bacon, egg, and cheese rather than the Sweet Kiwi and Dried Mango, and Strawberry Kiwi flavors. The appearance, flavor, and texture respectively were "liked moderately" (80%), "like much" (72%)

or “liked very much” (80%). Based on preference testing, consumers are favorable to the convenient, complete, and nutritious bacon, egg, and cheese waffle. Physicochemical analysis including texture (Newtons/force), Color (Lab values using a Hunter Colorflex) and water activity (Rotronix meter) were measured over the shelf life period. The water activity of the product remained stable over the shelf life period and tested (0.854-0.859). There were small changes in L (lightness), a (redness) and b (yellowness) values. Based on the proximate analysis with determination of protein, fat, carbohydrates, selected vitamins and minerals, a nutrition facts panel was implemented. For future research, the idea of a whole grain vegan waffle would be conducted to ensure low fat content, but also guarantee that it is a good source of fiber, protein, vitamins, and minerals. This project was funded by the USDA/NIFA grants (Development of Functional food products). [Acknowledgment: This research has been supported in part by the NSF-HBCU-UP project grant #HRD0928904.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Function Prediction on Co-enzyme A Disulfide Reductase from *Clostridium difficile*

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Clostridium difficile infection (CDI) has recently been identified as one of the leading acquired health care-related infections. CDI is a toxin mediated intestinal infection caused by the *C. difficile* pathogen that is only able to colonize the human gut when the normal intestinal flora is disturbed, usually following hospitalization and antibiotic treatment. Increasing prevalence of CDI and emerging resistance to antibiotic treatments has made it a target of countless research efforts. Previous research has unveiled that other pathogens use low-molecular-weight (LMW) thiol/disulfide redox systems as buffers to evade the oxidative neutrophil defenses of the immune system. Glutathione (GSH) and Glutathione Reductase (GSR), the most common LMW thiol/disulfide pair, act as a reserve of cysteine and a cofactor in the detoxification of products of oxidation. While *C. difficile* lacks the GSH/GSR redox system, comparisons are currently being made to other organisms such as *Staphylococcus aureus* which uses coenzyme A (CoASH) and coenzyme A disulfide reductase (CoADR) in its own redox system. The focus of this study is to use comparisons of predicted catalytic residues from known disulfide reductases to test the hypothesis that CoADR can function as the major LMW disulfide reductase of *C. difficile*, making it a possible target of future drug development. Homology models of CoADR enzymes from *C. difficile* and *S. aureus* were made through the YASARA

suite of programs, and evaluated by YASARA and through MolProbity and the Swiss Model Workspace. Functionally important residues were identified and ranked through the THEMATICS and POOL programs with the use of computed theoretical titration curves as markers of catalytically active residues. With this data, predicted residues were labeled and compared with structural alignments in YASARA. Structural and sequence alignments were also produced using the Chimera software. Analysis of these data reveals that CoADR active site residues from *C. difficile* match more than half of the functionally important residues from *S. aureus* CoADR, supporting the hypothesis that CoADR may act as the primary LMW disulfide reductase in *C. difficile*. Implications of this research include the potential for the development of novel drug treatments for CDI that target CoADR. Further research efforts may consist of testing how degradation or impairment of the CoADR enzyme affects *C. difficile*'s ability to survive in oxidizing environments. [Acknowledgment: This study was funded by the Louis Stokes Alliance for Minority Participation program at Northeastern University.]

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Subcategory: Materials Science

Synthesis and Characterization of Polyimide-CNT Composite Films

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Polyimides are thermally stable at high temperatures, thus have wide variety of applications in the aerospace industry. Carbon nano-tubes (CNT), reinforced polymer composites, improve multi-functionalities such as structural and thermal properties. We prepared polyimide composites with 0 and 1 wt% CNTs. Three varieties of CNTs: Single Wall – functionalized, Double Wall – functionalized, and Double Wall – non-functionalized CNTs were used. The functionalization is performed by oxidation in acid followed by purification. Polyimides were prepared using BPADA, BAPP, and refluxing in anhydrous NMP followed by precipitation, cleaning, dissolving and dispersing CNT in NMP, and curing in a vacuum oven. High quality films of polyimides with and without CNTs were characterized using FT-IR, TGA, DSC, and Positron lifetime spectroscopy (PLS). The FT-IR spectra for all the samples showed the characteristic peaks of polyimide such as C=O asymmetric/symmetric stretching and bending of imide, C-O-C between two aromatic rings, (CO)₂-NC of imide, aromatic ring vibration, etc. This confirms the completion of polymerization to form polyimide in all the films. TGA curves showed weight loss with temperature in two stages. The first stage 180 - 300°C showed a weight loss of ~ 15% that may be associated with the trapped NMP release. The second stage 500 – 750°C with a drastic weight loss is associated with

decomposition. The residual weight is ~ 40% at 750°C in pure polyimide and functionalized single or double wall CNT dispersed polyimides. The non-functionalized CNT dispersed polyimide showed similar two-step behavior, but the weight loss is remarkably less--about 80% weight remained at 750°C. DSC curves of all polyimide samples showed two distinguishable endothermic peaks at around 90 °C and 200°C. The first peak may be correlated with the onset of NMP release, while 200°C for structural change. We used PLS to study the micro-porosity of CNT incorporated polyimide composites. The third lifetime component provided the information on pore size (lifetimes) and concentration of pores (intensities) using a simple model, and the values were compared between the films with and without CNT. [Acknowledgment: NASA/National Science Foundation]

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Subcategory: Chemistry (not Biochemistry)

Luminescence Evidence of the Unusual Stability of the Divalent Samarium Site in Various Borate Systems

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The sensitivity of lanthanide spectroscopy to the near environment surrounding the lanthanide ion is well known. Slight changes in the structure are readily apparent in the optical spectra characteristic of the compounds. The emission spectroscopy of divalent samarium provides an excellent monitor of such changes due to the simplicity of features that can arise. However, when samarium is reduced in a borate matrix, an identical emission spectrum arises from samples prepared under a variety of conditions and even compositions. Samples have been prepared by precipitating mixtures of samarium and strontium (or barium) with sodium tetraborate. These have been fired under conditions that resulted in divalent samarium. As exhibited in Figure 1, the divalent samarium emission spectra collected for each sample is consistent, regardless of the composition. Some examples of the studied compositions which give identical emission spectra include:

Fired tetraborate precipitates generated with samarium:

- strontium ratios ranging from 0.1% - 90%.
- Fired precipitates of samarium tetraborate without strontium present.
- 0.1% - 25% samarium in strontium tetraborate fired with varying amounts of additional boric acid.
- 1% - 5% samarium in barium tetraborate fired with additional boric acid.

Given the sensitivity of the emission spectrum to the near environment around the samarium ion, all of these compositions must result in an identical samarium site. It is believed that the similarity in size of strontium and samarium ions may result in strontium tetraborate and samarium tetraborate being iso-structural such that the samarium emission may be indistinguishable between the two forms. Since the site is prevalent at a variety of boric acid concentrations, it is assumed that the tetraborate of the samarium (rather than the di-, hexa-, or octaborate) is the most stable combination. The presence of strontium appears to stabilize the divalent samarium, but the samarium tetraborate phase can be identified by emission spectroscopy even in compounds containing pure samarium or even barium borates. [Acknowledgment: The authors wish to acknowledge the support of the National Science Foundation for their support to WSSU through the Raising Achievement in Mathematics and Sciences Program.]

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Subcategory: Chemistry (not Biochemistry)

Cisplatin-induced LDH release and Caspase 3/7 activation in TPKTS cells Are Significantly Reduced by Metal Complexes

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Six complexes of copper(II) and zinc(II) ions with antioxidant ligands were synthesized and characterized by elemental analysis and Fourier Transform Infrared spectroscopy. 3,5-substituted salicylate ligands were used with copper (II), while aminothioli ligands were used with zinc (II). The ORAC assay was used to assess the antioxidant activities for all complexes, and the results show that copper complexes are more active than the zinc complexes. The ABTS assay was used for antioxidant activity determination for the zinc complexes, while the NBT assay was used for the copper complexes. Different assays were used because the zinc complexes were unreactive towards the NBT assay while the copper complexes were unreactive towards the ABTS assay. The cytoprotective effects of the copper and zinc complexes were systematically assessed. These compounds were tested against cisplatin induced-apoptosis in the TPKTS murine kidney cell line. The apoptosis was evaluated by measuring the rate of lactate dehydrogenase (LDH) release and caspase 3/7 activation using commercial available assay kits. The results indicated that all compounds tested significantly reduced both LDH release and caspase 3/7 activation in cisplatin-treated cells. Complete reversal of cisplatin toxicity was

observed for the following compounds: 3, 5-dibromosalicylato copper (II) (Cu-DBS), 3, 5-dichlorosalicylato copper (II) (Cu-DCS), N-Acetylcysteinato zinc (II) (Zn-NAC) and Ribosyl-cysteinato zinc (II) (Zn-RibCys). The order of activity was Cu-DBS > Cu-DCS > Zn-RibCys > Zn-NAC. These results suggest that these or similar complexes may be useful in preventing cisplatin-induced nephrotoxicity. [Acknowledgment: The project described was supported by NIH Grant Number P20 RR-16460 from the IDeA Networks of Biomedical Research Excellence; US Army-Academy of Applied Science, Inc; Research and Engineering Apprenticeship Program and Program of the National Center for Research Resources and the Arkansas Space Grant.]

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Subcategory: Chemistry (not Biochemistry)

Accurate Computational Study of Electronic Interaction Energies of Hydrogen Bonding Complexes

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Noncovalent interactions, particularly, hydrogen bonding, play an important role in the structure and function of biological systems such as DNA and proteins. Numerous research efforts have been devoted to accurately evaluate intermolecular interaction energies of hydrogen bonding and van der Waals complexes by both *ab initio* molecular orbital and density functional theory calculations. We have studied the structures and interaction energies of hydrogen bonded complexes between protonated 1,3-butanediol and one, two, and three water molecules by *ab initio* molecular orbital calculations at the MP2/6-311++G(d,p) level, and a variety of density functional theory calculations, including several newly developed dispersion corrected DFT-D methods with different basis sets. The computed binding energies were compared to the well established, accurate MP2/CBS and CCSD(T)/CBS extrapolation benchmark results. However, the involved CCSD(T)/aug-cc-pVTZ or CCSD(T)/aug-cc-pVQZ type of calculations is highly demanding in computer memory and disk space. CCSD(T) level calculations are impractical when used in the many structures of current molecular systems. We will present computational results based on a composite method M2.X with smaller basis sets introduced by Riley and Hobza and co-workers. The M2.X method does not include CCSD(T) calculations, but can produce CCSD(T)/CBS quality interaction energies for noncovalent interactions. The computed binding enthalpies, entropies and free energies were compared to the experimental values from the electrospray ionization high pressure mass spectrometry to further assess the feasibility of the computational procedure. [Acknowledgment: This research is supported by a HBCU-UP grant from NSF awarded to Dr. Daqing Gao, Central State

University, Wilberforce, Ohio. This research is also supported by Ohio Supercomputer Center]

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Subcategory: Chemistry (not Biochemistry)

Synthesis, Spectroscopic Characterization, Structural and Bioactivity Studies of Bis(cyclopentadienyl)titanium(IV) Complexes

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New complexes of Cp₂Ti[S₂P(OR)₂]₂ (where R = Et, Pr-n, Pr-i, Bu-i and Ph) and Cp₂Ti[S₂POGO]₂ (where G = -CH₂CMe₂CH₂-, -CH₂CtEt₂CH₂- and -CMe₂CMe₂-) have been prepared by the dropwise addition of the appropriate O,O-dialkyl or -alkylene dithiophosphoric acid to bis cyclopentadienyl titanium dichloride in 1:2 molar ratio and refluxed in benzene solution. These new yellow colored complexes have been characterized by elemental analyses, molecular weight measurements and spectroscopic techniques (IR., NMR ¹H, ¹³C and ³¹P NMR). These Titanium (IV) complexes have also been screened for their antibacterial activities. [Acknowledgment: This study was supported, in part, by Evans Allen grant awarded to Adnan Elkhaldy, Ph.D., Department of Natural and Physical Sciences-Chemistry, Alabama A&M University, Normal, Alabama 35762.]

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Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

One-Step Electrophoresis and Staining

Richard Williams, Florida Agricultural and Mechanical University

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Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) is a widely used technique for protein separation that requires several steps, including sample separation on acrylamide gel, staining, destaining, and imaging. At times, the staining procedure with Coomassie blue yields a very dark background, which would require long destaining process (several hours to complete). This current study uses diluted concentrations (0.00125 – 0.005%) of the standard dye solution

for the SDS-PAGE procedure to develop a shorter and more efficient way to perform gel electrophoresis and stain in one-step. This study provides a more efficient method to conducting the standard SDS-PAGE procedure which will reduce amount of time used to destain and provide better visual results of protein separation on an acrylamide gel. The procedure includes the incorporation of Coomassie blue dye G250 and R250 in the electrophoresis buffer during the actual run of SDS-PAGE. The proteins were stained while being separated, providing only the need to fix after electrophoresis and imaging. The proteins that are separated using this one-step procedure are comparable to the standard Coomassie blue, silver-nitrate and Sypro Ruby protein staining procedures. Unlike the automated electrophoresis procedures using chips technology, the separated proteins can be utilized for further analysis such as mass spectrometry. The diluted dye is easy to make and can considerably enhance efficiency and shorten time periods of procedures. It is cost efficient and produces a lower background. In the future, this study will be used on different stains such as silver nitrate and sypro ruby stains that are used during the SDS-PAGE procedure to gain better visual results of protein separation on an acrylamide gel. *[Acknowledgment: This study was supported, in part, by a grant from Title II Florida A & M University Program.]*

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Subcategory: Nanoscience

Simple, Green and Room Temperature Synthesis of Ascorbic Acid-Capped Zinc Selenide Nanoparticles

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Among the II-VI semiconductor nanocrystals, Zinc selenide (ZnSe) is of special interest as it exhibits via quantum confinement effects, tunable blue-ultraviolet (UV) luminescence. This UV range is practically difficult to obtain for cadmium-based systems such as CdSe, for which the toxicity of cadmium is an additional disadvantage. ZnSe is an n-type and intrinsic direct band gap semiconductor with a wider band gap of 2.58 eV (480 nm) at 25°C and transmittance range of 0.5-22 μm . It is potentially a good material of choice for short-wavelength photoelectronic devices such as blue laser diodes, light-emitting diodes, photodetectors, biomedical labeling and sensors than other II-VI semiconductor materials. Though many synthetic methods have been reported for the synthesis of ZnSe nanoparticles, however, the chemical hazards to health and environment that usually occur during the synthesis and applications of these materials are major concerns. This has led to the increased emphasis on 'green chemistry' and chemical processes which are aimed at total elimination or at least minimization of general waste and pollution of the environment.

In line with this, we herein report a simple, green and room temperature synthesis of ascorbic- acid capped ZnSe nanoparticles. The reaction involves addition of selenide ion solution produced via reduction of selenium powder to an ascorbic acid-cadmium complex solution at room temperature. By varying the pH of the solution and reaction time, the temporal evolution of the optical properties was investigated. The as-synthesized ZnSe nanoparticles were characterized using UV/vis and photoluminescence (PL) spectroscopy, Fourier transform infrared (FTIR) spectroscopy and transmission electron microscopy (TEM). All the particles at the different pH of 7, 8, 9, 10 and 11 exhibited quantum confinement in their optical spectra. The absorption and emission maxima are red-shifted as the pH increased, indicating increase in particle size. The 24-hour sample gives the smallest particle size and highest luminescence for all the pH used. The typical TEM representative shows that the as-synthesized materials are monodispersed, small and spherical in shape. The presence of lattice fringe in the high resolution TEM confirmed the high crystallinity of the as-synthesized materials while the FTIR confirmed the capping of the ascorbic acid. *[Acknowledgment: NIH-RISE Grant # 1 T37 MD 001810-08]*

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Subcategory: Cancer Research

Spectrometric Screening of Organic Compounds for Use as Photosensitizers in Photodynamic Therapy Treatment of Cancer

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Photodynamic therapy (PDT) is a cancer treatment used for various types of malignancies. It is a minimally invasive alternative to traditional surgical, radiation, and chemotherapy treatments, which can be extremely harsh on patients and have severe and sometimes permanent side effects. Photosensitive agents, or photosensitizers, absorb light at selective wavelengths (600-800 nm) and can be activated to chemically change the internal environment of cancer cells by exciting oxygen molecules to the singlet state which react quickly with nearby tissues and kill cancerous cells without harming healthy tissue. In this project we explore the light absorbing properties of a variety of organic compounds to determine their potential as photosensitive agents. Solutions of these compounds, in dimethyl sulfoxide (DMSO) and ethanol, were investigated using UV-Vis spectrometry to measuring the absorbance in the visible (400-800 nm) region of the electromagnetic spectrum. The best candidates were selected by comparing absorbance measurements in the red (600-800 nm). Derivatives of these photosensitizers are also being investigated using UV-Vis

Spectrometry to determine which will be best suited for use as a PDT drug. Based on the UV-Vis absorption spectra of the samples in this group, Zinc Phthalocyanine and Manganese Phthalocyanine would make the best photosensitizers as they showed the highest absorption between 600 and 800 nm in both ethanol and DMSO. Thus, more studies are being done on these two compounds to determine their efficiency in producing high yields of singlet oxygen. Other compounds studied showed a significant absorbance at lower wavelengths than is preferable. These were Copper (II) Porphyrin IX and Chromium (III) Mesoporphyrin IX Dichloride in DMSO, and Cobalt (III) Mesoporphyrin IX and Zinc (II) Etioporphyrin I in both DMSO and Ethanol. Derivatives of these compounds are being investigated to determine whether their efficiency as photosensitizers for photodynamic therapy can be improved by shifting their absorbance to the 600-800 nm region of the spectrum.

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Subcategory: Chemistry (not Biochemistry)

Synthesis of Poly(xylitol sebacic-b-glycolic acid) Elastomers with Applications in Tissue Engineering and Drug Delivery

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Biodegradable polymers have been used for tissue engineering and drug delivery for the past couple decades. Tissue engineering addresses the need to repair, replace and improve damaged tissue. Synthetic biodegradable polymers have become increasingly important in the field of medicine and bioengineering. Extensive research has been done on several kinds of biodegradable polymers because of their biocompatibility, biodegradability, and high-purity. The objective of this research is to synthesize block polymers using different ratios of xylitol, sebacic acid and glycolic acid. Successful synthesis of these block polymers has shown that the degree of crosslinking between these materials can easily be altered to produce a pre-block-polymer that is still viscous enough to take the shape of any mold for any application. This polymer is an elastomer and as such can be used in the construction of three-dimensional scaffolds, which regain their structure after being stretched or twisted. Future work consists of characterizing the polymer using a proton NMR, as well as testing its mechanical properties and degradation profiles.

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Computer Sciences and Information Management

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Subcategory: Computer Science & Information Systems

Social Media System: An Automated Twitter Search for Adverse Weather Conditions Based on Geographical Location

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The National Weather Service (NWS) always aspires to quickly notify the public of significant weather events. However, certain information regarding weather conditions and the damage being experienced by the affected area cannot always be known in real-time. The NWS chose to explore a different avenue for monitoring and obtaining real-time data by using social media during adverse weather situations. Within the last five years, social media has become responsible for the way that many people communicate and exchange information. It is also one of the best ways to stay aware of current events as well as learn the thoughts, opinions, and actions of others. For this project, a social media program was created to allow the NWS to monitor and interact with Twitter, the second-largest social media service in the United States. Along with the rate at which users tweeted, the ability to perform advanced geographical queries would also prove crucial to the efficiency of this tool. The results of this project demonstrated how to successfully integrate selected features from Twitter into a system designed to improve the organization's effectiveness. Furthermore, it allowed the organization to acquire knowledge for future social media related-research as it pertains to weather.

[Acknowledgment: This study was supported by the NOAA Office of Education's Educational Partnership Program in Silver Spring, Maryland.]

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Subcategory: Computer Science & Information Systems

AlphaBraille: A New Method For Printing Accessible Text

David Brickler, Morehouse College

Visually challenged individuals (those who are blind or who have low vision) understandably are not able to read in the same manner that fully sighted people do. Therefore, in order for them to acquire a well-rounded education i.e. accessing information, and gaining knowledge there has to be an alternative process. As a solution to this, the Braille system of writing was developed many years ago as a tactile way for them to read without being able to see -- very few, however, are

actually able to (or choose to) utilize the system. To present yet another alternative, researchers at the Prototyping and Design lab at UMBC created AlphaBraille, an initiative intended to facilitate the process of gathering information from the written word for people who are blind and who have low vision. AlphaBraille generates 3D models from text and uses the MakerBot 3D printer to make an inexpensive and efficient way to merge Braille words and alphanumeric text. AlphaBraille is intended to empower both visually challenged and fully sighted individuals to print text in Braille using minimal resources. Structurally, AlphaBraille uses a Python script to generate a model of the text that the user wants to print with the MakerBot. The program creates a plate that has alphanumeric text embedded in it for use by low-vision and fully sighted individuals and Braille dots for visually challenged individuals. At the time of this writing, no formal testing has been done on AlphaBraille. It was, however, found difficult by this researcher upon independent testing to make sturdy Braille dots that conformed to the standards of Braille size, which this research predicted would make the plates difficult for visually challenged people to read. Feedback from participants at an ADA celebration did acknowledge AlphaBraille prints to be potentially effective in conveying text. However, as predicted, they stated that the Braille text was too large. As 3D printing technology improves, we predict that smaller, sturdier Braille dots will be possible to print. *[Acknowledgment: CRA-W Program]*

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Subcategory: Computer Science & Information Systems

OSSEC Intrusion Detection System's Ability to Detect Denial-of-Service Attack on the Linux Operating System

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Due to the growing number of cyber-attacks, Intrusion Detection System (IDS) are becoming a vital part of any enterprise conducting business over the Internet. IDS monitor suspicious activities on a network and alert the system or network administrator of any abnormal activities. This idea of cyber-security emerged from a paper that introduced the notion of intrusion detection written by James Anderson in 1980. A common attack is the Denial of Service attack where computing or memory resources are stressed to serve legitimate traffic request. This study focuses on Host-based Intrusion Detection System (HIDS), a software running on individual host machines that analyzes activities and maintains system file or integrity with a specific purpose of detecting DoS attacks. The main thrust of this research is the design and configuration of an IDS such as the open source Office of State Security and Emergency

Coordination (OSSEC). OSSEC performs log analysis, integrity checking, rootkit detection, time-based alerting and active response. Rules are defined in order to detect HIDS attacks such as DoS attacks, based on the analysis of the webserver (Apache) log files. To accomplish such a task, XML and regular expressions languages are used to identify patterns and respond by actions such as alerting the system administrator or stopping the attacks by killing processes. The next step is to test the IDS effectiveness by generating DoS attacks with the TevDos tool. This tool is used to simulate DoS attacks by sending multiple requests to the webserver (Apache). The effectiveness is discussed in terms of detection rate and false positive rate. *[Acknowledgment: This research is funded by Emerging Caribbean Science (ECS) Program.]*

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Subcategory: Computer Science & Information Systems

Designing an Effective Scheduling Algorithm

Lauritz David, Jr, University of the Virgin Islands

Many institutions, businesses, and organizations require scheduling to keep them on track with daily, weekly, monthly, and even yearly tasks. Scheduling is the action of sorting, organizing, and structuring required demands into available resources. In some situations there are constraints on the demands, which can only work for particular resources. There are two types of constraints, soft constraints and hard constraints. Hard constraints must be met for the demand to be scheduled, but the soft constraints are requests that are satisfied for convenience. For example a college schedule would have hard constraints such as the amount of seats in the class, but a soft constraint could be the time the class was held. To implement this into a program, research was done to find the optimum algorithm for getting the best results in a reasonable amount of time. The Tabu Search algorithm was chosen because it was simple and effective. When completed, it would check possible solutions and choose the one that satisfies all hard constraints and the most soft constraints, producing a satisfying schedule. First a priority queue program organizes the demands from most constraints to least. Next, a blank schedule is created for the beginning of a binary tree. As the tree branches out, the first level of branches attempts to add one demand to the blank schedule, and creates another level of branches for each instance where the demand can fit in the schedule. Each branch is called a node. Before the tree continues branching a cost function is added to determine which node satisfies most of the soft constraints without violating any hard constraints. The tree continues branching and adding demands into available resources, but only following the branch with the best cost until all the demands have been placed creating a complete schedule.

Being a student at the University of the Virgin Islands (UVI) and knowing that it made its schedules by hand, sparked an interest in seeing the possibility of writing a scheduling program and later applying it to the UVI classes. Not only would the program be able to schedule UVI classes but it will also find the near optimal solution, satisfying as many constraints as possible.

[Acknowledgement: The University of the Virgin Islands, ECS Program, SURE, NSF, HBCU-UP.]

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Subcategory: Computer Science & Information Systems

NeRvolver: A Multi-Objective Evolutionary Algorithms and Fuzzy Logic-based System for Automated Construction, Tuning, and Analysis of Neuronal Models

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Myles Johnson-Gray, Parth Patel, and Tomasz G. Smolinski, Delaware State University

Computational modeling of neurons plays an important role in modern neuroscience. It allows for exploration of various types of neuronal activity, as well as nerve cells responses to stimuli and perturbations, without requiring a prohibitively large number of 'wet' experiments. Neuronal modeling is also gaining popularity in biomedical research, where computational studies of, for example, central pattern generators, which drive such critical rhythmic activity as breathing or walking, can aid in the understanding of diseases affecting those vital functions. Building neuronal models, however, even on the single-cell level, requires a lot of effort invested in the design of a realistic model structure and proper tuning of the model's parameter values. Hence, automated methods for neuronal model construction have lately gained a lot of attention.

Here, we propose a computer system based on the hybridization of multi-objective evolutionary algorithms and fuzzy logic for automated construction and tuning of neuronal models. The system, NeRvolver, is designed to optimize the parameters of existing neuronal models, but also to allow for creation, 'from scratch,' of sets of models matching some predefined criteria (e.g., neuron's activity characteristics), by utilizing, for example, only a limited set of generic parameters as the starting point in the process of model construction. Moreover, in addition to generating neuronal models, through the hybridization of evolutionary algorithms and fuzzy logic, the system generates classification rules describing biological phenomena discovered during the process of model generation (e.g., 'IF sodium axon conductance is low, THEN spike frequency is low').

The purpose of generating such rules is twofold: 1) they can be used in later runs of the modeling algorithm to improve its

convergence time, and 2) they may provide insights into the functioning of the biological neurons being modeled. For example, by using the aforementioned rule, the system may automatically increase the sodium axon conductance across the individuals in the evolutionary algorithm's current population, if a higher spike frequency is desired. In addition, based on the above rule, the conclusion may be drawn that sufficient sodium axon conductance is necessary for adequate spike frequency. Such inferences, here automatically generated by the system, can obviously be extremely useful for the understanding of the underlying biological phenomena. [Acknowledgment: NSF HBCU-UP 0928404 to EF; NIH NIGMS RISE R25GM089669 to MJ-G; NIH NCRR 5P2ORR016472-12 and NIGMS 8P20GM103446-12 to PP and TGS; NSF EPSCoR 0814251 to TGS]

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Subcategory: Computer Science & Information Systems

Computing a Network of Proteins Based on Functional Similarity

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To understand a biological system, it is not enough to understand the individual components. We must also understand how these components function together. Network models let us see patterns that help us to understand complex associations amongst proteins. Nodes represent genes and/or proteins. Nodes are connected by an edge if they are associated in some way. We have used various network edge types, including protein interactions, gene regulation, gene co-expression, and similar phenotype. For this project, we want edges between proteins with similar functions. For two reasons, it is not straightforward to measure the similarity of protein function. First, proteins can have multiple functions. Second, each function is represented by a hierarchy of functions at various levels of specificity, so that some functions can be considered to be more similar than others. We investigated different ways to compute a functional similarity, and decided to implement the Kappa Statistic using python programming language. We applied this measure to proteins associated with the Mediator complex to better understand variants of the complex. [Acknowledgment: National Science Foundation – NSF SMART Program at the University of Colorado - Boulder]

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*Subcategory: Computer Science & Information Systems***Augmented Reality as a Tool for Learning and Safety****Usha Govindaraju, Bowie State University**

In order to keep up with upcoming technologies, we have incorporated the idea of Augmented Reality (AR) into smart phones. AR is a technology that offers a direct or an indirect view of a real world environment. Using this tool, one would be able to see a computer generated environment. Such an application would be very useful when evacuating a building because one can simply pull out their smart phone and see where they are and where the exits are. The goal of the project is to use AR as a tool for learning and safety during evacuation at Bowie State University. Our proposed prototype will help people to safely evacuate a building in case of an emergency situation. It will further enhance knowledge and understanding of where the exits are in the building. Moreover, our proposed prototype can also lead to research opportunities for undergraduate and graduate students and will help to build a research infrastructure using AR. Our hypothesis is that the use of Augmented Reality will help us improve people's knowledge of exits in the building and safety evacuation procedures. We have examined Vizard, 3ds Max, FLARToolKit, and Unity3D technologies to support our 3D visualization tool. Our objective is to use markers and mobile devices to visualize the 3D model of the building plan as a three dimensional object. This can be achieved by setting up markers at different locations of the building. Students can use their smart phone and use the camera option to view the projected 3D model of the building and know exactly where they are located in the building and where the exits are in the building to evacuate safely. We are currently exploring the use of GPS and real-time video to integrate it in our prototype. The outcome of this project will result in visualizing the 3D model of the building using markers and smartphone. The 3D model will be able to show the simulation of people exiting the building. In conclusion, this project will ensure safety in an emergency situation and will help the students to find the safest exit in the building. The anticipated outcome of this project is to use augmented reality as a tool for guiding people people to safety in an emergency situation using mobile device. *[Acknowledgment: The authors would like to thank the National Science Foundation for supporting the project. This work is funded by grants HRD-1137541 and HRD-1238784.]*

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*Subcategory: Computer Science & Information Systems***Design and Testing of Photon Detection Unit for Quantum Communication Receiver Station****Devonte Holmes, Virginia State University**

Quantum Communication (QC) is a next-generation technology for secure transferring of information. The security of such network is guaranteed by the unique nature of entangled photon pair. A key component of QC network is the user-end station that is capable of detecting a single photon at a specific wavelength. The project investigates a high-speed, in-expensive receiver station. The receiver station uses a PGA300 photo diode from Princeton Lightwave to single photon detection. In order to achieve high operating speed and precise photon counting, the diode avalanches are carefully controlled by gating signal, which is generated by a Cyclone 4 FPGA device. The built-in phase lock loop on the FPGA accepts a reference input frequency, which comes from the reference output of the laser source. Using a MAX9601 device, a high-speed signal up-convert circuit is designed to convert the weak laser reference output to a sufficient gate signal. The circuit deliver high-quality gating signal at 76 MHz and the overall system achieve a 120 Kbps secure channel per user station. I was responsible for using a program named PCB123 to design a PCB board for usage of a sensitive QKD (Quantum Key Distribution) station to detect one photon. This photon was to be used in study and research for communication in technology dealing with information and data. My project dealt with circuits, capacitors, diodes, resistors, and connecting these various parts to help this PCB board function and perform some of the duties of the QKD Station. This research is important because it will prove useful detecting photons for devices and communication technology. The speed can be measured, and the photon can be examined for research purposes to improve all technology that uses and deals with photons. *[Acknowledgment: NSF HBCU-UP Program Oak Ridge National Laboratory]*

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*Subcategory: Cancer Research***Validation Study On Potential Cervical Cancer Genes Identified By Novel Microarray Data Analysis****Luis E. Irizarry-Nieves, University of Puerto Rico, Mayaguez**
Clara E. Isaza, Jaileene Perez-Morales, Marilia Perez-Santiago, and Mauricio Cabrera-Rios, University of Puerto Rico, Mayaguez

The Applied Optimization Group at University of Puerto Rico, Mayaguez has been analyzing publicly available microarray data

as a multiple criteria optimization (MCO) problem. One of the methods that can be used to solve an MCO problem is Data Envelopment Analysis (DEA). By using DEA, it is possible to find which genes change their expression to most between the conditions being compared in a microarray experiment. This work started with a set of genes selected through DEA applied to cervical cancer microarray data. A comprehensive literature search was undertaken to investigate the role of these genes, aiming to bridge data and mathematically-driven results with biological meaning. DEA was applied to two cervical cancer microarray databases and 53 genes were selected as changing significantly their expression between normal and cancer tissues. Literature searches were performed for each one of the genes to find out if they and/or their products had been reported previously as playing roles in cervical cancer, or in other types of cancer. The information for the selected genes was obtained using Pubmed and Genecards.

This work concentrated on the following information: alternate names, brief description of function, cancers related to the gene, previous uses as a therapeutic marker, and indirect relations to cancer. The results showed that 8 of the 53 genes identified have not been associated with a cancer before; thus, making them interesting leads to follow. There were 23 instances of a gene being directly related to a cancer, 55 instances where a gene had been used as a therapeutic or prognostic marker and 54 instances where the genes had an indirect relation to cancer. This study supports the analysis of microarray data as an MCO problem. It shows that there is still useful information that can be obtained from the available data, and presents 8 genes not associated with cancer before that are worth of further investigation. *[Acknowledgment: The Bio IE lab is funded by NSF UPRM CREST Nanotechnology Center for Biomedical and Energy-Driven Systems and Applications (Project 0833112) as well as the NIH MARC Assisting Bioinformatics Efforts at Minority Schools. NIH-MARC grant "Assisting Bioinformatics Efforts at Minority Institutions" PAR-03-026.]*

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Subcategory: Computer Science & Information Systems

A Pilot Study to Determine the Effects of a Web-Based Animated Pedagogy in Two Basic Science Courses

Dion Jackson, Talladega College

An effective education practice utilizes successfully integrated knowledge in classroom teaching strategies. The progressive evolution of technology has become the driving force behind innovative social media demands in classrooms. Active learning techniques have a great potential to be the medium which captivates students minds in the learning environment. This pilot research project proposes to determine the need to

integrate two basic web-based STEM courses, Biology-101 and Computer Science-150, to retain students' interest in STEM careers. Forty percent (40%) of the entering college students choose STEM fields as a major. This study identified related factors in STEM enrollment and course retention which influence learning in traditional and web-based courses. An assessment procedure will be used to collect students' opinions after applying this model in the Fall 2012 and Spring 2013 semesters. *[Acknowledgment: This study was partially supported by NSF/HBCU-UP Grant HRD-0811157, Talladega College, Talladega, AL 35160]*

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Subcategory: Computer Science & Information Systems

Usage of Mobile Technology to Improve Unspoken Interaction Between Faculty and Student in Classroom Settings: A Study of the Literature

Kierra Jackson, Talladega College

Educational technology can broaden and enhance the use of active learning in classrooms. Students are using technology as a tool for communicating with others and engaging in an active role rather than the passive role of recipient of information transmitted by a teacher. This active engagement is an important tool in improving student learning outcomes. This study examined the possible benefits of using mobile phones to increase interaction and promote active learning in large and small classroom settings.

Today's students are part of the electronic generation and meeting face-to-face with a professor may not happen often. The student might prefer to have a discussion via e-mail or text messaging. Research indicates that many students prefer to use their mobile phone to interact with their professor in the classroom setting. Use of the cell phone in the classroom gradually increased to 99% in 2006, as compared to 96.4 % in 2005. The acceptance of mobile phone technology as a learning aid is an obvious step toward college progression. Scornavacca, Huff, & Marshall (2009) indicated that in classroom settings only 10% of the students raised their hand to ask a question whereas, 38% used Short Messaging and Services (SMS). Therefore, it was indicated that students hesitate to ask question in classroom for fear of embarrassment and humiliation.

This study resulted in the development of a model Text-2-Text-2-Learn (T-2-T-2-L) to ask a question during the class lecture or beyond to increase the interaction between Faculty and Student using SMS techniques. Using this model, the professor receives

the message and responds after class or at a later time. This process reduces the feeling of being humiliated by classmates. This study also developed an assessment procedure to apply the model in two Fall 2012 and Spring 2013 classes. The students' opinions will be collected from the classes and will be evaluated later for the possibility of integrating the model in more than two courses. Text-2-Text-2-Learn could be used to determine the use of SMS to reduce barriers between faculty and students in order to enhance students' learning outcomes and reduce attrition in courses. *[Acknowledgment: The study was supported by NSF/HBCU-UP Grant HRD-0811157, Talladega College, Talladega, AL 35160]*

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Subcategory: Computer Science & Information Systems

Measuring the Usability of Text-Based CAPTCHAs

Terecia Jones, Philander Smith College

Cedale Smith, Philander Smith College

The adoption of Completely Automated Public Turning Tests to Tell Computers and Humans Apart (CAPTCHA) to differentiate between humans and computers is an increasingly adopted practice by websites. One of the most familiar of these CAPTCHAs is to ask users to type in some sequence of distorted but common characters. However, these text-based CAPTCHAs are found to be unusable and difficult to interpret, even for humans with near perfect vision. This study aims to investigate usability issues in the widely adopted text-based CAPTCHAs.

We develop a scale to measure the usability on dimensions of: (i) distortion; (ii) content; and (iii) presentation. Survey instrument and screen capture software are used to collect data from 85 users and to record web browsing behavior and time consumed in solving CAPTCHA. An exploratory factor analysis and equation modeling are applied to test the dimensions proposed to measure CAPTCHAs usability. Analytical work indicates that there are significant correlations among: (i) reaction time to solve CAPTCHAs; (ii) rate of misidentification; (iii) rate of timeout; and (iv) overall usability of CAPTCHAs. Ideally, CAPTCHA design should consider usability metrics that support a broad range of users. However, currently, users find it challenging to solve text-based CAPTCHAs.

The study offers its implication for research and practice and provides its guidelines in designing usable text-based CAPTCHAs. Future step in this research is to confirm our scale dimensions and to test the developed instrument to measure the usability of text-based CAPTCHAs. *[Acknowledgment: This study was supported, in part, by a grant from NSF/HBCU-UP award no.*

238895, Awarded to Dr. Frank James, Dr. Samar Swaid and Dr. Cynthia Burroughs, Philander Smith College, Little Rock, AR]

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Subcategory: Computer Science & Information Systems

Integration of X-Band Radar Software to Visualize Real-time Radar Data

Danielle Mason, Virginia State University

For the SMARTLabs (Surface-based Mobile Atmospheric Research and Testbed Laboratories) group, utilizing the various radars for aerosol detection in clouds is a vital part of its mission for the group's ACHIEVE (Aerosol-Cloud-Humidity Interaction Exploring & Validating Enterprise) trailer. The focus of this research is on the X-band radar. To have successful functionality of the X-band radar for the SMARTLabs ACHIEVE trailer, it is necessary to produce code to retrieve data from an FPGA board linked to the radar and to also visualize that data through the use of Fast Fourier Transforms (FFTs) and a reliable programming language. So that the communication between the FPGA board and the computer is accurate, developing a specific data format through the use of C was an initial step. This was followed by the development of a method to visualize data in the most efficient way possible. In this case, Python, along with its matplotlib, SciPy, and NumPy modules, was used. Both programs were then integrated together within a graphical user interface. At the time, the use of such a set up was acceptable, however, other methods can be found to replace the current one in place. Future work will stem from refining aspects of the software and visualization so that it will run in an optimized manner, thus displaying more plotted data in a relatively faster amount of time. This can possibly be achieved by converting all software and visualization into one language, most likely C. *[Acknowledgment: This research is supported through the NASA NSTI Program.]*

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Subcategory: Computer Science & Information Systems

Using Visual Studio 2010 for Windows Phone to Develop Silverlight Applications

Carlton McClain, Alabama State University

Traditionally, among several programming paradigms, undergraduate computer science students mostly use imperative and/or object oriented paradigms. Standard Library

Functions and Standard Template Library (STL) have been used to strengthen their programming ability. Using current internet era application development environment can move students' programming abilities to another level, enabling them to code windows phone programs that interfere with the physical environment and create sophisticated applications.

In this research, the entire Windows Phone development environment necessary for developing and testing windows phone applications is studied and used. This includes software development tools such as web-browser Microsoft Silverlight, Microsoft Integrated Development Environment (Visual studio 2010 Express), NET Framework 4.0, XNA Framework and XNA Game Studio 4.0, and Windows Phone Emulator. The hardware tools that are frequently used in developing applications for detecting physical phenomena such as motion, speed, and rotation that affect programming is Windows Phone. Several Windows Phone applications are being coded, compiled, and tested by the emulator.

The study reveals differences between Silverlight programming for the web and Silverlight programming for Windows Phones, indicating Windows Phone has the upper hand when it comes to interaction with sensors such as accelerometer, gyroscope, or simulation of the location. This approach can serve as an addition to pedagogy. It brings about a choice and an auxiliary alternative to advanced programming, specifically in educational settings. Future work is to expand these applications and test them on actual physical windows phone devices such as Nokia Lumia 900 Windows Phone 7.5. *[Acknowledgment: A large debt of gratitude is owed to my research advisor Dr. Iraj Danesh, NSF and HBCU-UP program that made this research possible.]*

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Subcategory: Genetics

Computationally Detecting Interaction Sites of Cytochrome and Photosystem I for Generating Green Energy

Pankaj Mishra, Tennessee State University

Wei Chen, Ali Sekmen, and Barry Bruce, Tennessee State University

Hydrogen is a particularly useful energy carrier for transportation; it can function as a replacement for petroleum-derived liquid fuels and utilized in a fuel cell without producing carbon dioxide or oxides of nitrogen. However, there are no sources of molecular hydrogen on the planet. It merely remains to find an efficient and environmentally sustainable way of capturing, storing and utilizing this practically limitless but dilute energy source. In order to generate hydrogen at a high rate, some recent research proposed to create mutagenized

complexes of cytochrome and photosystem I unit and engineer new residues into the native complexes to create a binding site to those found in green algae and higher plants. For finding the best candidates from cytochrome and photosystem I, it is important to predict the interaction sites of protein pairs and chemical properties. Predicting the interaction sites of protein pairs by laboratory experiment is time consuming and expensive. In this research, computational approaches are proposed for predicting interaction sites of protein pairs of cytochrome c6 and photosystem I unit Psaf. First, a mathematical model is built for the caused by electrostatic bond and hydrogen bond. Second, time efficient algorithms which use dynamic programming technique is designed to calculate the interaction scores and predict the interaction sites based on the scores. Third, the interaction sites for 86 protein pairs of c6 family and Psaf family from the same organism are predicted by using the proposed algorithms. Finally, net charges of residue sequences at interaction sites and statistics properties are analyzed. In future, more issues such as hydrophobic bond and property in three dimensional protein structures will be considered for making the prediction more accurate, and solution will be comparison to that of laboratory experiment.

[Acknowledgment: This research is supported by TN-Score and NSAF to the Department of Computer Science, Tennessee State University.]

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Subcategory: Genetics

Is Digital Normalization Really the Way for a Better Tomorrow?

Gavin Richard, Grambling State University

C. Titus Brown, Michigan State University

In the field of computer science there is always a need to find the fastest, cheapest, and most accurate way to process data. Digital normalization, also referred to as diginorm, is a program created for this very reason. It processes shotgun sequencing data sets to lower variation, gets rid of most errors, and disposes of repetitive data. The purpose of this project is to prove that diginorm is actually discarding data that is redundant rather deleting data that may be important for assembling full-length transcriptomes. To test this experiment, the yeast transcriptomic reads produced from shotgun sequencing are run through a program created in the lab that halves data randomly and then processes the data through diginorm. The program developed in the lab was run multiple times so that the original data was divided into three portions—halves, fourths, and eighths—with each portion having random data sets. The digital normalized data was run through the Trinity assembler followed by the three divided data sets. Afterwards the full-length

transcriptomes, produced from the three portioned data sets, were compared to the digitally normalized transcriptome. The results show that although diginorm reduces the number of reads to approximately 2.32 million, considerably lower than the original 50 million, when compared to the assembled transcriptomes from the portions of 25, 12.5, and 6.25 millions reads, the data run through diginorm produced better results. When run through the Trinity assembler, the digitally normalized data was shown to produce a greater number of transcripts, a larger maximum contig length, and a N50 (which shows half of the assembly is contained in a contig larger than this value) that is also bigger than the portioned data. Proven to be both efficient and effective, the next step is to test diginorm for its speed in comparison to other programs so that one day it could make processing genetic data to find cures for diseases faster and cheaper. *[Acknowledgment: This study was supported by Michigan State University SROP to Dr. C. Titus Brown, Assistant Professor, Department of Computer Science and Engineering, Michigan State University, East Lansing, MI 48825.]*

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Subcategory: Computer Science & Information Systems

Towards a Framework/Middleware for Location-Aware Mobile Information Systems Using NFC

Brian Rose, Norfolk State University

Navigation with handheld devices has become increasingly popular in the modern age. Today, many handheld devices use Global Positioning System (GPS) as the main method of location-awareness and navigation assistance. While GPS can pinpoint the exact location of where a device is outdoors by using satellites, it is unable to do so in highly congested or indoor areas. Other technologies have been used to work around this problem, including WiFi and Bluetooth. This research was performed to create a new system for navigation using a signal detection technology called Near Field Communication (NFC). Previous works that used similar technologies for tour systems inspired it. The project set out to develop an Android application using the Java programming language and the Android Software Development Kit (SDK). The Robinson Technology Center at Norfolk State University was used as the location for the system prototype functionality. Programming was done using the Eclipse Integrated Development Environment (IDE) with the ADT (Android Development Tool) plugin. A prototype middleware was developed that enabled Android devices with NFC the ability to be location-aware as well as provide information about a current location. The prototype will be expanded in the future to include a populated database with complete campus information, and additional NFC tags will be created for all locations on the Norfolk State campus. *[Acknowledgment: This*

study was supported by the National Science Foundation Grant 0714930 (STARS).]

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Subcategory: Computer Science & Information Systems

Multiple Sequence Alignment Using Motif Assembly

Charnelle Smoak, North Carolina A&T State University

Multiple sequence alignments are useful for conducting phylogenetic inference and are used as a means to infer the structure and function of a protein in conjunction with previously obtained knowledge. Alignments produced by current multiple sequence alignment methods rarely produce the best model of sequence evolution, requiring hand-editing of alignments to ensure that important biological motifs are aligned. We devised a multiple sequence alignment pipeline which anchors these motifs and builds a multiple sequence alignment around them eliminating the need to hand-adjust alignments around key motifs. This alignment method produces superior alignments compared to native alignment algorithms in some cases. In our test case, the motif assembly method aligned the sequence to a more biologically acceptable alignment. The motif assembly method has to be modified to include a wider range of datasets. Future research will expand the usability of the pipeline. *[Acknowledgment: This work is supported in part through NIH grant: T36-GM-095335.]*

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Subcategory: Computer Science & Information Systems

An Analysis of Urban Watch Flow Data

Kendra Thompson, Mississippi Valley State University

The Monterey Bay National Marine Sanctuary's (MBNMS) Water Quality Protection Program (WQPP) team coordinates annual volunteer-based water quality and watershed monitoring programs. One such program is the Urban Watch monitoring program, which provides an approach for local residents and community members to become involved in learning more about water quality and inner-city pollution issues. The program's purpose is to utilize volunteers to monitor dry weather storm drain activity (June - October), and also to identify numerous pollutants (analytes) and contaminants within selected storm drain outfalls that are harmful to the Sanctuary and marine environment. The data collected and analyzed by Urban Watch program volunteers has helped

Monterey and surrounding cities implement educational programs to inform the public of the pollutants entering and affecting the Sanctuary. Since the program's initiation in 1997, there have been many assumptions including how much water is flowing into the Sanctuary and the level of pollutants contained in the water flowing through the storm drain outfalls. Since urban runoff is one of the leading sources of pollution of coastal waters, knowing the flow or gallons per minutes (GPM) from each outfall is very useful to the MBNMS and the WQPP. Using the flow from these outfalls, pollutant concentration (load) can be calculated.

With additional monitoring, the velocity along with existing flow depth and width data was used to develop a C++ program to analyze and calculate the GPM from each storm drain outfall. The GPM calculations were applied to compute the load of each analyte. Analytes that were considered to be a main concern are detergents, chlorine, ammonia, and orthophosphate. The results included annual GPM and loading computations for four of the Sanctuary's storm drain outfalls. The final phase of the project will result in statistical estimates of ten years worth of Urban Watch data. Overall, the analysis of the Urban Watch data is intended to observe and estimate loading of urban pollutants entering the Monterey Bay National Marine Sanctuary. *[Acknowledgment: This study was supported, in part, by the National Oceanic and Atmospheric Administration (NOAA), Educational Partnership Program (EPP); awarded to Kendra Thompson, Mississippi Valley State University, Itta Bena, MS.]*

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Subcategory: Computer Science & Information Systems

Hyperspectral Microwave Atmospheric Sounder Emulator

Janelle Williams, Virginia State University

Giti Javidi, Virginia State University

Lawrence Hilliard, Goddard Space Flight Center

Major weather facilities around the world that recognize microwave atmospheric sounding is the key to developing technology for weather and climate missions. The mission for Hyperspectral Microwave Atmospheric Sounding Emulator is to produce a model for demonstrating the hyperspectral techniques that retrieve data near 118 and 183 GHz through a 52 channel Intermediate Frequency processor. This project establishes a test bed that mimics the functionality of the instrument such as how data is retrieved and processed through computers in the instrument. The computers are programmed using a new framework application called Interoperable Remote Component. This software allows flexibility to program computers on how to communicate with each other, what devices to connect to and other factors. Once the construction

of the test bed is completed, the IRC system will be installed on each computer and tested for functionality using sample data produced through a microcontroller. Not all parts of this project are completed; MIT Lincoln Labs is responsible for building the Intermediate Frequency processor module. NASA GSFC is still developing the receivers and the computers that process the incoming data. Completion is expected in 2014.

[Acknowledgment: Summer research work was funded by the NASA NSTI Program.]

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Subcategory: Computer Science & Information Systems

Concurrent Missile Control and Interception System Simulator

Charlesvester Wims, Alabama A&M University

Xiang Zhao, Alabama A&M University

The objective of the project is to design and implement a concurrent missile control and interception simulator using a modern computer programming language. When multiple missiles are directed toward targets, how to track and intercept the missiles accurately and rapidly is a challenging and crucial problem to designing the defense systems. In order to allow students to explore the latest parallel processing techniques and apply them to solving real-world problems, this project aims to build an example simulator for missile control and interception system. We will use multithreading techniques to control multiple missiles simultaneously, track and display their positions in a GUI (Graphic User Interface).

The simulator intends to provide the following functionalities: (a) calculate and display the missiles' current positions in the GUI, (b) intercept one of the missiles from the opposite side, from a fixed location, (c) intercept the missiles from the opposite site, from an arbitrary location. In this project, we will create one thread for each missile and another separate thread for its interceptor. These threads will calculate the positions of the missiles and their interceptors, correspondingly. The intersection points of the missiles and interceptors will also be computed using efficient root finding algorithms. The intersection results can be viewed in the GUI window. We believe the outcomes of the project will provide a system prototype for future student senior design project and research in high performance computing. *[Acknowledgment: NSF HBCU-UP grant #HRD0928904]*

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Ecology, Environmental and Earth Sciences

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Subcategory: Pollution/Toxic Substances/Waste

Gene Expression of Cytochrome P4501A (CYP1A) in *Cyprinodon Variegatus* When Exposed to WAF and CEWAF in Various Salinities

Veronica Alston, Tuskegee University

The overall summary of my project was to test the changes in the CYP1A gene when *Cyprinodon variegatus* (Sheepshead Minnow) were exposed to different levels of salinities in WAF and CEWAF treatments. The salinities that were used in this experiment were 5 parts per thousands (ppt), 15ppt, and 25ppt. The purpose of the different salinities was to see if the salinities had an effect on the CYP1A gene while being exposed to oil, WAF and CEWAF. CYP1A1 is involved in phase I xenobiotic and drug metabolism. It is involved in the metabolic activation of aromatic hydrocarbons (polycyclic aromatic hydrocarbons, PAH). WAF is Water Accommodated Fraction. This means that the oil in the water has not been treated with anything and consists of just oil and water. WAF is made in the lab by blending the oil for 30 seconds then pouring the compound into a separatory funnel and covering with foil for one hour. After this, the oil is drained and ready for use. CEWAF is Chemically Enhanced Water Accommodated Fraction. This means that the water that has oil in it has been treated with an oil dispersant. The water will contain oil and a dispersant within it. CEWAF is made in the lab by mixing oil and dispersant in a aspirator bottle with a magnetic stir bar, covering with foil, spun for about 18 hours and then let sit for an additional three hours. My hypothesis is that the higher the salinities, the higher the mortality would be and also the mortality would be higher in the WAF treatments. In this experiment, larval fish had a higher mortality rate in the higher salinities than in the lower ones. Also from the data, larval fish that were exposed to the CEWAF had a less likely chance of surviving the exposure than the fish in the WAF treatments. The qPCR showed that the higher salinities, the higher the CYP1A gene was expressed. This has a relation to the mortality data that was collected.

[Acknowledgment: National Oceanic and Atmospheric Administration]

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Subcategory: Ecology

Habitat Preferences for North Dakota Myotis Bats: Using Land Cover to Predict Distribution Patterns

Monica Bailey, University of Minnesota

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Nicholas Kludt, University of North Dakota

Currently, little is known about the distribution of insectivorous bats in North Dakota. Very limited knowledge is available about the species presence, abundances, or geographic distribution. Due to this lack of knowledge, initial acoustic-capture population sampling was conducted in a non-random fashion in development areas thought to have robust populations of Myotis bats. To better understand the habitat requirements of these species, USGS GAP data was analyzed using a variety of buffers corresponding to previously determined Myotis genera foraging distances, divided by sex and age, and sensor detection range. The habitat preferences were then determined via statistical testing, after which a predictive model of other possible "bat hot-spots" across the state was developed. GAP data, land cover data specifically classified for conservation and diversity modeling applications, for 2005 and 2010 was analyzed to contrast land cover differences between a historically wet year and a relatively normal weather year, respectively, and possible implications for the data were discussed. With the rise of the White-Nose Syndrome fungal epizootic in the Eastern United States, it is imperative to expand our knowledge of these economically important mammalian pollinators and prodigious insectivores. If said fungus expanded to include North Dakota, it is only through knowledge of the distribution and habitat requirements of the various Myotis species that conservation efforts could be taken to preserve their populations.

[Acknowledgment: UTTC, CIPAIR, and NASA]

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Subcategory: Environmental Engineering

Spectral Analysis of Soil Moisture Time Series from the NOAA-CREST Observation Site in Millbrook, NY

Amelise Bonhomme, New York City College of Technology

Kibre Tesfagiorgis, Marouane Temimi, and Nir Krakauer, City College of New York

Soil moisture is the water content located within the soil. It affects our weather and climate, agriculture, and irrigation. The study of soil moisture enables the study of runoff potential and flood control, soil erosion and slope failure, reservoir management, and water quality. The ultimate goal of this project is to examine the relationship of soil moisture to

temperature and precipitation, as well as to statistically analyze the collected data. These measurements are provided by L-band (1.4 GHz) microwave readings and soil moisture and temperature sensors (Stevens Digital Hydra Probe II) mounted at two locations (A and B) and depths of 2.5, 5, and 10 cm. Here, we focus on the data provided by the sensors. These measurements include hourly data from the time of deployment of the soil moisture probes in November 2010. The probes are located close to the National Oceanic and Atmospheric Administration US Climate Reference Network Millbrook station, which measures soil moisture at three locations (1, 2, and 3) at depths down to 1 m as well as surface temperature and precipitation. To achieve this goal we analyze *in situ* observations from Millbrook, NY. We analyzed the relationship between precipitation and temperature as well as that of the soil moisture and diurnal temperature range. We then analyzed the correlation, lagged auto and cross correlation, and coherence of the different measurement time series. The soil moisture shows a great variation over time. We see a strong correlation coefficient between the different soil moisture data collected at the Millbrook site, and a weak correlation coefficient at the hourly scale of the precipitation data with the soil moisture data from Millbrook. [Acknowledgment: National Science Foundation Cooperative Remote Sensing Science and Technology Center Research Experiences for Undergraduates, National Oceanic and Atmospheric Administration Cooperative Remote Sensing Science and Technology Center.]

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Subcategory: Ecology

Comparison of Nitrogen Oxide and Ozone Concentrations in the Soul of the Northwest Corridor of Charlotte, NC

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Chinaemeze Kelsey Okoro, WSSU

Jonathan Pullin, Cindy Hauser and Timothy Champion, Johnson C. Smith University

Passive samplers were prepared according to the Ogawa & Co. protocol. After assembly, the samplers were placed in plastic bags, sealed in air-tight containers, transported to the specified sites and placed in Ogawa shelters, for protection from wind and precipitation, mounted between 2 and 3 meters above the ground. Researchers were trained regarding proper procedure for retrieving and placing collectors under the protective cover. Duplicates were collected at each site to ensure precision. Upon removal from the field, exposed NO_x filters were extracted into 8 mL of de-ionized water and refrigerated until analyzed. Two laboratory blanks were prepared for each filter, along with a set of six standard nitrite (NaNO₂, cert. ACS, Fisher) solutions varying from 0.000 to 1.000 ppm (including the reagent blank) in

de-ionized water to produce a standard curve. Absorbance spectra were collected from 400 nm to 650 nm using an Agilent 8453 UV-Visual spectrophotometer, with de-ionized water as the reference. The ambient concentrations of NO, NO₂ and NO_x were determined according to the Ogawa & Co. provided protocol. Exposed ozone filters and laboratory blanks were extracted with 5 mL of de-ionized water and sonicated for ten minutes. Nitrate standards (NaNO₃, a Dionex cert. ACS, Fisher) were prepared using de-ionized water, with concentrations ranging from 0.5 to 3.000 ppm (including the reagent blank). Standard and sample solutions were analyzed using DX-100 ion chromatograph (IC), with a Na₂CO₃/NaHCO₃ buffer as the mobile phase. Ambient O₃ concentrations were determined using the Harvard School of Public Health protocol incorporating pressure and temperature data to correct for the standard volume per mole of air collected. The NO concentrations were plotted to illustrate site-by-site variations. Data indicated that the inner city and suburban sites were similar in NO concentration throughout the project. The NO₂ concentrations consistently varied from week-to-week. The NO_x concentrations at the inner city site (located adjacent to a major highway) were higher than those measured at either the second inner city site (which is more residential) or the Davidson site (which is suburban). The O₃ concentrations for the Davidson site measured slightly higher than both of the inner city sites during weeks two and four of the study. [Acknowledgment: Funded by Johnson C. Smith University]

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Subcategory: Water

Comparative Study to Determine the Water Quality Parameters of Bioluminescent Mangrove Lagoon and Salt River Bay, St. Croix, USVI

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Lynisha Farrell, Anthonio Forbes, and Shelsa Marcel, University of the Virgin Islands

Bernard Castillo II and Kynoch Reale-Munroe, University of the Virgin Islands

Located on St. Croix, US Virgin Islands, Salt River Bay National Historical Park and Ecological Preserve contains both historic ruins and a diverse ecosystem. Salt River Bay is known for its mangrove forests and coral reefs. Bioluminescent dinoflagellates can be found throughout the entire bay. The dinoflagellates responsible for bioluminescence are small unicellular protists. Bioluminescence results from the conversion of chemical energy to light energy. Bioluminescence appears to be most concentrated in Mangrove Lagoon. The main objective of this study was to determine and compare

water quality parameters of Mangrove Lagoon and Salt River Bay. Water quality parameters, namely dissolved oxygen, salinity, temperature, pH, and turbidity were collected using a YSI data logger within the bioluminescent Mangrove Lagoon and Salt River Bay. Salinity and temperature are the two water quality parameters that this research project focused on, and the results acquired were compared to known bioluminescent bays in literature. Results showed that the average salinity in Salt River Bay was 36.47 ppt and 37.98 ppt in Mangrove Lagoon, while the average temperature was 29.86°C in Salt River Bay and 30.30°C in Mangrove Lagoon. [Acknowledgment: This research was funded by UVI CS-Summer Undergraduate Research Experience Program, and NSF HBCU-UP Grant Award No. HRD 0506096.]

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Subcategory: Ecology

***Biomphalaria glabrata*: The Putative Induction of an Imposex Condition using Triphenyltin Chloride**

Mohamed Dumbuya, University of the District of Columbia

Biomphalaria glabrata is a freshwater snail which is an intermediate host for the human parasite, *Schistosoma mansoni*, a flatworm species responsible for Schistosomiasis. *Biomphalaria glabrata* is hermaphroditic, thus it has both male and female adult sex organs on the same individual. These organisms have the option of either producing eggs by mating or by self-fertilization. The environment that sustains the snail population is usually contaminated with triorganotin compounds contained in paint used to adorn the fishermen vessels in the waterways. These triorganotin compounds are known to produce an imposex conditions in gastropods. Imposex is a pathological condition involving the masculinization of female gastropod; however, *B. glabrata* is a hermaphrodite which deviates from the normal possibility of a transformation from female to male. This interests us in such that this organism serves as a possible agent to stop the life cycle of the schistosome and prevent schistosomiasis. We hypothesize that this imposex condition can be created in *B. glabrata* when these snails are infected with the transformational- amount of a triorganotin compound. This project begins with the implementation of a fecundity study for a period of 2 months conducted on 20 selected susceptible NMRI snails. Later 10 of the 20 snails were placed in the following concentrations, 5x10-5ppm, 5x10-4ppm, 5x10-3ppm and 3x10-3ppm of the triphenyltin Chloride to obtain the LD50. 5x10-5 was the LD50 amount. Two groups of snails were formed-- experiment and controls. The experimental groups were placed in the LD50 amount, and the controls remained in distilled water. Light and electron microscopy was done on the snails from each group. In

order to obtain the initial structures of the ovotestis, paraffin embedding was used and sections were view under a light microscope. Results indicated that the there was considerable reduction in the fecundity as compared to the controls. The eggs were deformed and smaller than the control eggs. Thus initial studies on the morphology of the ovotestis indicate that the imposex condition has not been achieved. [Acknowledgment: This research study was supported by grants from (Cancer Academy/ NIH/NCI /5R25CA129035, MARC/NIH/ NIGMS:1T34GM087172-01A1, STEM Center /NSF/HBCU-UP, HRD-0928444)]

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Subcategory: Plant Research

The Effect of Mu1 Copy Number Variation on the Gene Expression Level of MRS-A.

Danielle Epps, Michigan State University

Transposable elements are sequences that can move from one locus to another while increasing their copy numbers in the genome. Pack- MULEs refer to Mutator-like elements carrying gene or gene fragments. Pack-MULEs are abundant in plant genomes, and may affect the expression of their parental genes. Mutator elements are the founder elements of Pack-MULEs and have been known to acquire fragments of cellular genes and are still actively amplifying in the genome. However, it is not clear whether the copy number variation caused by their amplification has any impact on their parental genes. To test this notion, we collected samples from maize plants containing distinct copy numbers of Mutator elements, and we will measure the RNA level of the parental gene in these plants. Through this experiment, I intend to determine the relationship between copy number of Pack-MULEs and the expression level of their parental genes. This research project deals with DNA and RNA of maize, and I am looking to discover more about the transposable elements within this crop on genome evolution. [Acknowledgment: NSF]

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Subcategory: Plant Research

Studies on Growth and Mapping of Ecological Restoration of Shortleaf Pine

Ivahnah Evans, Virginia State University

Laren Robinson and Shobha Sriharan, Department of Agriculture, Virginia State University

Southern yellow pines are a significant timber resource throughout the southeastern U.S. Loblolly pine (*Pinus taeda* L.) and shortleaf pine (*Pinus echinata* Mill.) are the most commercially important and widespread of the southern pines, and are commonly found together within their native ranges. Earlier trials by other investigators have shown that the trials of loblolly pine provenances in states in the western part of its range, such as Oklahoma and Arkansas, commonly show that seedlings from eastern seed sources, such as North Carolina, outperform the local provenances in terms of growth and yield, but with some additional risks in terms of susceptibility to infrequent weather events.

We undertook studies to test the hypothesis that the soil conditions (texture and water retention) are important for the growth of short pine leaf pine in Virginia. Shortleaf seedlings from commercially-available sources from Virginia, Arkansas, and Missouri were planted in two sites in Southeastern Virginia to test growth and yield. The two sites were in Greensville County and Chesterfield County. Bare-root shortleaf pine seedlings from Virginia (VA), Missouri (MO), and Arkansas (AR) provenances were obtained from the NKFC and planted at the two sites in: (i) Greensville County, VA, near the locality of Skippers and the North Carolina border and (ii) in Chesterfield County, VA, near the Appomattox River between the villages of Ettrick and Matoaca (Randolph Farm of Virginia State University). The plants were monitored to assess overall growth and yield. A GIS database and map was created to monitor height, mortality rates, and diameter, to compare shortleaf pine seedling growth between AR, MO, and VA between the two growing sites. The height growth for shortleaf pine at the Greensville County, VA site was shown to be greater for pines from the VA provenance than for those from the MO or AR provenances. It is possible that the MO and/or AR could overtake VA in subsequent years, or that they might perform better on different sites within VA. The site conditions do seem to be important in terms of the health and mortality of shortleaf pine. *[Acknowledgment: The authors acknowledge the faculty advisors Dr. Shobha Sriharan and Dr. Greg Frey and funding agency, USDA NIFA [USDA NIFA Grant to Virginia State University (Award #2011-38821-30892) and Delaware State University Subcontract (Award #2010-38821-21456).]*

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Subcategory: Pollution/Toxic Substances/Waste

The Effect of a Small Ruminant Farm Operation and Sustainable Farm Practices: Run-Off and Soil Quality at Hickory Hill Farm, DE

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Raju Khatiwada, Dahlia Jackson O' Brien, and Gulnihal Ozbay,

Delaware State University, Department of Agriculture and Natural Resources

This project was designed to evaluate the effect of management practices at Hickory Hill farm on the surrounding environment by measuring water and soil quality at three different study sites. Three pastures were chosen as soil sampling sites on the farm. Site G recently housed goats and sheep, site C recently housed cattle, and site N is without any recent animal activity.

Our hypothesis in this research is that there is significant variation in the soil nutrient contents depending on the different farm practices (goats versus cattle and other control field with no animal). Plant species were identified to determine the present vegetation species on the sites. Water samples were taken after major storm event, Hurricane Sandy when enough run off had accumulated in the irrigation channel at the farm. Physical water quality parameters: pH, salinity and dissolved oxygen were measured for water samples. Water samples were also analyzed for the nutrient concentrations (i.e. ammonia, nitrate, soluble reactive phosphorus). Soil samples were collected in replicates of 3 from the sites once per month. Soil quality parameters: pH, soil texture, organic level, soil salinity, and soil nutrient concentration were determined. The soil pH ranged from 5.35-7.98. The goat pasture site averaged a pH of 5.8, i.e. the most acidic study site. The water samples pH ranged from 6.39-6.60. The cation exchange capacity, organic matter percentage and Mehlich 3 phosphorus amount of the soil were higher at the sites with higher animal activity, providing evidence to support the hypothesis that the soil nutrient contents varies with different animal farm practices. The soil had moderately coarse to sandy clay texture and was relatively consistent at all the study sites. It is vital to continue monitoring the farm to ensure its management practices are allowing optimal farm profitability and environmental health. *[Acknowledgment: NSF-SMILE, USDA Evans-Allen Grants Program]*

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Subcategory: Water

Detection of Harmful Algal Blooms in Lake Sardis, MS

Marlon Flowers, Mississippi Valley State University

The purpose of this research was to examine the water quality of Lake Sardis in Mississippi for the presence of harmful algal blooms (HABs). Our approach involved processing of true color satellite images retrospectively followed by field sampling and measurement of the concentration of phytoplankton and several other water quality parameters. Satellite data from Medium Resolution imaging Spectrometer (MERIS), Moderate Resolution Imaging Spectroradiometer (MODIS) and Sea-viewing

Wide Field-of-view Sensor (SeaWiFS) were downloaded from the NASA website and processed to generate true color images. These images were used to detect the presence or absence of algal blooms in Lake Sardis for a period of two and a half years from January 2010 to July 2012. Field campaign to collect water samples in clean Nalgene bottles for HABs quantitative analysis was done on 26 June 2012. Twelve sites at Lake Sardis were sampled. In the laboratory we performed High Performance Liquid Chromatography (HPLC) analysis for quantification of pigments of possible HABs and conducted analysis for the cyanobacteria specific pigment phycocyanin. We further conducted analyses for Colored Dissolved Organic Matter (CDOM), Suspended Particulate Matter (SPM), microscopy, toxin, and also determined the absorption coefficients of total particulate, phytoplankton and non-algal particulate matter.

The true color MERIS and high resolution MODIS images clearly showed the presence of algal blooms in Lake Sardis, whereas the spatial resolution of SeaWiFS sensor was not adequate to resolve the algal blooms in the lake at the same time when phytoplankton blooms were observed in the MERIS and MODIS images. The HPLC pigment data however clearly showed the dominance of cyanobacteria at the sites towards the southwest portion of the lake. The toxin analysis indicates the presence of hepatotoxin microcystin. The presence of algal blooms together with the toxin levels detected demonstrates that the HABs can be a concern to Lake Sardis water quality. Future monitoring is needed to make sure that Lake Sardis does not become harmful to its environment. *[Acknowledgment: This study was supported, in part, by a grant from NSF/HBCU-UP Grant awarded to Rachel Beecham, Ph.D., Associate Professor, Mississippi Valley State University, Itta Bena, MS]*

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Subcategory: Ecology

Use of GIS to Evaluate Correlation of Soil Types and Vegetation at the Las Vegas National Wildlife Refuge

Antonio S. Garcia, New Mexico Highlands University

Geographic Information Systems (GIS) is a tool for analyzing and displaying spatial information. The strength of GIS is its ability to create a base map and combine layers of information and use it to meet the objectives of the practitioner or scientist. Currently, GIS is being used as part of my research, and GIS will continue to provide information to help determine which soil types are associated with plant communities at the Las Vegas National Wildlife Refuge. It is recognized that soils play a major role in plant vegetation types. My current work indicates that GIS can be used to create a map of layers that show a correlation between soil types and plant types. A grid sampling soil method

will be used in this research project to determine composition of grass complexes on the Refuge and how they deviate from what is expected from the GIS analysis. Use of historic photographs and recently collected LIDAR (Light Detection and Ranging) will be used to evaluate current soil and vegetation disturbances. Results will help assess the degree to which previous land uses may account for differences between grass types that are expected and those that are actually observed in the field. Recommendations can be made for future re vegetation of Native Grasses within the Refuge. *[Acknowledgment: This study was funded partly by The New Mexico Forest and Watershed Restoration Institute, Dr. Andy Eagen, Director, New Mexico Highlands University, Las Vegas, NM 87701.]*

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Subcategory: Ecology

Evaluating Compost Piles Using Soil Bacteria Community Analysis

Veneta Graham, Philander Smith College

Klarissa Kahill, Leneea Warner, and Nastassia Jones, Philander Smith College

In this research the compost windrow pile at the Little Rock, Arkansas landfill was compared with the soil content at Philander Smith College in Little Rock as we plan to create a compost pile similar to that at the landfill. As we are in the beginning stages of growing vegetation on our campus, creating a compost pile seemed ideal instead of using manufactured soil. Soil samples were taken from both sites in order to compare the different types of microorganisms present within the soil. High levels of Actinobacteria were expected to be present in both sites due to the earthy smells in both areas. Pseudomonas and methanotrophic bacteria were proposed to be in the Philander Smith College site as a result of water leakage and a cafeteria adjacent to the sample site.

In order to complete this experiment, DNA was extracted using the Fast Spin Kit for Soil. The extracted DNA was then sequenced using a proprietary analysis pipeline and classified using the GreenGenes database (www.mrdnalab.com). Initial analysis of the sequencing data suggests increased levels of Actinobacteria, Proteobacteria, Chlorobacteria, Firmicutes, and thermophilic bacteria (Thermi and Thermotogae) in the Little Rock landfill windrow. Additionally, Proteobacteria, Actinobacteria, and Firmicutes were present at the Philander Smith College site, but in lower percentages. The high levels of Acidobacteria at the Philander Smith College site suggest that the soil is acidic and more detailed analysis of this soil is needed to determine its total composition.

The results affirm the hypothesis that Actinobacteria would be found in both sites, and indicate the importance of thermophilic bacteria to the composting process. Therefore, once the composting piles are established on the campus of Philander Smith College, factors such as oxygen levels, carbon to nitrogen ratio, moisture, and temperature will be monitored in order to ensure that the thermophilic bacteria are able to colonize and survive in the compost pile. [Acknowledgment: This study was supported by the HBCU-UP grant from the National Science Foundation.]

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Subcategory: Environmental Engineering

Meteorological Effects of a Large-scale Solar Farms

Lauren Herrera, Suffolk County Community College / Brookhaven National Laboratory

As the Department of Energy focuses their future on renewable energy, Brookhaven National Lab (BNL) has produced a two hundred acre solar farm that converts the sun's radiance into electricity for over four thousand homes. Owned by BP Solar and MetLife, the Long Island Solar Farm (LISF) is the largest photovoltaic solar farm in the northeastern United States. The solar farm contains various sensors that monitor the meteorological conditions around the solar panels. These sensors track the wind, rain, sun's irradiance, barometric pressure, clouds, air temperature, panel temperature and soil temperature, both inside and outside the solar farm. An annual calibration of each sensor is needed. but maintenance and repair are crucial in the event of an unexpected occurrence.

This research concerns annual calibration of each sensor and the impacts the sensor's data will have in observing the environmental effect throughout the solar farm during the next twenty years. Every sensor has its own specific calibration procedure, which is then performed and documented into the BNL meteorological services database. If the calibrated sensor's percent error is below one percent while calibrated in the laboratory, the sensor passes calibration. If the calibrated sensor's percent error is below three percent while calibrated in the field, the sensor passes calibration. Rain sensor calibration had a percent error of 1.82 and 2.57 while in the field and therefor passed calibration. All twenty-five air temperature sensors also passed while in the laboratory, but due to a lightning strike, three of the sensors failed the second trial and were replaced with spare calibrated sensors. All twenty-six Panel Temperature sensors passed while in the field.

Annual calibration of each sensor will help ensure the accuracy of the data being collected. Data collected will be used by BNL scientists, LIPA and companies that will use solar energy in the

future. Data observations made over the next twenty years can assist in anticipating future complications and ultimately find new ways in improving solar energy. [Acknowledgment: This study was supported by Brookhaven National Laboratory, Department of Energy, Environmental Engineering department; John H. Heiser (Brookhaven National Lab, Upton, NY)]

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Subcategory: Microbiology/Immunology/Virology

Identification of Pectolytic Bacteria found in the Pacific Northwest

Jeronda Hunt, Fort Valley State University

Brenda Schroeder, Austin Bates, and Jenny Knerr, Washington State University

Potatoes are the leading vegetable crop in the United States contributing to about 20% of farms' sales receipts for vegetables. Over 50 percent of potato sales are used for french fries, chips, and other potato products. The Western states account for almost two-thirds of the total U.S potato production, with Idaho and Washington as the leading producers of potatoes. However, production levels can be impacted by pectolytic bacteria in the Pacific Northwest (PNW) causing diseases such as blackleg, aerial stem rot and soft rot of tubers. The pectolytic bacteria responsible are classified numerous species.

Three potentially important species for the PNW include: *Pectobacterium carotovorum subsp. carotovorum*, *Pectobacterium atrosepticum* and *Pectobacterium wasbiae*. In this project, a collection of 137 isolates of pectolytic bacteria were isolated from symptomatic potatoes grown in Washington and were characterized to determine their identity. Each strain was placed on CVP media and incubated at 37°C to confirm they were pectolytic. PCR amplification of regions of the 16S rDNA, acnA, and mdh were sequenced. Identification of each strain was determined by comparison to known genes in Genbank using the Blast algorithm as well as phylogenetic analyses of concatenated acnA and mdh sequences to confirm these identifications. [Acknowledgment: This work was supported, in part, by grants NSF BIO REUI-1156880 and HRD HBCU-UP #0625289 awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA 31030.]

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*Subcategory: Ecology***Soil Microbial Exploration of Environments with Site Assessment Emphasis****Klarissa Kahill, Philander Smith College**

Veneta Graham, Leneea Warner, and Nastassia Jones, Philander Smith College

Bioremediation is one of the most effective yet inexpensive branches of biotechnology that uses microorganism metabolism for the removal of pollution or contaminants from the environment. Bioremediation involves targeting specific preexisting microorganisms of an environment to break down specific toxins. The first step in this process is site assessment. Site assessments are performed on all field sites to determine preexisting conditions and to give a general overview of the environmental quality before research is conducted. One aspect of site assessment for bioremediation and of this study is soil bacteria community analysis. The 16S rRNA gene was used to assess the bacteria community because it provides phylogenetic characterization of microorganisms that comprise microbial communities, which may lead to some clues as to the physiological capabilities of the community.

The present study was undertaken by obtaining soil samples from four different sites in the Little Rock area including: the Landfill Garbage (Site 1), the Landfill Windrow Compost (Site 2), the Landfill Top Cover (Site 3), and Mabee Kresge Science Hall (Site 4). DNA was extracted in triplicate from all four samples, and then sent for sequencing and taxonomically classified using the GreenGenes database (www.mrdnalab.com). Preliminary data analysis suggests that typical soil bacteria belonging to the following phyla are present in all sites as expected: Actinobacteria, Proteobacteria, Firmicutes, and Bacteroidetes. Additionally, results indicate that Site 2 has the highest percentage of Actinobacteria at 20% in comparison with the other three sites, all under 12%. This was an expected finding because the composting windrow only consisted of organic matter, for example, yard waste, and Actinobacteria are generally decomposers of organic material such as chitin and cellulose in plants. There was an increase in Proteobacteria at Sites 1 and 3 with 65% and 61% respectively. This may be caused by an increase in decomposers at these sites. Firmicutes and Bacteroidetes are ubiquitous soil bacteria found at all four sites as expected. This study compared bacteria communities present at various sites to simulate this aspect of site assessment for bioremediation. To further this research, culturing bacteria found in these sites will give clues to the function of the bacteria in each site, as well as determine if the bacteria are responding to stimuli in the environment. *[Acknowledgment: This study was supported, in part, by the HBCU-UP grant from NSF]*

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*Subcategory: Ecology***Measures of Tropical Premontane Reforestation Success, Early Tree Species Survival and Growth and the Influence of Policy****Michelle Kernak, Northwest Indian College**

Much of the landscape in Costa Rica is dominated by abandoned cattle pastures. The government responded with stringent deforestation policies and incentives feasible for local farmers. There is keen interest in matching plantation success with financial incentives for reforestation. To measure plantation success, I tested the relativity of 2-year survival of native tree seedlings planted into an abandoned pasture. I then examined the 13-year growth of the species at an existing plantation at the Las Cruces Biological Station in Southwest Costa Rica. There were considerable species differences in both survival and growth. First year mortality averaged 9%, second year 38%. Height of planted trees at year 13 varied between 6 and 14 meters. Both survival and growth were different between species which illustrates an important link between tree species selection and success of reforestation under current incentive programs. This information will contribute to the development of reforestation plans that are available under the Costa Rican government incentives, the Environmental Services Program. This information will help ensure successful reforestation, and also will increase the confidence of local farmers to reforest pasture lands. *[Acknowledgment: Native American Pacific Island Research Experience Organization for Tropical Studies, Duke University, Northwest Indian College]*

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*Subcategory: Ecology***Introduction to Methods and Processes of Integrated Weed Management****Mary Lawrence, Northwest Indian College**

Noxious weeds are a problem in the western United States, spreading at a rate of 4,600 acres/day in western states. Thus, these problematic plants are reducing the abundance of cultural and ecologically important native plants. There are 64 noxious weeds in Idaho alone. On the Nez Perce Reservation in north central Idaho, noxious plants have affected the health and abundance of plants that are important to the Nez Perce people in terms of nutrition and cultural significance. The Nez Perce Tribe's Bio-Control Program has initiated a program to address the problem of noxious weeds spreading throughout the area. The Nez Perce Tribe Bio-Control Program's hypothesis is that selected insects will reduce the prevalence of noxious weeds.

Working as an intern for the Nez Perce Tribe Bio-Control, I collected, reared, and distributed insects to noxious weed infested areas of California, Idaho, Montana, Oregon, and Washington. The insects reared were *Hylobius* which attacks purple loose strife. We also worked with spotted weevil and flower weevil, which attack yellow star thistle and *Cyphocleonus*, which attacks spotted knapweed. This is a long-term and on-going program. To date we have observed the bio-control insects feed on host plants, reproduce, and become a source of new insects. In areas where insects were released two years prior, the noxious plants were absent or reduced in abundance. Although this is a long-term project, there has been markedly good success in the initial stages of the project. It is anticipated that continued research will produce statistically significant differences of incidence of noxious plants based on the biological treatment that has been, and is planned to be used. [Acknowledgment: I acknowledge Paul Brusven, Coordinator of Bio Control with the Nez Perce Tribe as my intern supervisor, and Northwest Indian College for intern support.]

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Subcategory: Plant Research

Optimizing In Vitro Culture of *Vitis vinifera* Varieties

Brittany Legrant, Fort Valley State university

Nathan Tarlyn, Amit Dhingra, and Kate Evans, Department of Horticulture, Washington State University

The goal of this research was to develop a protocol for surface sterilization to reduce the amount of contamination of material collected from the greenhouse and test optimal media for growing standard grape varieties in tissue culture. Availability of this procedure is an important first step toward enabling reverse genetics approaches for understanding grape gene function through transformation. Material used for this research was the standard variety *Vitis vinifera* 'Chardonnay' and the dwarf variety *Vitis vinifera* 'Pixie'. Pixie was developed from the standard variety Pinot Meunier and is considered to be a potential research model for all varieties of *V. vinifera*. To identify the optimal growth media, each variety was grown in two different media with three different concentrations of agar. However, a significant amount of the treatments were contaminated, making it difficult to assess the success of the media. Therefore, efforts were directed to develop the protocol for surface sterilization. The explants were subjected to three different treatments: 1) a 25% bleach solution; 2) a mercuric chloride solution; and 3) a combination treatment where the container with plant material and 25% bleach solution was submerged in a sonicator. Percentages of contamination for each treatment is as follows: 1) bleach – 59% contaminated; 2) mercuric chloride – 24%; 3) bleach and sonicator – 17%. Significant improvement in surface sterilization protocol will

contribute to further research on grape regeneration and transformation. This is especially critical for the standard varieties as the vines take up a significant amount of space in the greenhouse. Optimizing the surface sterilization protocol and subsequently the media will allow *in vitro* culturing of grape varieties for future research. [Acknowledgment: This study was supported, in part, by a grant from NSF HRD HBCU-UP and DBI REU-Site Programs awarded to Dr. Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA 31030.]

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Subcategory: Climate Change

Ragweed Inflorescence Length Is Correlated with Pollen Output Per Inflorescence

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Tiffany Carey, University of Michigan

Kristina Stinson, Harvard University

Global temperatures and atmospheric concentrations of CO₂ are predicted to rise. These changes are likely to have profound changes on Earth's vegetation. Ragweed, (*Ambrosia artemisiifolia*) is an allergenic plant found throughout the US. Understanding how climate change will affect ragweed is essential to understanding the public health impact this phenomenon may have. While previous research has shown that ragweed size and pollen output per plant is correlated with increasing atmospheric CO₂ concentrations, there have not yet been studies examining how various ragweed regional ecotypes are affected by increasing CO₂ conditions. A goal of this larger multi-year study is to map predicted ragweed allergy hotspots in New England based on the ragweed pollen load throughout the region. However, accurately and efficiently quantifying the amount of pollen released by each plant for each regional ecotype and CO₂ concentration is formidable. The aim of our project is to identify easily measured physical attributes of ragweed that correlate with the amount of pollen produced. We hypothesize that both ragweed inflorescence weight and length will correlate to the amount of pollen released by each inflorescence. In our project, we sampled 62 ragweed individuals grown from wild-collected seeds of ecotypes originating in NY, VT, or MA (about 20 per ecotype), at varying CO₂ levels. The plants were part of a larger experiment exposing ragweed to 400 (ambient,) 600, and 800 ppm corresponding to present CO₂ levels and those predicted for the next 50-100 years. We bagged the flowering spikes to capture pollen and harvested the spikes and pollen after pollen release. After harvesting the spikes, we measured their length and dry biomass. We used microscopy to count the pollen grains produced by each spike. We performed regressions to test for correlations between spike size and pollen output. Our results

suggest that there may be a relationship between inflorescence length and pollen output per inflorescence, $R^2 = .224$ ($P < .0001$). Inflorescence weight and pollen output per inflorescence weren't correlated, $R^2 = .0722$ ($P = .0333$). These relationships can help develop estimators of pollen output, simplifying data collection for future experimental work. Predicting how increased CO₂ will affect ragweed growth and pollen output and understanding how different ecotypes respond to such changes will better inform decisions regarding ragweed and allergenic plant policy and management. *[Acknowledgment: This study was supported by EPA STAR grant 83435901 to K. Stinson and by the Summer Ecology Program at Harvard Forest.]*

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Subcategory: Plant Research

Effect of Chitosan and Hydroxypropyl Methylcellulose-Based Edible Coatings on Microbiological Quality of Fresh-Cut Sweet Potatoes (cv. Beauregard) Under Modified Atmosphere Packaging

Courtney Mazique, University of Arkansas at Pine Bluff

Saowalee Jongrattananon and Jaehon Koo, University of Arkansas at Pine Bluff

Fresh-cut produce became one of the fastest growing commodities, not only for institutional food service, but also at the consumer level. The fresh-cut produce industry has been rapidly growing in the past decade in response to an increased consumer demand for fresh and convenient food such as peeled and/or precut fruits and vegetables, and packaged salad mixes. It is difficult to preserve fresh-cut fruits and vegetables in a fresh-like quality during prolonged periods. Sweet potatoes are highly nutritious and a good source of protein, fiber, beta carotene, vitamin C, and calcium. Fresh-cut sweet potatoes are only marketed on a very limited scale due to rapid quality deterioration such as browning and short shelf life. Edible coatings are a thin layer of edible material applied on the surface of a food product with the purpose of generating a semipermeable barrier to gases, water vapor, and volatile compounds. The objective of this study was to determine the effect of edible coatings on quality of fresh cut sweet potatoes during refrigeration storage. Freshly cut sweet potatoes were treated with 1% chitosan and 1% hydroxypropyl methylcellulose (HPMC). Sweet potatoes without edible coating were considered as controls. Microbiological quality of fresh-cut sweet potatoes were evaluated under modified atmosphere packaging (MAP) in low O₂ permeability bags flushed with gas composed of 2% O₂ and 5% CO₂ with a balance of N₂ or air packaging in high O₂ permeability bags containing ambient air during 14 days at 4°C. Packages will be sampled during storage to determine the effects of sanitizer washing treatment on the

microbial load. Aerobic plate counts (APC) and yeast and mold counts (YMC) were determined using standard procedures, by plating appropriate dilutions of homogenates on plate count agar (PCA) and potato dextrose (PD) agar, respectively. Chitosan treated sweet potatoes showed slower increase of APC and YMC than HPMC treated and control samples regardless of different packaging method during storage. This study indicated that sweet potatoes treated with chitosan maintained 1-2 logs lower APC and YMC than HPMC treated sweet potatoes during storage regardless of different packaging method. Overall, no significant beneficial effect of MAP was observed on microbiological quality characteristics of fresh-cut sweet potatoes. *[Acknowledgment: This research is supported and funded in part by the United States Department of Agriculture to Jaehon Koo, University of Arkansas at Pine Bluff, Pine Bluff, AR.]*

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Subcategory: Environmental Engineering

Downscaling of SMOS Data Using NDVI, Elevation, and Sand Fraction

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Surface soil moisture information at high spatial resolution is necessary for better forecasting and understanding of various hydrological, meteorological and ecological models. Microwave remote sensing systems show great potential in retrieving soil moisture information on a daily basis. However, major limitations using passive microwave systems are due to lower spatial resolution. Accurate fine-scale soil moisture observations are needed at a consistent basis to be used for local and regional scale models. In the absence of consistent high resolution soil moisture datasets, downscaling procedures enable the conversion of coarse resolution surface soil moisture estimates to high and liable resolution soil moisture estimates. Surface soil moisture distributions and dynamics depend greatly on vegetation (NDVI), topographic (EL), and sand (SF) features. The downscaling algorithm is based on the understanding of each of these physical parameters (NDVI, EL, and SF) and coarse remote sensing data and how they impact soil moisture retrievals. Results suggest that not all physical parameters (NDVI, EL, and SF) affect surface soil moisture equally, since every region has its own soil composition. Unhealthy vegetation can be due to high sand fraction or seasonal change, or vice versa. *[Acknowledgment: This study is supported by the National Science Foundation (NSF) and NOAA-CREST under the grants: NOAA-CREST grant #NA11SEC4810004 and CREST-REU-NSF grant #AGS-1062934]*

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Subcategory: Environmental Engineering

Biosorption of Hexavalent Chromium from Aqueous Solutions Utilizing Highly Characterized Peats

Casandra Newkirk, Claflin University

Anthony Rizzuti, Claflin University

Hexavalent chromium is a toxic element which is present in many aquatic environments, with current remediation technologies having high costs, lacking efficiency, and at times producing a concentrated sludge. Peat, an inexpensive, naturally occurring, plant-derived, abundant organic-rich soil has demonstrated the potential to remediate heavy metals from aqueous solutions, and is environmentally friendly. The purpose of this research was to investigate the hexavalent chromium biosorption potential of four highly characterized peats [Loxahatchee Sawgrass (LS); Okefenokee Taxodium (OT); Maine Sphagnum (MS); and Okefenokee Nymphaea (ON)] from aqueous solutions. All peat types were mixed with hexavalent chromium solutions. The liquid portions of the samples were then centrifuged, vacuum filtered, and analyzed for chromium concentration using an ICP instrument. Additional parameters tested include the absorbent sample dose (0.125, 0.25, and 0.5 g), contact time between samples and hexavalent chromium (2, 24, and 48 hrs), concentrations of the hexavalent chromium solutions (1, 5, 10, 20, and 30 ppm), mixing temperature (24, 30, 35, and 40°C), and pH of the hexavalent chromium solutions (2-10).

The results demonstrate that as absorbent dose increased from 0.125g to 0.5g, the percent of hexavalent chromium extracted increased slightly (LS 69-77%; OT 65-73%; MS 58-68%; ON 64-72%). As contact time increased from 2 hours to 48 hours, the percent of hexavalent chromium extracted decreased (LS 80-70%; OT 77-66%; MS 73-59%; ON 78-64%). As the hexavalent chromium solution concentration was increased from 1ppm to 30ppm, the percent of hexavalent chromium extracted decreased dramatically (LS 100-56%; OT 96-51%; MS 99-43%; ON 93-50%). As the mixing temperature was raised from 24°C to 40°C, the percent of hexavalent chromium extracted decreased slightly (LS 74-65%; OT 69-64%; MS 62-56%; ON 68-64%). As the pH of the hexavalent chromium solution was increased from 2-10, the percent of hexavalent chromium extracted fluctuated, but generally decreased for two of the types (LS 95-51%; OT 96-51%), while increasing slightly for one of the peat types (MS 86-95%), and fluctuating sporadically, but generally decreasing for the last peat type (ON 89-70%).

The pH that was most effective at extracting the hexavalent chromium was 2 for LS and OT, 5 for MS, and 4 for LN. Overall, all peat types tested exhibited a great potential for biosorption of hexavalent chromium from aqueous solutions.

[Acknowledgment: This study was supported by a grant from

the DOE, awarded to Dr. Rebecca Dillard, Associate Vice President of Academic Affairs, Claflin University, Orangeburg, SC, 2010]

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Subcategory: Pollution/Toxic Substances/Waste

Impacts of 1,4-Dichlorobenzene on the *Callinectes sapidus* Cardiac System

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Xóchitl Pérez and Loretta Roberson, UPR, Rio Piedras and UPR, San Juan

Mark W. Miller, UPR-Medical Sciences Campus, San Juan

The San Juan Bay Estuary (SJBE), one of the main water bodies of Puerto Rico, has been highly impacted by anthropogenic pollution. Previous studies have identified a series of organic pollutants present in Canal Suarez, an important fishery area in the SJBE, including 1,4-Dichlorobenzene (DCB). DCB is a chlorinated aromatic compound used in home products including deodorizers, fumigants, disinfectants, and pharmaceuticals and has been shown to be carcinogenic, causing tumors in mice and rat tissues, liver tumor in mice, and kidney tumors and leukemia in rats (National Toxicology Program. 2011). The blue crab, *Callinectes sapidus*, is an important fisheries species inhabiting the SJBE. Their high abundance and fecundity and predatory activity make them valuable indicators of environmental conditions in estuary systems. In view of the hazardous character of dichlorobenzene, this study was conducted to identify sub lethal effects of DCB on the blue crab cardiac system. It is expected that DCB will promote changes in heart rate and amplitude.

In this study, adult crabs were collected from Canal Suarez and housed in the laboratory with simulated estuarine conditions. The semi-intact working heart preparation (Fort et al. 2004) was perfused with saline water (control), followed by ethanol (the DCB solvent), and finally a test concentration of DCB. Control measurements of heart rate and amplitude were compared with values from DCB perfusion. Heart rates were measured qualitatively and quantitatively to describe pollutant effects on the cardiac system. Statistical analyses show no significant effects on heart rate ($p=0.50$) or beat amplitude ($p=0.94$), however, there is a trend towards possible effects of DCB.

Once the impact of DCB on heart rate and amplitude has been characterized at the extracellular level, further research will be conducted to study the effects of pollutants on the cardiac ganglion of the *Callinectes* cardiac system. [Acknowledgment: This study was supported by a grant from the NSF Puerto Rico

Center for Environmental Neuroscience and the Department of Environmental Science, UPR Rio Piedras, PR 2011]

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Subcategory: Ecology

Geochemical Characterization of Sediments in a Small Bay on Lake St. Croix at Hudson, WI

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Jill Coleman Wasik and Joy Ramstack, St. Croix Watershed Research Station, Marine on St. Croix, MN

Stormwater ponds are often used to protect natural water bodies by retaining runoff from residential and industrialized areas and serving as a trap for suspended solids and pollutants. However, the trap efficiency of these ponds can decline over time. This study was conducted to address the concerns of local residents about sediments and pollutants inputs from aging stormwater ponds making water levels too low to be navigable by personal watercraft in Long Pond, a small bay of Lake St. Croix in Hudson, WI. The geochemical profiles in the sediment cores from Long Pond were compared with profiles in Lake St. Croix and the stormwater ponds to understand whether the pond reflected trends in the lake or if it is affected by runoff received from three stormwater ponds. Sediment cores were collected along a transect in Long Pond and grab samples were taken from each stormwater pond. Magnetic susceptibility measured using a Geotek LTD multi-sensor revealed that magnetic activity increased over time.

This result was confirmed by loss-on-ignition results that indicated that mineral content was high in the surface sediments and non-magnetic organic content was high in the deeper sediment. We concluded that Long Pond was initially a wetland with a central pool. A rise in the regional water table and urban stressors caused sediment accumulation in the central basin creating a more lake-like environment. Sediment samples were analyzed by inductively coupled plasma mass spectroscopy for As, Cd, Cu, Fe, Mn, Ni, Pb and Zn, and the results were compared to data from Lake St. Croix obtained from a previous study in 2009.

The results showed that metal concentrations in Long Pond are higher than in Lake St. Croix demonstrating an effect of the stormwater pond that captures runoff from nearby Interstate 94. Phosphorus (P) analyses of sediment extracts using an ammonium molybdate colorimetric method revealed that in the last 20 years an increasing proportion of total P came from inorganic P inputs while organic P inputs were the largest

proportions in the past, but these inputs are lower than those to Lake St. Croix. We concluded that though Long Pond is connected to Lake St. Croix, it behaves differently whereas pollutants levels are somewhat affected by stormwater pond inputs, and sediments accumulation in Long Pond has not been significantly changed. Lead-210 analysis is currently being done on the sediments to quantify their age and the accumulation rate. [Acknowledgment: North Star STEM Alliance Pentair Foundation, Long Pond Local Residents]

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Subcategory: Microbiology/Immunology/Virology

Natural Variations of Fatty Acid Composition in the Model Green Alga *Chlamydomonas reinhardtii*

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Chlamydomonas reinhardtii is a biochemical and genetic model organism which has been used extensively to study photosynthesis, flagellar motility, and recently, lipid metabolism. In this work, the neutral lipid accumulation properties and fatty acid composition of standard laboratory strains and wild strains were obtained from *Chlamydomonas* genetic stock center at the University of Minnesota. Additionally, wild *Chlamydomonas*-like algae were isolated by single colony purification from water and soil samples collected from various locations around the University of Nebraska-Lincoln (UNL). The wild strains and lab strains were cultured and compared to other true *Chlamydomonas reinhardtii* strains using lipid extraction, separation by several chromatographic methods, and fatty acid analysis by gas chromatography. Extracting and analyzing the lipids from these strains showed that the *C. reinhardtii* strains have variations in the contents of triglycerides. The fatty acid composition of these strains were identified and quantified by gas chromatography. Strains from the genetic stock center and the strains isolated from around UNL produced varying amounts of the fatty acids (carbons: double bonds) 16:0, 16:1, 16:2, 16:3, 16:4, 18:0, 18:1 18:2, 18:3 and 18:4. This study shows that there are natural variations in triglyceride content and fatty acid composition in the model green alga *Chlamydomonas reinhardtii*. [Acknowledgment: This study was supported, in part, by a grant from NSF HRD HBCU-UP #0625289 awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA 31030.]

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Subcategory: Ecology

Biometric Analysis of the Invasive Pacific Lionfish (*Pterois volitans*) in the Virgin Islands

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Indo-Pacific lionfish (*Pterois volitans*) are precipitously invading the waters of the Caribbean and tropical Atlantic. Due to their population explosion and aggressive behavior, lionfish have the potential to become the most devastating marine invasion in history by significantly reducing the abundance of coral reef fishes and leaving behind a devastated ecosystem. It was first found in the US Virgin Islands in 2008 and is now becoming a common sight on most coral reefs. Lionfish are now being found on both St. Thomas and St. Croix. These two islands differ in the abundance and size of reef fish with St. Croix having much fewer and smaller fish than St. Thomas. In order to understand its potential impact on native fishes, we need to learn more about its biology and basic life history characteristics. The analysis of weight length data can be used to evaluate the condition of fish species. This condition factor is a measure of the well-being or rate of consumption of reef fish. Our primary goal is to test the hypothesis that lionfish in St. Croix have a lower condition factor than lionfish in St. Thomas.

This leads toward two objectives; (1) Mathematically relating the relationship between weight and length of lionfish in St. Thomas and St. Croix; (2) Measuring the variation from the expected weight (W) for length (L) of individual fish as indications of corpulence, well-being, or gonad development. Length and weight of sample lionfishes (N= ~90) were obtained. The Fulton's Condition Factor ($W/L^3 \times 100,000$) was done to determine the ratio between the observed weight and an expected weight dependent on the length of the fish. According to the ANOVA Analysis that was obtained (N=48) the average female length = 29.59 cm and average male length = 26.66 cm; ($F = 26.66, P < 1.46 \times 10^{-6}$). Weight analysis indicated (N=90) the average female weight = 256.38 g; average male weight = 424.41 g; ($F = 26.66, P < 1.46 \times 10^{-6}$). Studies are being continued to determine the length-weight relationships, condition factor, GSI among habitats. We are also interested in examining growth rates of lionfish in the territory. Factors that would be taken into consideration are age and length of lionfish. The age will be determined by examining the otolith obtained during dissection process. [Acknowledgment: This Research was funded by NSF VI-EPSCoR Grant number 0814417]

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Subcategory: Air

Preliminary Assessment of Volatile Organic Compounds (VOCs) in Indoor Parking Facilities in the Greater Houston Area

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Automobiles have been widely known as sources of VOC emissions in outdoor environments; however, the impact of these emissions indoor has not yet been studied in detail and needs to be developed. Two different types of indoor parking facilities have been assessed for the VOC concentrations, which include residential attached garages and commercial ground garages. For this assessment, Houston, TX, a representative big city, was chosen because of its high dependency on private cars by its citizens, the numerous petrochemicals industries emitting VOCs, and the several days each year that it experiences a high ozone level. These factors significantly increase Houstonians' exposure to VOCs. Indoor air samples were collected using 6-L stainless steel canisters for a 24-hr period and analyzed using a modified version of EPA Method TO-15, which is TSU-TO15 with GCMS coupled to cryogenic pre-concentrator. The eight most abundant VOCs were identified in each sample. Six out of the eight VOCs identified are classified as hazardous air pollutant based on EPA regulations. This research found the concentrations of VOCs are higher in attached residential garages following ground commercial garages. Future studies are to compare VOC emissions in all four seasons and human exposure. [Acknowledgment: National Science Foundation grant.]

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Subcategory: Ecology

An Analysis of Walleye (*Sander vitreus*) Population Decrease at Fish Lake

Carlos Rivera, Saint Olaf College, Northfield, MN

Walleye (*Sander vitreus*) are an important fish for the Ojibwe (Anishinaabe) people; it is an important staple to their lives. Since a recorded high in the early 2000s, the population of Walleye (*Sander vitreus*) have been steadily decreasing while populations of largemouth bass (*Micropterus salmoides*) have been increasing. Different factors were identified and tested at Fish Lake Reservoir north of Duluth, MN, and they include: temperature, predation, dissolved oxygen (DO), and vegetation. Experiments were carried out using a Hydrolab minisonde that took data at depths a foot apart until the bottom was reached. Preliminary conclusions include surface water being too hot to sustain Walleye, deeper waters have too low of DO levels that

stresses the fish, and vegetation spreads which then dies, decomposes and uses oxygen. As of now, Walleye are limited to where they can live at Fish Lake Reservoir. Special thanks to National Science Foundation for funding this project, and many thanks to Brian Borkholder for mentoring me throughout the summer, and providing me with such an amazing experience. *[Acknowledgment: This research was in part due to the National Science Foundation for funding the research done by the National Center for Earth Science Dynamics.]*

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Subcategory: Ecology

From Seed to Table “Dream Keeper Garden”

Joy Semien, Dillard University
Myya Jackson, Dillard University

As America’s obesity and heart disease rate begins to increase rapidly, it has become evident that it is time for a drastic change to the mental and physical mentalities of our culture. It is important that individuals take the time to develop good health habits. In America, over 600,000 people die of heart disease each year; most are triggered by obesity. In Louisiana alone, there is an average of 67.6% of the population suffering from obesity and approximately 10,000 people die each year due to heart disease. It is important for our society to take a stand against this health epidemic by developing educational and research programs. As LAMP students, our goal is to evaluate the attitudes and knowledge of Dillard University botany students and Langston Hughes Academy scholars regarding fruits and vegetables. Our research is part of a community outreach program in partnership with Dillard University Community Development Corporation and Langston Hughes Academy (LHA). This ensures the future of Louisiana youth, by preparing the next generation of healthy individuals and scientists through a community outreach program, From Seed to Table “Dream Keeper Garden.”

This program allows students on both a college level and an elementary level to explore science from an interactive and creative stance. In the program students will have the opportunity to engage in a mentorship between Dillard students and LHA elementary students that will provide a positive change. Students will also have the opportunity to grow and maintain several different species of crops, some of which they will then take home to their families to eat while selling the rest at a local farmers market.

In addition, students will have the opportunity to engage in cooking and tasting events which will aid in the overall learning experience. We will rate the project success by analyzing pre-

and post-surveys that ask questions involving food preferences, knowledge of types of vegetables, and development of agricultural plants. Our experimental controls are based on the comparison of botany students versus non-botany students as well as previous scientific studies. Our overall expectation of the completion of the project is that it will not only promote healthy living, but also promote the study of environmental science on both a primary and undergraduate educational levels. Future research focus: Relationship of how past-present environments can influence common outlooks on health and the environment. *[Acknowledgment: Our project is funded by a small grant received from Blue Cross Blue Shield of Louisiana as well as the Louisiana Alliance for Minority Participation.]*

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Subcategory: Ecology

Nez Perce Tribal Wetlands Study - 2012

Sandra Slickpoo, Northwest Indian College

Wetlands on the Nez Perce Reservation were inventoried in summer 2012 to assess the degree and severity of changes that may be attributable to climate change. Wetlands were last inventoried in 2003. I participated as a field assistant in the project entitled “Assessment of Vulnerability to Climate Change,” and completed a poster project titled “Nez Perce Tribal Wetlands Study.” Elisabeth Brackney, wetlands planner for the Nez Perce Tribe led the study. The hypothesis was that climate change has influenced the size of reservation wetlands and composition of flora. The Nez Perce Reservation comprises 770,470 acres. Between 2003 and 2008, about 250 wetlands on the reservation were evaluated and inventoried. This past summer (2012) I assisted in retrieving current data from 40 of those wetlands. Some of the methods consisted of mapping the wetlands with a Global Positioning System unit for size comparison, plant composition and percentage, wildlife observation, land use observation, hydrology and soil classification, and photographs. Preliminary results showed that in 33 of the 40 wetlands inventoried there was an increase in size from the previous inventory. Previous total acreage was 124.16 and current is 161.59, a 37.43% increase overall. Three study areas are presented as samples to show a typical inventory of wetland flora that is present in north central Idaho and on the Nez Perce Reservation.

Results are preliminary to this study and analysis is ongoing. Principal Investigators are preparing an analysis of meteorological data to ascertain whether the increase may be attributed to increased yearly rain fall. Collaboration with Nez Perce Tribe Land Services Department will also examine the idea of whether improved land management practices may be

responsible for the increase of acreage. Further analysis will also include species comparisons of wetland plants and will indicate possible change between the old and more recent inventory. *[Acknowledgment: The Northwest Indian College STEM Scholarship paid for my internship. I would also like to acknowledge my internship supervisor, Elisabeth Brackney (Nez Perce Tribe); the project botanist, Emily Poor; my Northwest Indian College Student Advisor, Dr. Thomas Backman; and my Senior Project Committee Chair, Rochelle Troyano.]*

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Subcategory: Computer Science & Information Systems

Decision Support on Pesticide Risk Import for Production

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Research has indeed proven that rice is one of the many crops that serve as a main source of food supply throughout the world. Rice is viewed as a staple food by more than half of the world's population. However, pests are a major issue as it pertains to growth of this crop. Pests such as weeds, insects, and various diseases, hinder the growth of this staple food. When observing this issue from a farmer's perspective, their duty is to eliminate this issue and ensure that their consumers are satisfied. Farmers must consider an effective, accurate and profitable decision prior to determining which pesticide(s) to utilize. There are numerous choices of pest controls that are recognized as "pest managers." When farming, a farmer's intention would be to produce as much of the crop as possible, but this cannot be reached if the crops are affected by pests. At this point, the decision of which pesticide is most effective becomes a factor.

Therefore, the objective of this study is to develop a decision support tool with various pesticides to increase the production and importation of rice. This project was performed as a means to research various pests (i.e. descriptions, symptoms/effects, pesticides [types, risk factors]), in order to eliminate pests. At the completion of this research, a database was established in order to support the decision making process of a farmer to determine which pesticide is most effective to eliminate this issue and protect their crop(s). *[Acknowledgment: National Science Foundation (NSF); NSF-MAGEC-STEM Plus Program]*
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Subcategory: Ecology

Isotopic Signatures in Mammoth Molars as Possible Biogeographic and Paleoecologic Markers

Brenda Villasenor, University of Washington

George Last, Eirik Krogstad, Pacific Northwest National Laboratory

Presently, there is a lack of information on mammoth habitat ranges across the Northwest despite the abundance of mammoth findings. Accordingly, this study seeks to examine isotopic variations in mammoth tooth enamel for paleoecological and paleoclimatic markers indicative of discrete mammoth ranges in the Northwest. Tooth enamel is widely used in paleoecological studies because of its resistance to alterations through time. In contrast to fossilized bones and dentin, tooth enamel does not become easily contaminated by environmental stresses. Most importantly, isotopic ratio variations in tooth enamel are known to vary with diet, climate, and other biogeographic conditions. Key isotope ratios targeted in this study include, $18\text{O}/16\text{O}$, $13\text{C}/12\text{C}$, and $87\text{Sr}/86\text{Sr}$. The $18\text{O}/16\text{O}$ ratio adheres to the composition of the meteoric water being consumed, and that is governed by paleoclimate. Similarly, the $13\text{C}/12\text{C}$ ratios are indicative of the types of plants (i.e. C3 vs. C4 vs. CAM plants) consumed.

Browsers generally eat more C3 plants (which are generally more depleted in 13C than C4 plants) whereas grazers generally consume more of the C4 plants. Strontium isotopes are known to vary with geologic (i.e. bedrock and soil) environment. Various spot analyses of $87\text{Sr}/86\text{Sr}$ and trace elements were measured using laser ablation single collector (Thermo Element-2 XR) and multi-collector (Thermo Neptune Plus) inductively coupled plasma mass spectrometry (ICP-MS).

This investigation was essential in furthering efforts to identify the geographic origin of the Coyote Canyon mammoth in Kennewick, WA. Speculation remained on whether this mammoth originated from its burial site or if the mammoth was transported there during an Ice Age flood event. The isotopic variations in the tooth enamel revealed dietary patterns indicative of environmental and climatic conditions in northern regions in the northwest. Future efforts include plotting migration paths for mammoths in the northwest by comparing fossils located in vertebrate paleontological sites. Examining home range and/or migration patterns may lead to greater comprehension of the distress and recovery of mammoth populations after catastrophic impacts of the Ice Age floods. *[Acknowledgment: This study was supported, in part, by Batelle and McBones Research Center. Special thanks to George Last, Ph.D., senior research scientist at Pacific Northwest National Laboratory in Richland, Washington]*

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Subcategory: Ecology

Fire Regime Facilitates Unexpected Nutrient Limitation in Hawaiian Subalpine Forest

Laurence Walsh, University Of Hawaii at Hilo

Kealoha M. Kinney, University Of Hawaii Hilo

We focus on dry-land systems on the Island of Hawaii, where our efforts over the past several years have begun to elucidate the importance of natural and/or anthropogenic disturbance events in shaping pathways of primary succession (1-3). Primary succession in forests is characterized by a process called long-term forest decline, whereby forests accumulate biomass and three-dimensional stature relatively quickly, but then enter a regressive phase where forest biomass is lost (4-6). There is a strong consensus that long-term forest decline is a general feature of primary succession, and that the most probable cause is persistent phosphorus (P) limitation. However, the generality of P limitation in comparison to other factors is poorly understood. For example, do natural or anthropogenic disturbance events alter pathways of primary succession? Are there modes of disturbance, such as fires, anthropogenic activity, or biological invasions that are likely to produce qualitative changes during successional development?

Answers to these questions are important to developing a more fundamental understanding of the mechanisms of primary succession, and to informing sound conservation and management. *[Acknowledgment: University Of Maryland, University Of Hawaii Hilo, US Forest Service, Institute Of Pacific Island Forestry, National Science Foundation REU Program.]*

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Subcategory: Ecology

Correlations Between Particulate Matter and Wood Stove Emissions During the Winter Months on the Nez Perce Reservation

Kayla Warden, Northwest Indian College

The hypothesis is that use of wood stoves in the winter produces a significant increase in particulate matter in the Kamiah Valley during the winter/early spring of 2011. EL-USB-1-LCD Temperature Data Loggers were installed in five homes in close proximity to the wood stove, which was the sole source of heat for each home. For the purposes of this study, ninety degrees registered on the temperature probes was an indication that the wood stove was burning. Temperature was sampled at five minutes intervals. At the same time, a Thermo Scientific

TEOM 1400a PM2.5 monitor at Kamiah, ID measured ambient air temperature and PM2.5. This data was also collected at five minute intervals. The data from both samples was combined with reference to time stamp and a t-test was run to ascertain whether there was a significant difference in PM2.5 levels based on whether the sample stoves were burning or not.

Preliminary results from one home show that there was a significant difference ($P < 0.05$) in PM2.5 based on whether the stove was burning. The topography of the Kamiah Valley makes it a prime location for atmospheric thermal inversions to occur (Ahrens, 2008). Temperature inversions occur when a layer of warm air overlies cooler air in the lower atmosphere. Inversions commonly occur during the night and ordinarily dissipate when daytime surface heating produces vertical motions that convectively re-mix the lower atmosphere; however, reduced surface heating (due to fog or low clouds) can prolong the temperature inversion. Temperature inversions effectively trap pollutants beneath the warmer air aloft, causing increased concentrations of pollutants with relatively little dispersion. *[Acknowledgment: I would like to thank the Northwest Indian College Science Department Bachelor of Science in Native Environmental Science. I would like to thank all of the instructors and advisors for assistance during this winter project. I also would like to thank the Shelley Pressley with Washington State University Laboratory for Atmospheric Research Department of Civil and Environmental Engineering and Mary Fauci with Nez Perce Tribes Environmental Restoration and Waste Management Air Quality Department.]*

This project is being funded by Washington State University, Laboratory for Atmospheric Research; Nez Perce Tribe Air Quality Program; Northwest Indian College STEM Scholarship Program.]

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Mathematics and Statistics

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Subcategory: Mathematics and Statistics

Dynamics of Triatomine Infestation in a Population of Houses

Javier Baez, Arizona State University

Trypanosoma cruzi, is the causal agent and parasite of Chagas, a neglected tropical disease transmitted mainly by blood-sucking triatomine insects in Latin America, the most prominent vector being *Triatoma infestans*.

Currently there is no vaccine available for Chagas so disease control relies on control of the vector population. In this work we developed deterministic and stochastic mathematical

models for the dynamics of bug infestation in a community of houses. First, we considered a spatially implicit Levins-type metapopulation model with only one type of house. Next, we studied the effect of differences in housing quality and structure in infestation dynamics and the effect of heterogeneity in the distribution of houses of different quality. Finally we developed more realistic spatially explicit metapopulation models. The models were used to assess the effect of different control strategies on house infestation. *[Acknowledgment: This project has been partially supported by grants from the National Science Foundation (Grant DMPS-0838705), the National Security Agency (Grant H98230-11-1-0211), the Office of the President of ASU, and the Office of the Provost of ASU.]*

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Subcategory: Electrical Engineering

The Application of Fast Fourier Transforms on Frequency-Modulated Continuous-Wave Radars

Dwayne Brooks, Elizabeth City State University

In collaboration with NASA Goddard Flight Center scientists and financial support from NASA summer internships, a group of students were assigned hands-on projects through which they had an opportunity to delve into the deeper engineering concepts. The outcome of this research model can be implemented in a classroom setting to introduce students to some of the abstract topics in signals and systems such as discretization and sampling of signals, Fourier Transforms, Z-transforms, and filter design. MATLAB software or any similar computational software can be utilized to do the signal operations and graph computational results in these processes. The processing and graphing of the signals can also be fully done in software.

This paper summarizes the practical steps in this process for a specific project involving Frequency-Modulated Continuous-Wave (FMCW) radar systems. The FMCW radar systems send recognized frequency signals to moving targets and receive the signal back at the detectors. One of the applications of the FMCW systems is to measure the exact height of landing aircrafts. In addition, they are used in early-warning radar systems, and in proximity sensors. The advantage of using these radar signals is that the velocity and range of target can be quickly calculated using Fast Fourier Transforms (FFT). Taking the row-wise FFT of the signal matrix gives range information in form of range bins. Then taking column-wise FFT enables displaying the velocity for each range bin. The 3-dimensional graph of the resulting matrix gives a signal power plot with respect to both the range bin numbers, and their velocity. The FMCW radar system signals can be generated by simulation

method and investigated in a classroom setting. The assessment of the project is in progress. *[Acknowledgment: NASA Science and Technology Institute for Minority Institutions funded my research.]*

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Subcategory: Mathematics and Statistics

The Effect of Mixed Type Wall Segments on the Ideal MHD Duct Problem

Jason Cornelius, Delaware State University
Pablo Suarez, Delaware State University

In this poster, we study the effect of boundary conditions on the flow of a conducting fluid in the presence of a transverse magnetic field. This problem is relevant because the study of its solutions provide insight on how to control (through non-mechanical means) a conducting fluid through the use of magnetic fields, as well as by using the conductive properties of the duct itself. This phenomenon has a wide array of applications in power engineering, metallurgy, and fluid delivery systems.

In this problem, we consider a fluid of modest Hartmann number, moving through both rectangular and circular channels. Of particular interest is the effect of perfectly conducting and perfectly insulating wall segments on the velocity of the fluid, as well as the intensity of the induced magnetic field. For a simple configuration, we provide a semi-analytical solution to the MHD duct problem using separations of variables in conjunction with Fourier series. For more complicated boundary conditions we use numerical methods only. We consider two, three and four piece segmented walls in which each segment is arbitrarily assigned either perfectly conducting or perfectly insulating characteristics. Utilizing the Finite Element Method, we obtain numerical solutions (in the form of velocity and magnetic profiles) for the relative V and B fields under these various boundary conditions. Using these results, we conclude that regions near the perfectly conducting segments appear to exhibit the most restricted fluid flow. In the future we hope to extend these results to include time-varying and non-transverse magnetic fields. *[Acknowledgment: We acknowledge the work, Magnetofluidynamics in Channels and Containers, by U. Müller and L. Bühler, which has served as a key reference for this research. Funding for this research was provided by the National Science Foundation as well as the SMILE, HBCU-UP project at Delaware State University.]*

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*Subcategory: Mathematics and Statistics***New Observations and Data on M&m Sequences****Ivan Espinosa, California State University, Fullerton**

A mean and median sequence (known as an M&m sequence) begins with any three real numbers, and successive terms are determined in such a way that the n th term satisfies the condition that the mean of the first n terms equals the median of the first $n-1$ terms. No examples of M&m sequences are known that fail to eventually become stable. The M&m conjecture states that all M&m sequences stabilize (that is, they are eventually constant). This problem, as often is the case in pure mathematics, was largely motivated by mathematical curiosity. Many students have had the experience of trying to determine what score they must achieve on a subsequent exam in a course in order to raise their overall average to a certain value. A few years ago, Dr. Harris Schultz from California State University, Fullerton posed a related question that motivated the definition of an M&m sequence given above. We wrote a C++ program to generate large quantities of M&m sequences along with accompanying data. We collected this data, looked for patterns, and made some new observations about these sequences in order to make headway in resolving the M&m conjecture. A few tricks have given us some progress on the theoretical side of this project which has been confirmed by all of the data collected by the program. Finally, our research invites a few interesting questions about other sequences that are related to M&m sequences, for example, involving other statistical quantities similar to the median of a list of numbers. In addition, some of our observations from the data collected remain as unproven conjectures that are quite germane to the success in resolving the M&m conjecture in general. For instance, it appears that the ultimate stable value of each M&m sequence occurs multiple times prior to the stabilization point. This remains to be proved. *[Acknowledgment: LSAMP]*

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*Subcategory: Mathematics and Statistics***Understanding Sigmoid Mathematical Models****Megan Grimes, North Carolina A&T State University**

Blessing Ihedioha, North Carolina A&T State University

Most population mathematical models stem from sigmoid functions or the logistic curve. A generalized logistic curve models the “S-shape” behavior of growth of some populations. Three kinds of sigmoid functions studied in this research are: logistic, Gompertz, and Michaelis-Menten. Their parameters are

studied and analyzed. Although these functions have “S-shaped” behavior, the rate at which the functions grow varies due to their parameters. Upon completion of analysis, we were able to conclude as to which sigmoid function best pertains to certain applications. The logistic function is best used for population modeling, the Michaelis-Menten is used for chemical reactions, and Gompertz function models systems that saturate at large values of time. *[Acknowledgment: National Science Foundation Interdisciplinary Training UBM Sciences Program: grant awards 0634598 and 1029426]*

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*Subcategory: Social Sciences/Psychology/Economics***Can CFA Franc Promote the Trade between the WAEMU (West African Economic and Monetary Union) and Its Trading Partners?****Kodjo Houssou, University of Minnesota**

This paper discusses briefly the implications of the peg exchange rate CFA-Euro on the trade in West African Economic and Monetary Union (WAEMU) based on the framework of SHANE-ROE-SOMWAPU, optimal control and the real business cycle theories. Hence, the study aims to show by econometrical estimation under the international market clearance condition, the effect of the exchange rate on the trade in WAEMU. It analyzes deeply the dynamic propagation mechanism of the rate of change of the exchange rate on the exportation volume, consumption, and foreign interest rate. Definitely, the exchange rate seems to be an important macroeconomics variable affecting the trade between WAEMU and its trading partners such the European Union, USA, China, etc. We find that the depreciation of the exchange rate will be effective if the real value of the exportation and the consumption is greater than one percent increase of the foreign interest rate. The results indicate also that under the peg exchange regime system with Euro, the exportation demand in WAEMU is an exponential function of the foreign interest rate, the import prices, and the consumption. *[Acknowledgment: I am grateful for the STEM fellowship at the University of Minnesota for financial support. Without STEM, this research could not have been possible. The views and content of this paper are mine and not those of STEM or College of Science and Engineering]*

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Subcategory: Mathematics and Statistics

The Triangle Intersection Problem for Hexagon Triple Systems

Zachary Meadows, Alabama State University

Carl Pettis, Alabama State University

The existence and intersection problems for Steiner triple systems have been thoroughly researched. A Steiner triple system (more simply triple system) of order n is a pair (S, T) , where T is a collection of edge disjoint triangles (triples) which partitions the edge set of K_n (= the complete undirected graph on n vertices) with vertex set S . $|T| = n(n-1)/6$. It has been proven that the spectrum for triple systems (= the set of all n such that a triple system of order n exists) is precisely the set of all $n \equiv 1$ or $3 \pmod{6}$. A complete solution of the intersection problem for triple systems follows: $I(n) = \{0, 1, 2, \dots, n(n-1)/6\} \setminus \{x-1, x-2, x-3, x-5\}$ and $\text{Int}(n)$ represents the set of all k such that there exists a pair of triple systems of order n having exactly k triples in common. It has also been shown that $\text{Int}(n) = I(n)$ for all $n \equiv 1$ or $3 \pmod{6}$, except for $n = 9$. This problem was expanded to examine 3-fold triple systems. The Triangle Intersection Problem for Hexagon Triple Systems (HTS) states for each $n \equiv 1$ or $3 \pmod{6} \geq 7$ and each $k \in 3I(n) = \{0, 1, 2, 3, \dots, n(n-1)/2 = x\} \setminus \{x-1, x-2, x-3, x-5\}$ construct a pair of 3-fold triple systems of order n intersecting in k triples each of which can be organized into a hexagon triple system. A complete solution for this problem was given with a few possible exceptions for $n = 13$. This research focuses on the results for $n = 7$. Upon examination of the solution, a number of the HTS(7) were found not to be perfect. A perfect HTS(n) is one where the inner triples form a STS(n). Once identified, we used the perfect HTS(7) to find solutions to the triangle intersection problem for hexagon triple systems when $n = 7$. Additionally, through the use of permutations and substitutions, we hypothesize that we can strengthen the result of the solution by using perfect HTS(7) to solve the intersection problem for $n = 7$. Future research will include examining the results for $n = 9$ and giving a new more robust solution for this problem as well. *[Acknowledgment: This study was supported by a grant from NSF awarded to Alabama State University, HBCU-UP, Shree Singh, Ph.D., Program Director, 2011.]*

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Subcategory: Mathematics and Statistics

Principal Component Analysis in Financial Risk Management

Kwasi Platt, Savannah State University

Andrew Herrera, Natalie Dorrow, Paul Cabrera, and Tao Pan, North Carolina State University

The volatility of stock returns is important to both financial institutions and regulatory bodies, both of whom aim to accurately measure the risk of investments. Value at Risk (VaR) is a common measure of portfolio risk in use today. Initially we calculated the VaR under the assumption that the daily stock returns were normally distributed, but found that calculations of VaR under that method underestimated risk because the distribution of daily returns had fatter tails than the normal model. We improved the accuracy of the calculations through the consideration of distributions with fatter tails, specifically Student's-t distribution. Expanding the model based upon Student's-t to consider a portfolio of these assets resulted in similar successful calculations. We also evaluated the method of Principal Components Analysis (PCA) for dimension reduction, and discovered that dimensionality could be significantly reduced without much sacrifice of accuracy. We then applied PCA to try and find macroeconomic factors to explain asset price movement in particular industries. *[Acknowledgment: National Science Foundation; Peach State LSAMP Program; North Carolina State University]*

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Subcategory: Mathematics and Statistics

F-test in Microarray Experiments

Emily Ramos, California State University, Fullerton

Duy Ngo, Calvin Pham, Gulhan Bourget, and Atousa Karimi, California State University Fullerton

Suzette Puente, University of California at Berkeley, Department of Statistics

Kristen Cunanan, University of Minnesota, Department of Biostatistics

Microarray experiments measure thousands of genes at once to identify differentially expressed genes under different conditions. For example, comparisons can be made between genes from the same tissue (cancerous and non-cancerous liver) or different tissues (brain and skin). In a complex disease, researchers are interested in discovering disease causing genes in humans. It has been discovered that humans have approximately 30,000 genes. Microarray experiments can study, for example, all those 30,000 genes at once. If all genes are studied, a microarray experiment produces 60,000 gene expressions from healthy and diseased people. After the collection of data, the next step is to analyze gene expressions. The first step in data analysis is to study if there is a difference in the mean expressions of 30,000 genes from both groups (healthy versus diseased). A common approach is to use the classical F-test. One of the assumption of this test is that genes are independent. However, in nature, many genes can act

together; hence, the assumption of independency is violated. Nevertheless, many researchers are still using this test. In this research, we investigate through Monte Carlo Simulation study to see if the F-test can still be used. Our findings show that F-test can be considered in analysis if the dependency among genes is small to mild. *[Acknowledgment: We would like to thank the California State University Louis Stokes Alliance for Minority Participation for funding our research.]*

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Subcategory: Mathematics and Statistics

Wreath Product Symmetric Functions

Joshua Recore, Winston Salem State University

Frank Ingram, Winston Salem State University

Since Jacobi and Frobenius, symmetric functions have played a fundamental role in representation theory and number theory. The purpose of this research project is to systematically study the Schur functions and give a combinatorial construction using partitions and tableaux. Schur functions can also be defined in terms of Young tableaux in Stanley's work. Another purpose is to generalize this combinatorial construction to wreath product Schur functions using colored tableaux. We achieve this by first considering tensor product of Schur functions and then pass the results to the case of wreath product. In the same spirit, we also obtain the description of Littlewood-Richardson rule for the wreath product Schur functions. We deviate slightly from Macdonald's inner product by requiring that the power sum associated with irreducible characters of G to be invariant under the complex conjugation, which will facilitate us to pass the results from tensor product to wreath product easily. This research is organized into five parts. After an introduction to symmetric functions, we give a preliminary review of the main results concerning Schur functions to set the notations and for later usage in part two. In part three we studied tensor products of symmetric functions and formulate several bases modeled on one variable case. The notion of colored partitions and tableaux is the fundamental combinatorial objects for us to formulate results in tensor products. In part four wreath product Schur functions are introduced by two sets of power sum symmetric functions indexed by colored partitions, which correspond to conjugacy classes and irreducible characters of $G \sim S_n$. We show how to pass from tensor products to wreath products by carefully treating the inner product. In part five we give generalized Littlewood-Richardson rule and discuss their special cases, and finally we discuss the relationship between symmetric functions and characters of wreath products of symmetric groups. *[Acknowledgment: NSF HBCU-UP Award#-0927905]*

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Subcategory: Mathematics and Statistics

FDTD Simulation of Metamaterials

Michael Sanchez, Delaware State University

In recent years there has been tremendous interest in metamaterials. Metamaterials are artificial man-made materials that provide properties which may not be available in nature, such as the perfect imaging lenses and invisibility cloaking devices. In a recent article in *Science*, Pendry et al. have proposed a coordinate transformation approach for designing an electromagnetic cloaking structure. This idea has been extended to other cases, for instance, the electromagnetic wave flowing through a metamaterial slit can be bent as if the slit is much wider. Our research focuses on the numerical simulation of electromagnetic wave propagation for such metamaterials. The numerical method we implemented is based on the Finite-Difference Time-Domain (FDTD) method. The FDTD method is a very popular and successful method for solving Maxwell's equations, and it has a wide range of applications in computational electromagnetism. The metamaterial is an anisotropic medium derived by using optical coordinate transformation and the corresponding FDTD method is developed. Our results correspond with the theory and the results presented by other groups using different methods. Our method also shows good stability as the FDTD method normally has stability problem when simulating anisotropic media. In the future, we will further investigate the metamaterial simulations such as optical black hole and space time cloak.

[Acknowledgment: Historically Black Colleges and Universities Undergraduate Program]

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Subcategory: Mathematics and Statistics

Rimming Flow of an Oldroyd-B Fluid

Anthony Yasuda, University of California, Riverside

Nicholas Danes, California State University, Chico

Ravi Shankar, Butte College, Oroville, CA

We want to study non-Newtonian flow on the inner wall of a rotating horizontal cylinder. Oftentimes it is desirable to obtain a hollow pipe which has smooth interior in the industry. Engineers may then analyze our theoretical description of this system and prevent roughness on the interior of tubes. In particular, we chose to model the viscoelastic properties of the fluid using Oldroyd-B in cylindrical coordinates for both steady and non-steady states. Our motivation in adopting this model was to generalize Dr. Fomin's previous results of the upper-convected Maxwell model by considering viscosity of the solvent

and polymeric components as separate from the total material viscosity. In order to simplify our system and form non-dimensional equations, we used scale analysis. Taking advantage of small parameters, and ignoring terms of that order, we are able to reduce our equations even more simpler. It has been well-documented that polymeric solutes used in rotational molding and coating technologies exhibit relatively weak elastic properties, therefore the Deborah number for such flows is small. ($De < 1$) Exploiting this fact we apply asymptotic expansion and eventually obtain an approximate analytical solution to the second order of the asymptotic series for the steady-state case, and produced numerical solutions to the first asymptotic order for the non-steady state case. Once these solutions are found modeling the thickness of viscoelastic fluid, we study the effects of varying elastic and viscous parameters and their smoothness and physical validity. We found that the second order solution is likely valid for $De < 1/3$ and the first order solution for $De < 1/2$. Also, our solutions appear valid for most values of mass flux, but when mass flux approaches $2/3$, there appears singularities, likely due to film solution destabilizing in more extreme condition. *[Acknowledgment: The authors would like to acknowledge the National Science Foundation for support of this project (DMS Award 0648764).]*

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Nanoscience

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Subcategory: Nanoscience

Surface Coverage of Double Thiolated Molecules on Microsurfaces for Microcantilever Sensors

Alex Avendano, Iowa State University

In unpublished experiments, Kang et al., using their microcantilever sensor, obtained amounts of surface stress up to ten times higher when using double thiolated DNA strands as probe. It is important to study the parameters such as surface coverage as well as the hybridization density and efficiency of these new molecules to better understand the reason as to why they achieved better sensitivity than the single-thiol DNA strands. Understanding these reasons is of uttermost importance as it will allow the development of techniques and methods to optimize these microcantilever sensors. Fluorescence techniques were used to measure surface coverage of double thiolated DNA strands. These values were then compared to those of single DNA strands. The general scheme of the experiment was to perform immobilization on gold surfaces with fluorescent DNA strands (Poly A), then displace them using an etching solution and measure the fluorescence to determine the concentration of the oligonucleotides in the solution. Concentration values for the

etched samples were determined with the use of calibrations curves. Standard calibration curves were made using known concentrations of fluorescent strands in the etching solution. From the concentrations, the corresponding densities were computed. Surface coverage measurements have shown that double thiolated DNA strands have the same attachment to the surfaces as the single thiolated strands, averaging an equal grafting density. This suggests that the greater surface stresses generated by double thiolated Poly-A in Kang et. Al unpublished experiments can be related to a different mechanism of surface stress generation. If the mechanism of surface stress generation were the same, then the amount of surface stress should be the same, given that there is the same number of molecules on the surface. Therefore, it is clear that double thiolated molecules have a different mechanism of surface stress generation which is capable of generating values of up to 10 times higher than those in single molecules. Future work aims to investigate the mechanism of surface stress generation for the double thiolated molecules. The knowledge of these mechanisms will provide ways into optimizing cantilever based microsensors for better sensitivity in applications such as disease diagnostics or dangerous substance detection. *[Acknowledgment: This study was supported by National Science Foundation Awards EEC-1004959 REU Site: MoSalc and CMMI-0547280.]*

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Subcategory: Nanoscience

Using Carbon Nanotubes Conjugated siRNAs for Respiratory Syncytial Virus F Gene Silencing

Brandi Barlow, Alabama State University

Komal Vig, Trey Slaney, Pooja M. Tiwari, Erdal Eroglu, and Shree R. Singh, Alabama State University

Respiratory Syncytial Virus (RSV) is a pathogen that affects the respiratory tract and causes inflammation in bronchioles. This disease can have a large impact on the body resulting in high mortality rate in infants. Despondently, there is still no successful treatment for this virus and there is a need for newer therapies. RNA interference (RNAi) is a post-transcriptional, gene silencing mechanism which uses small interfering RNA molecules (siRNA) for gene silencing. However, a crucial factor for RNAi is to successfully deliver siRNA to the cell effectively. Recently nanomaterials are being employed for the same and carbon nanotubes (CNTs) are one such nanomaterial. CNTs which are tightly coiled hexagonal arrangements of carbon atoms configured into tubes are used to deliver a vast amount of therapeutic agents. In the current study, we want to investigate possibility of using CNTs as a deliver agent for siRNA molecules so as to achieve RSV inhibition in cultured cells. Functionalized CNTs were conjugated with siRNA against RSV

fusion (F) gene and used in vitro with mock RSV infection in HEP-2 cells. Silencing of F gene was observed using indirect immunofluorescence, western blot, reverse transcription PCR and progeny viral titers by plaque assay. Western blots revealed a decrease in F protein expression levels demonstrating that siRNAs against RSV conjugated to the CNTs could inhibit RSV in HEP-2 cells. Research is currently in progress to examine additional siRNAs designed for different RSV genes, alone or in combination for RSV inhibition using rna analysis, protein and viral titers. *[Acknowledgment: This work was supported by NSF-CREST (HRD1241701) and NSF-HBCU-UP (HRD1135863) grant to Prof. Shree R. Singh, Director Center for Nanobiotechnology Research, Alabama State University, Montgomery, AL.]*

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Subcategory: Nanoscience

Detection and Inhibition of Mold Growth Using Biosynthesized Silver Nanoparticles

Marylyn Creer, Alabama A&M University

Tatiana Kukhtareva, Jeanette Jones, and Afef Janen, Alabama A&M University

There is a great need for early detection and treatment of fungal contaminants in buildings where high humidity and high temperature exists. This research presents results of an investigation of types of fungi found in a well populated building and methods used to detect and treat fungal contaminants posing potential risks for health safety and bio-defense.

We studied indoor mold growth which can cause symptoms such as nasal stuffiness, allergies, skin irritation, wheezing and eye irritations to individuals exposed to large amounts of molds in occupational settings. The existence of over 300,000 species of mold, many of which are potentially pathogenic has been estimated. Some pathogenic fungal species produce "mycotoxins," causing toxic reactions in healthy individuals. In humans the range of diseases and respiratory infections caused by fungi include aspergillosis, mucormycosis, skin, hair and nail infections. We investigated both the feasibility of mold detection using an extracellular biosynthesis process; and the inhibition of mold growth by biosynthesized silver nanoparticles (AgNPs). Our approach is based on the ability of fungi to reduce noble nanoparticles from silver, gold salt, like AgNO₃, HAuClO₄, etc. This reaction process is known as extracellular/intracellular biosynthesis process. Silver and gold nanoparticles expose an absorption peak in the visible range, giving opportunity for easy detection using the portable spectrometer, and thus can be used in sensor fabrication. Mold presence can also be detected by electrical signals generated during the reaction process since

silver is a good conductive material. Mold was collected in various locations inside the building. Three types of fungi were isolated from the building using standard isolation techniques. Analysis showed presence of *Alternaria*, sp., *Aspergillus*, sp., and *Rhizopus*, sp. We found that combination of these fungi isolates successfully reduce silver nanoparticles. Reaction process was monitored using UV-Visible spectroscopy, and the surface plasmon resonance peak of 420nm corresponded to appearance of silver nanoparticles. Injection of 20 µL with 10 ppm concentration of AgNPs in Petri dishes of 100mL Sabouraud Dextrose Agar (SDA) resulted in the inhibition of mold growth. Future research is to determine the minimum inhibitory concentration of AgNPs capable of preventing mold growth and the measurement of conductivity changes during the extracellular biosynthesis reaction. *[Acknowledgment: This study was supported in part by the NSF HBCU-UP Grant # HRD0928904.]*

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Subcategory: Nanoscience

Incorporation of Silver, Diamond and Gold Nanoparticles in Polymer Nanofibers for Tissue Engineering and Drug Delivery

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Kenneth LaiHing, Ro-Jay Reid, and Hanna Smalley, Oakwood University

Susan V. Olesik and Toni Newsome, Ohio State University

Nanofibers have interesting characteristics such as large surface area to volume ratio, flexibility, and superior mechanical performance. For this reason, these fibers are used in many important applications such as drug delivery systems as well as tissue engineering. Drugs are now able to be controllably released to target cells, which decreases side effects. This provides an economic benefit to the consumer as well as drug synthesis systems. The most efficient technique for preparing nanofibers is electrospinning. An electric charge was applied to the metal tip of a syringe, allowing a flow of solvent plus polymer to spray at a continuous rate. During collection the organic solvent evaporated, leaving only the fibers of the particular polymer on the plate. Nanofibers consisting of polylactic acid (PLA), poly(lactide-co-glycide) (PLGA) and poly(ethylene vinyl acetate) (PEVA) with silver, diamond, and gold nanoparticles were prepared and characterized using optical and scanning electron microscopy (SEM). By varying the concentration, voltage, flow rate, and distance between the needle tip and collector plate, the system was optimized to produce different diameter nanofibers with consistent results. Nanofibers with different and unique properties were generated when different polymers were used with the various

nanoparticles. Most solutions consisted of 5% (w/v) of each polymer in various organic solvents. This concentration produced the most consistent results. Nanofibers obtained from these polymers are biocompatible, making electrospinning with inert nanoparticles an ideal method of drug delivery to target cells. The nanoparticles ranged in size from 3 to 50 nm and nanofibers from 100 to 500 nm. Future research will focus on the biodegradability of the fibers, and characterizing each to discern a time table for the specific polymer used. The fibers are expected to dissipate into the body in low concentrations over a certain time period, therefore causing little to no side effects in the subject. As a result, drugs will be able to be released to target cells controllably which decreases side effects. This may provide an economic benefit in drug synthesis and delivery for the consumer. *[Acknowledgment: This research was funded, in part, by grants from the National Science Foundation (NSF), to Dr. Kenneth LaiHing and the HBCU-UP Program. Grant #811507]*

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Subcategory: Nanoscience

Detection of Protein Using Carbon Nanofiber Based Biosensor

Christian Ezeagwu, Norfolk State University

Nanotechnology is an emerging field, drawing attention due to its infinite innovating applications. Subordinate to nanotechnology, lies the area of electrical biosensors, in which progress is being made to optimize functions such as the diagnostics of infectious diseases and environmental monitoring. Carbon nanofibers (CNF) are a favorable electrode candidate for potential biosensor studies due to: its ability to be functionalized, high current carrying capacity, strength, and flexibility due to molecular structure. The sensors utilized in this study are individual, freestanding, vertically-aligned CNF, fabricated through plasma-enhanced chemical vapor deposition on a silicon wafer. The fabricated wafers were utilized in effort to enable the binding of protein onto the wafer, thus resulting in the detection of protein. The electrochemical properties of CNF chips, including unmodified variations that serve as the control group in this study, can be characterized through cyclic voltammetry (CV). In an attempt to functionalize the fabricated wafer, the chip is initially treated with a solution composed of phosphate buffered saline (PBS) and the coupling reagent [N-(3-dimethylaminopropyl)-N'-ethylcarbodiimide hydrochloride (EDC) / N-hydroxysulfosuccinimide sodium salt (NHS)]. The application of EDC+NHS to the CNF chip was evaluated through CV, to confirm application. The chip was then treated with a solution of anti troponin (monoclonal antibody) in a PBS solution and was then followed by a CV scan. The wafer was finally treated with cTnI (antigen protein) in a PBS buffer, followed by the final CV scan. Through cyclic voltammetry

analysis, a successive substantial decrease in overall current is observed, due to the physical blockage on the electrode surface, caused by probe/EDC+NHS binding. Upon binding of the target protein, the current of the CV scan decreases slightly, again suggesting a change in the electron transfer at the electrode's surface; concluding that the capture probe immobilization and specific target analyte binding occurred on the CNF electrode surface. Upon successive research on the detection of protein using carbon nanofiber based biosensors, impedance spectroscopy (EIS) is to be used as a confirmation technique, to verify the binding of reagents. *[Acknowledgment: This study was supported, in part, by the NASA Science and Technology Institute (NSTI)]*

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Subcategory: Electrical Engineering

Introducing SiC as a Semiconductor Using MOS Capacitors

Keevin Hood, Norfolk State University, Norfolk, VA

Hypothesis: Using SiC as a semiconductor, a MOS Capacitor will produce a working CV curve even with non-high quality material. Silicon has been used as the top semiconductor for many years, but has failed in high powered device uses. There are many elements that exist but only a handful can even be considered for high powered devices. We introduced SiC for further research so that it can become a prime contender for high powered device use. Using the simulation of a MOS capacitor, we modeled silicon carbide (SiC) as a semiconductor so that production of higher quality SiC can become a common process. With the simulation software Silvaco, we simulated a MOS capacitor using molybdenum, Mo, for the metal or gate, silicon carbide, 4H-SiC, for the semiconductor and silicon dioxide, SiO₂, for the oxide. After simulation, we measured the device including different effects such as interface charge, oxide charge, and compared our results to the simulated CV curve of an MOS capacitor. Our experiment resulted in only slight degradations and shifts in our simulated CV curves which mean that our device was stable even with opposing characteristics. In conclusion, we found that SiC could possibly be used as a semiconductor for devices. Further research would help us determine whether we can replace Si with SiC, use SiC for high powered devices, or stop further research because of certain characteristics in SiC. I would like to thank my co-author Dr. Terry Alford and Arizona State University's Center for Solid State Electronics Research. *[Acknowledgment: Dr. Terry Alford]*

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*Subcategory: Nanoscience***Experimental and Theoretical Studies of Tunnel Junction-based Molecular Spintronics Devices****Jote Jinfessa, University of the District of Columbia**

Christopher D'Angelo and Pawan Tyagi, University of the District of Columbia

Molecular spintronics devices are highly promising for revolutionizing the computers and computational technology. Future development of molecular spintronics devices will depend on the ability to establish electrical connections to the variety of molecular device elements and then understanding the effect of molecules in yielding final device attributes. We are currently producing molecular spintronics devices by utilizing magnetic tunnel junction as the test beds. Magnetic tunnel junctions are being transformed into molecular spintronics by bridging the molecular device elements across the ~2 NM thick insulator. At present we are utilizing organometallic molecules with different lengths and chemical structures. This conference paper will demonstrate our current findings and highlight the attributes of tunnel junction based molecular devices. In addition to experimental studies we are also theoretically studying various forms of molecular spintronics devices. Molecular device elements are found to produce dramatic changes in the magnetic properties of the magnetic tunnel junctions. Degree of molecule impact strongly depends on the nature of molecular exchange coupling, temperature, and molecular device designs. This conference paper will discuss insights we are gaining from the experimental and theoretical studies about the magnetic tunnel junction based molecular devices. *[Acknowledgment: This research is partly funded by MARC/NIH/NIGMS - 1T34GM087172-01A1, STEM Center - NSF/HBCU-UP - HRD-0928444, and NSF-RIA/HBCU-UP-HRD1238802.]*

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*Subcategory: Microbiology/Immunology/Virology***Evaluation of Biodegradable PLA-PEG rMOMP-278 Chlamydia Nanovaccine in Mice****Edgar H. Macal Jr., Alabama State University**

Saurabh Dixit, Shree R. Singh, and Vida A. Dennis, Alabama State University

Chlamydia trachomatis, the leading cause of bacterial sexually transmitted infections (STIs) is an important public health problem of overwhelming significance because it causes considerable morbidity and socioeconomic burden worldwide.

An estimated 92 million cases of *C. trachomatis* genital infections occur globally each year, with over 4 million new cases occurring annually in the US. The annual estimated cost of non-HIV STIs in the US is \$10 billion, with approximately \$4 billion of this attributed to *C. trachomatis*. Development of a *C. trachomatis* vaccine has been a formidable task partly because of an ineffective delivery system. We generated a peptide derivative of *C. trachomatis* major outer membrane protein (MOMP) (rMOMP-287) and showed that it induced weak antibody responses in mice. We hypothesize that rMOMP-287 encapsulated in poly (lactic acid)-b-Poly (ethylene glycol) (PLA-PEG) will enhance antibody responses and serve as an effective delivery system. Encapsulated rMOMP-287 was ~200 nm, spherical in shape and with ~60 % encapsulation efficiency. Two groups of BALB/c mice (4 mice/group): (i) Group 1 (PLA-PEG + PBS) (ii) Group 2 (PLA-PEG + rMOMP-278) received three immunizations at two-week intervals and were sacrificed two weeks after the last immunization to collect serum samples for systemic antibody analyses. Analyses included IgM, IgG as well as IgG2a (Th1) and IgG1 (Th2) rMOMP-isotype specific antibodies. Our data indicates the successful encapsulation and characterization of rMOMP-287 in PLA-PEG and, more importantly, that PLGA enhanced the capacity of the peptide to induce antibody responses. These findings make this nanovaccine an attractive candidate against *C. trachomatis* infection. *[Acknowledgment: This work is supported by NSF-CREST grant (HRD-1241701)]*

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*Subcategory: Nanoscience***Positron Lifetime, Magnetization, and FTIR Studies of Mn/Rare Earth Oxides****Andre Merille, Grambling State University**Damilola Fasheru and Naidu Seetala, Department of Mathematics and Physics, Grambling State University
Rui Li and Kerry M Dooley, Department of Chemical Engineering, LSU-Baton Rouge

Mn/Rare Earth Oxide (REOs) nanoparticle catalysts are used as desulfurization adsorbents. The nanoporosity of these catalysts may influence the diffusion characteristics that may affect the desulfurization absorption efficiencies. Positron annihilation lifetime spectroscopy (PALS) can provide information on vacancy defects and nanoporosity (pore size and concentration of pores). Bulk Mn is mostly paramagnetic, but it shows ferromagnetic character when a thin film is coated on semiconductors/metals even though the interacting metal is nonmagnetic. The exchange interaction at the interface provides ferromagnetism for Mn. Here we study the nanoporosity, magnetic character, and FTIR spectra for Mn/REOs with different compositions. Five sets of Mn/Rare Earth Oxide (REOs)

nanoparticle catalysts with different compositions were studied. A ²²Na positron source was used for lifetime spectrum and POSFIT computer program provided three lifetime components for each sample. The third lifetime component provided the information on pore size (lifetimes) and concentration of pores (intensities) using a simple model. The second lifetime component showed variations in vacancy clusters and their concentrations. The magnetic curves consisted of paramagnetic and ferromagnetic components. The ferromagnetic character is presumed to be mainly coming from the exchange interaction at the interface for Mn with other oxides. The saturation magnetization follows the order of Mn composition in these Mn/REO catalysts. The FTIR spectra showed main difference in the absorption peak at the wave number of 2140 cm⁻¹ which may be assigned to CO absorption at Mn or Ce oxides.

[Acknowledgment: This work is partly supported by DOE-EFRC (Atomic Level Catalyst Design, contract# DE-SC0001058) and LA-SiGMA (contract#EPS-1003897) grants. Louisiana Alliance for Minority Participation (LAMP).]

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Subcategory: Nanoscience

The Photo-degradation of Melanin Thin Films by UV Lithography

Belther Monono, Alabama A&M University

Melanin plays a key photo-protective role in our bodies. Its high UV-visible light-absorption property and chemical binding property makes it useful for photo-electric applications and applications in tissue engineering. An interferometric technique is used to investigate the effect of ambient humidity on the photo-degradation of melanin. The melanin thin films were made using a spin coat machine. Gratings on the melanin thin films were fabricated using a 355 nm diode laser. A low power He-Ne laser is used to examine the grating formation. UV intensity ranged from 2 mW to 30 mW, and ambient humidity ranged from 15% to 98%. The results showed that humidity has a large effect on the photo-degradation of melanin. The results show great biological implications and implications in the development of organic electronics. It also shows that the use of an interferometric technique is a very effective to study biomolecular samples. *[Acknowledgment: This study was supported, in part, by a grant from NSF/AAAS awarded to Padmaja Guggilla, Ph.D., Alabama A&M University, Normal, AL. Also by a grant from EPSCoR awarded to Anup Sharma, Ph.D., Alabama A&M University, Normal, AL.]*

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Subcategory: Microbiology/Immunology/Virology

Mechanism of Bactericidal Effect of Gold Nanoparticle Against Gram Positive Bacteria

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MT Coats, Veolanda Peoples, Ejovwoke Ememu, Ronda Bibbs, and Shree R. Singh, Alabama State University

Streptococcus pneumoniae is a bacterium that causes otitis media, pneumonia, and sinusitis especially in highly susceptible individuals including children and the elderly. The ability of nanomaterials to possess bactericidal effect against *S. pneumoniae* in growing culture is under investigation. While the use of nanomaterials as antimicrobials is a rapidly growing field of research, the mechanism of action remains largely unknown. Our research sought to test the hypothesis that exposure of *S. pneumoniae* to gold nanoparticles (AuNP) will cause a change in the protein profile and protein expression in the bacteria. AuNP of uniform size and shape were synthesized utilizing sodium citrate. Strains of pneumococcus were grown in varying concentrations (below the MIC) of AuNP. The gross protein profile was examined by separating cell lysate using electrophoresis. As the amount of AuNP increased, the profile changed as well. While it is not a quantitative measurement, our data shows that there is a response in pneumococcus to AuNP that can be seen at the protein level. Future studies will include microarray analysis to measure the response of the bacteria on the gene level. *[Acknowledgment: This work was supported by NSF-CREST (HRD-1241701) and NSF-HBCU-UP (HRD-1135863) at Alabama State University, Montgomery, AL 36104.]*

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Subcategory: Nanoscience

Electrical Biosensing of Enzyme Activity with a Precipitation-Based Nanoreactor

Melody S. Roberson, Texas Southern University

The nanopipette presents a unique biosensing platform that can detect single molecules and provide a route for nanoscale studies of ion transport. Previous research has utilized quartz nanopipettes as nanoreactors to detect precipitates that form inside a nanopore. Precipitation of this insoluble salt was induced to generate oscillating current blockades. When the pore of the nanoreactor is blocked by the precipitate, the current decreases; after the trapped-precipitate evacuates the pore, the current expedites. We are using this same system to monitor the enzyme, alkaline phosphatase, and its effects on the formation of an insoluble salt, zinc phosphate. The enzyme

cleaves a phosphate group from a substrate, making the phosphate ion readily available to form a salt with zinc, thereby causing precipitation. We describe the conditions required to generate oscillating current due to zinc phosphate precipitation in a nanopore, as well as the effects of alkaline phosphatase. Based on preliminary calculations, we expect to detect less than one nanogram of enzyme using the nanoreactor.

[Acknowledgment: NASA University Research Center (URC)]

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Subcategory: Nanoscience

Electrospinning Nanofibers and the Degradation Properties of Poly(lactide-co-glycolide)

Christian Rogers, Alabama State University

Elijah Nyairo, Brandi Bethune, Monica Smith, and Manoj Mishra, Alabama State University

The emergence of electrostatic spinning of biodegradable polymers offers a fabrication technique by which continuous fibers are produced from the submicron diameter down to the nanometer diameter. This technique has received a great deal of attention in recent years as a method of fabricating nanofiber tissue scaffolds that more closely mimic the nanoscale features of the natural extracellular matrix (ECM). Poly(lactide-co-glycolide) (PLGA) nanofibers were fabricated by electrospinning and characterized for bone tissue engineering applications. For this study, PLGA was electrospun on a static collector. The fiber stream was optimized by adjusting the concentration of the solution and process parameters (applied voltage, needle size, volume feed rate, distance of the collector plate from the needle tip) to assess their effect on scaffold porosity, thickness, and fiber diameter. PLGA was chosen because of its high level of controllable biodegradability, biocompatibility and bioactivity. SEM and subsequent image analysis revealed that the structure of the electrospun PLGA scaffolds significantly varied with solution concentration. In vitro degradation mechanism of PLGA was clarified by DSC and FTIR. PLGA's amorphous structure caused changes in the glass transition temperature (T_g) over time as the polymer degraded. FT-IR data showed increase in O-H group absorbance over time. While studies involving fabrication of scaffolds based on PLGA and Hydroxyapatite (HA) are currently underway, preliminary studies reveal that at low concentrations, HA acts as reinforcement, whereas at higher concentrations the presence of aggregation appears to be detrimental to the scaffold. The combined effect of the polymer and reinforcement with higher strength bioceramic nanofillers, contribute to the stiffness of the resultant nanocomposite scaffold. *[Acknowledgment: This study was supported, in part, by a grant from DoD/HBCU-MI awarded to Minoj Mishra PhD, Elijah Nyairo, Derrick Dean PhD and Vinoy Thomas PhD,*

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Subcategory: Materials Science

Thin Film Growth and Nanostructure Fabrication for Semiconductor Devices

Danielle Taylor, Norfolk State University

Nanostructures are particles that require a microscope to look at them correctly. There are two functional properties that are being introduced to this research and they are ferroelectricity and piezoelectricity. These properties work well with Barium Strontium Titanate (BST) and Barium Titanate (BTO). Ferroelectricity is the property of certain materials which has spontaneous electric polarization that can be reversed. The purpose of this research is to investigate the electric and structural properties of nano scale in ferroelectric properties. There is a new approach to form nanostructures on functional oxide thin films using HSQ patterned templates. Thin films of BaSrTiO₃ and BaTiO₃ have been deposited on those templates by PLD (pulsed laser deposition) and Rf sputtering. In the future we plan to characterize BST films and Nanostructures using electro characterization. The mode that we are going to use is Piezoelectric Response for the AFM. *[Acknowledgment: DOD (CEAND) W911NF-11-1-0209 US Army Research W911NF-11-1-0133NSF-CREST (CNBMD) HRD 1036494 NSF-RISE HRD-0931373]*

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Subcategory: Nanoscience

Ribbon Lattice High Altitude Research Platform [HARP]

Christopher Woodward, Morehouse College

Malachi Norman, Morehouse College

The adhesive properties of graphene and boron nitride nanoribbons (GNR & BNNR), resultant from Van Der Waals interactions, make these ribbon materials a useful platform for attraction and retention of varying attitude atmospheric particulates. We hypothesize that GNR & BNNR would be a viable sensory platform at high altitudes. We are trying to determine how viable a Ribbon Lattice is as a sensory platform, and to research and test the adhesive properties of graphene at varying levels of the atmosphere, from Troposphere to Stratosphere, as a particulate collector and reader for pollution. We plan to accomplish project goals by the deposition of GNR &

BNNR on underlying silicon oxide substrate and its incorporation into the HARP platform. The HARP Platform composed of a multitude of research systems is lifted to the stratospheric levels via hydrogen balloon. The ribbon lattice samples were exposed to the atmosphere with the use of programmed Legos® Robots. Three samples were tested with timed opening and closing intervals. Sample 1 opened at HARP launch start and closing at 64,000 ft., Sample 2 opened from HARP launch to decent at 100 ft. Sample 3 opening at 64,000 ft. and closing at balloon burst at stratospheric 71,000 ft. To compare the particulates that were gathered at higher altitudes, we tested GNR and BNNR samples not placed on the platform. After exposure to various altitude atmospheres the characteristic Raman spectroscopy G band and D band peaks of GNR and BNNR remain unchanged. The van der Waals interaction inherent on the GNR basal plane may yet prove feasible as an adhesive for atmospheric particulates. Further studies will be needed to determine these ribbon materials suitability for high altitude sensor platform. In the future our research team would like to repeat test of Graphene/boron nitride platform over densely populated area for test of atmospheric particulates and pollutants at stratospheric altitude and Characterize BNNR material. *[Acknowledgment: This research was made possible by grant awards from the National Science Foundation (NSF)[Grant No. DMR-0820382] Historically Black Colleges and Universities Undergraduate Program (HBCU-UP/ACE 1043330), and the NSF Partnerships for Research and Education.]*

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Physics

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Subcategory: Nanoscience

Modeling Nanoplasmon Interactions with Vanadium Dioxide (VO₂) During Phase Transition Using the Finite-Difference Time-Domain (FDTD) Method

Matthew Acosta, California State University Long Beach

The interactions of surface plasmons during the insulator to metal phase transition of vanadium dioxide (VO₂) are studied using the Finite-Difference Time-Domain (FDTD) method. First we set up a simulation where we wanted to simulate the dependence of electromagnetic near field of gold nano rods on a glass substrate using a plane wave. From this simulation we wanted to see how a changing length of the rod will affect the plasmonic response of these gold nano rods. It was determined that a length of 1.7 μm had the highest plasmonic resonance. We then investigated how the metal-insulator phase of the substrate affects the near field plasmons of the gold rod. We have then chosen the length to be 1.7 μm because as we saw in

the last simulation, the gold nano rods are most resonant at this length. Substrates modeled include various metals, insulators, semi-conductors, and the two phases of VO₂. We found that the metal substrates discharge plasmons while insulator substrates allow plasmonic resonance in the gold rod, leading to a possible application of VO₂ as an optical switch. From these calculations, the intensity of the electric fields at the various phases of VO₂ are studied, furthering our understanding of the behavior of the metamaterial at the near field region. These calculations will then be compared to experiments done in the lab.

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Subcategory: Cancer Research

Investigating the Visibility of Cancer Cell Removal Using CO₂ Laser Ablation Technique

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The importance of this research is to study the visibility of eliminating chemotherapy as an option to treat patients after removing cancerous tissue or tumors. The hypothesis is proposed that laser ablation of tissue can be a highly successful method of removing tumors and cancerous cells from skin and internal organs, such as from the liver and kidneys, as opposed to chemotherapy. This will result in eliminating the need for chemotherapy after surgery, as compared to traditional surgical procedures, which result in many complications due to the dependence on chemotherapy after surgery for long periods of time. The carbon dioxide laser provides the cells with enough energy to be ablated one by one without cutting through the cell itself, leaving behind a remanence of the cancerous cell, which normally has to be eliminated after surgery by chemotherapy. The Carbon Dioxide laser with a 9.6 micron wavelength and 200 mW to 800 mW was used for ablating three different cow tissues (liver, kidney and heart). The different tissues are used as markers for the content of the water/blood percentage in different tissues in the body. This first step is necessary to determine the minimum and optimum laser power needed for ablations. Extensive power will lead to a different process, which will harden the surface tissue beyond point of elasticity of separation of the cells and then the process of ablation will fail. This paper will discuss the preliminary data of the ablation technique, using a real-time camera to monitor the process and measure the size of the crater to establish a graphical model for the ablated image of each type of tissue. Graphical modeling and crater size measurements indicated the successful removal of cancerous cells from the sample tissues

and organs, and provided evidence to support the hypothesis that laser ablation of tissue is a highly successful method of removing tumors and cancerous cells from skin and internal organs as opposed to chemotherapy. The results obtained provide future directions in alternative treatment options to chemotherapy in the field of cancer treatment.

[Acknowledgment: The authors would like to thank the generous support of the NSF LS-LAMP Louisiana Senior Alliance Program during the course of this study. In addition, we would like to thank our Mentor, Professor Darwish, for his commitment and guidance in every step that helped to make this work possible.]

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Subcategory: Physics (not Nanoscience)

Systematically Generated Layer 1 Weakly Coupled Free Fermionic Heterotic String Models

Rachel Elliott, Virginia Polytechnic Institute and State University

Gerald Cleaver, Jared Greenwald, and Doug Moore, Baylor University

Many physics theories are capable of providing quantum theories of three of the fundamental forces of nature, namely the strong, weak and electromagnetic force, but are unable to provide a reasonable quantum theory of gravity. String theory not only can quantize the strong, weak and electromagnetic forces, but the graviton (the quantum of the gravitational field) appears as a vibrational mode of closed strings; therefore allowing for a quantum theory of all four of the fundamental forces. This allows string theorists to provide a single unique unified theory of all fundamental interactions. The weakly coupled free fermionic heterotic string (WCFHFS) formalism has been successful in generating promising phenomenological models. This mathematical structure is also convenient for building systematic, computer automated models. Therefore this area of string theory is of interest to study further and due to the large size of the string theory landscape (containing on the order of 10500 configurations) computer automated model building is of interest to develop. The WCFHFS structure consists of closed strings and thus has disjoint sets of left and right moving modes. Left movers are the modes associated with the 10-dimensional (half-integer) fermionic superstrings whose vibrational modes describe matter. Right movers are the modes associated with (integer) bosonic strings propagating in 26-dimensions whose vibrational modes describe the force carriers. Two inputs are specified for constructing layer 1 WCFHFS models, namely the basis vector set and the GSO coefficient matrix. A number of modular invariance constraints are imposed on these inputs in order to ensure quantum mechanical consistencies. The basis vector set fully defines the

compactification of space by specifying the phase gained by parallel transporting fermion modes around non-contractible loops on the worldsheet. For this project, layer 1 WCFHFS models of orders 1-5 were built. Among these models the following grand unification theory groups were found: 1 Pati-Salam, 3 E6 and 32 SO(10), leaving 36 of the models as phenomenologically interesting and therefore only these 36 are of interest to develop further. In future work vacuum expectation values and the results of SUSY breaking will be found for a fully developed model. The number of spacetime supersymmetries, N , of the models were also found with $N \in \{0,2,4\}$ for even ordered layer 1 models and $N \in \{0,4\}$ for odd ordered layer 1 models. *[Acknowledgment: This study was supported by the National Science Foundation under grant PHY-1002637 awarded to the CASPER group at Baylor University under which the research was conducted.]*

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Subcategory: Physics (not Nanoscience)

PVDF:PZT Nanocomposites Films for Uncooled Infrared Detectors

Alayna Fields, Alabama A&M University

Uncooled infrared (IR) detectors have been rapidly technologically advanced over the past several years. In particular, IR detectors operating at room temperature are attractive to many civilian and military applications, such as night vision, detection of gas leakages, surveillance, fire rescue operations, manufacturing quality control, early fire detection and guidance, medical diagnostic, missile tracing and interception. Pyroelectric modified lead zirconatetitanate:polyvinylidene fluoride (PVDF:PZT) composite films have been fabricated by solution casting technique. The pyroelectric and dielectric properties of the composite films were examined for their use in uncooled infrared detection applications. The properties measured include: (i) dielectric constants and (ii) pyroelectric coefficient as a function of temperature. From the foregoing parameters, materials figures-of-merit, for infrared detection and thermal-vidicons, were calculated. The results indicated figures-of-merit of composite films were higher than pristine polyvinylidene fluoride films. *[Acknowledgment: This research has been supported in part by the NSF HBCU-UP Grant #HRD0928904]*

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Subcategory: Physics (not Nanoscience)

Carol: The Cooking Robot

Mohamed Haji, University of Minnesota/St. Olaf College

The goal of our summer research project was to develop a robotic platform that is capable of using tools and assisting humans in a common environment. Using a robotic arm, Carol, a force sensor for force-torque feedback, and a Kinect for vision feedback, we were able to program Carol to intelligently use a measuring cup and a knife. Using the vision input from a Kinect, we created a coordinate transform between the arm and the Kinect. This, used alongside pattern and color matching programs, enabled us to have the arm locate the positions of the various objects in our workspace. We use Inverse Kinematics and smooth motion planning to control Carol's movements. The force-torque sensor mounted on the wrist allows us to measure the weight of the scooped ingredients, determine whether contact is made with a surface, and to use proportional feedback to maintain a constant force on a surface. We have successfully automated the use of different tools using a robotic arm, force sensor, and Kinect. We faced many complications with the specific type of robotic arm we purchased. As we move forward, we hope to experiment with different types of robotic arms to improve the overall motion control. Our goal is to continue to build a toolbox of skills in robotics so that we can work further towards creating robots that interact with humans outside of hyper-controlled manufacturing environments. *[Acknowledgment: Special thanks to Dr. Jason Engbrecht, St. Olaf College, Devin Lackie, St. Olaf College, the TRiO McNair Scholars Program, TRiO Student Support Services (and LSAMP) and the St. Olaf CURI Program.]*

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Subcategory: Physics (not Nanoscience)

Temperature Dependence of the Dielectric Function of Ge by Spectroscopic Ellipsometry

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Germanium has important applications in photovoltaics as a substrate for III/V triple-junction solar cells, especially in space vehicles and for terrestrial concentrator-based applications. Unfortunately, the optical properties of germanium (complex refractive index and absorption coefficient) and their temperature dependence (important to consider the effects of the space environment or the radiation-induced heating in

concentrators) are not as well-known as for silicon, which limits the accuracy of modeling for solar cells and Ge-based optical interconnects. In this work, we report precision measurements of the complex refractive index of germanium from 0.5 to 6.6 eV at room temperature using variable-angle spectroscopic ellipsometry. To improve accuracy, especially at photon energies below 2 eV, we used a Berek waveplate compensator. By cleaning a commercial Ge wafer in isopropanol followed by deionized water, we were able to reduce the native oxide thickness to 1.3 nm. Heating the wafer in UHV at 700 K did not reduce the oxide thickness further. (The oxide thickness can be determined with precision measurements of Δ below the band gap on a single-side polished wafer.) From the ellipsometric angles of the Ge wafer measured at three angles of incidence (65, 70, and 75°), we calculated the dielectric function from 0.5 to 6.6 eV, by correcting for the effects of a native oxide. Mounting our wafer in a compact UHV cryostat allowed temperature-dependent measurements from 80 to 700 K at 70° angle of incidence. Using similar methods as described above, we determined the dielectric function at different temperatures. We also determined the critical-point parameters (amplitude, energy, phase angle, and broadening) of the E_0 , $E_0+\Delta_0$, E_1 , and $E_1+\Delta_1$ critical points as a function of temperature. To separate the non-resonant contributions from the critical-point line shapes, we calculated the second derivative of the dielectric function with respect to photon energy and fitted the result to analytical line shapes with two-dimensional critical points. In general, our results are in good agreement with those of Viña et al. However, our results cover a wider spectral range and are more accurate because of the use of a compensator. Work is in progress to form thermal oxides on Ge wafers by annealing in oxygen, which will allow a multi-wafer analysis for Ge similar to work on Si by Herzinger et al. *[Acknowledgment: This work was supported by NSF (HRD-0803171) the New Mexico Louis Stokes Alliance for Minority Participation and NSF (DMR-11104934)]*

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Subcategory: Physics (not Nanoscience)

Analysis of Stainless Steel Using Laser Induced Breakdown Spectroscopy

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Charlemagne Akpovo and, Lewis Johnson, Florida Agricultural and Mechanical University

Laser-induced breakdown spectroscopy (LIBS) was used to collect emission spectra from several National Institute of Standards and Technology (NIST) stainless steel samples.

Quantitative results are often obtained by creating calibration curves from well characterized standards. The calibration curves may then be used to determine the concentration of the elements that are present in the unknown material with similar characteristics. Several studies have been carried out on stainless steel using a wide range of experimental conditions. This includes using lasers with various wavelengths and pulse energies, as well as a diverse collection of spectrometers and detectors. One of the most important factors that affect plasma emission is the choice of wavelength used as the irradiation source. Plasma shielding and ablation efficiency will also play role in the observed emission. In this study, LIBS experiments were conducted using the fourth harmonic 266 nm of a Q-switched neodymium-doped yttrium aluminum garnet (Nd:YAG) laser. The laser has a pulse length of approximately 8.0 ns and is operated at 10 Hz. A dual channel spectrometer equipped with a non-intensified charged-couple device (CCD) was used to disperse and detect the plasma emission. The spectrometer has range of 200 to 680 nm and resolution ranging from 0.17 to 0.19 nm full width half max (FWHM) depending on the channel used. After optimizing the lens to sample distance for increased intensity while maintaining a low relative standard deviation (% RSD), experiments were performed on four NIST standards. These include NIST SRM 1219, C1152a, 1223 and C1153a. In the current setup, %RSD for several spectral lines range from 3-10% from most of the samples. Although 266 nm is known to have higher ablation rates, this may not necessarily correspond to better analytical performance in the current experimental configuration. In this study, we will compare the accuracy, precision, and detection limit of several elements using 266nm as the irradiation source. Future experiments will include comparing results obtained using 532 nm and 1064 nm as the irradiation source. *[Acknowledgment: Funded by the HBCU-UP Program]*

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Subcategory: Materials Science

Fabrication of Solution Processed Films for Organic Solar Cells

Dontrel Reynolds, Alabama A&M University

Organic solar cells hold the potential of low-cost production as compared to inorganic solar cells, as well as the increase in efficiency [1]. To realize these possibilities, the key is to fabricate most of the functional films in requisite structures via ambient solution-processed techniques. The PEDOT: PSS films, which are commonly used as an anode layer in organic electronic devices [2]. In the present study, several film-depositing techniques of PEDOT: PSS on ITO glass substrates, namely spin-coating, spray-coating, brush-painting and spray+brush (both together) were explored. It was

demonstrated that coating technique "Spray+Brush", without the use of special machine such as a spin-coater, is a viable alternative. In order to examine the potential application of PEDOT: PSS films in solar cells, ITO/PEDOT: PSS/Ag device structures were designed, fabricated, and characterized for morphological, optical and electrical properties. A smooth and thin films of PEDOT: PSS were obtained by "Spray+Brush" coating method with attractive sheet-conductivity having noteworthy potential in fabricating OSCs with different architectures. The research work to fabricate organic solar cell is in progress utilizing demonstrated technique.

[Acknowledgment: This work has been supported by NSF grants (0927644, EPS-1158862) and HBCU-UP (HRD0928904).]

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Subcategory: Pollution/Toxic Substances/Waste

The Effect of Heat on Granite Rocks for Nuclear Depository

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Granite is an intrusive rock that has become subject of great nuclear and geological interest, in particular as depository for nuclear spent fuel/nuclear waste. Since radioactive waste continues to emit significant amount of heat for a prolonged period of time, knowledge of thermal properties of the storage material is of critical importance. The focus of our study is to define thermal properties of granites subjected to high temperatures by determining the thermal expansion coefficient by Thermomechanical Analysis (TMA) and thermal stability by combined Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), and Mass Spectrometry (MS). Additionally, the compressive strength of the samples heated to high temperatures is being determined. Data indicates that granite undergoes step like transitions that expand its dimensions with increased temperature, the largest transition being at an average temperature of 700°C. With DTA, MS, and TGA, experiments show that granite has a small mass loss of 0.41% (mainly oxygen and water) before reaching 800°C. It is hypothesized that granite becomes weaker as temperature is increased due to the analyzed dimension change and mass loss.

The results of our studies confirm this to be accurate through compression tests of pre and post heating procedures of Gabbro samples, by comparing the strength test of a sample at room temperature vs. a sample heated to 700°C and then cooled. This study will facilitate the search for a potential long term storage facility for spent fuel rods that are replaced in nuclear power reactors. The thermal mechanical properties of these granites will also be helpful in understanding the uncertainty in the

predicted rates of strength of current storage facilities. Future work involves similar experimentation on other potential depository units such as clay and salt mines and the comparison of these two materials to granite. *[Acknowledgment: This research was supported by UHD Scholars Academy through NRC HIS/MSI IUNI grant.]*

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Subcategory: Nanoscience

Light Activated Nanoscale Patterning of Dye-labeled Biomolecules

Angelicia Thomas, Alabama A&M University

Sierra Richardson and Aschalew Kassu, Alabama A&M University

Phospholipid bilayer membrane has been proposed as a natural biocompatible platform for attaching biological molecules such as proteins for biosensing related applications. Due to the enormous potential applications of biomimetic model biomembranes, various techniques for immobilization and patterning of these membranes onto solid supports and their possible biotechnological applications have been reported. Immobilization of biomolecules on surfaces is widely used for biosensing applications. These molecules are either covalently bonded or adsorbed on the surface and have affinity to the specific biomolecule which is targeted in sensing. Known immobilization techniques include photopatterning of thiol surfaces with UV light and plasma techniques for generating chemically reactive surfaces. UV-induced immobilization of biomolecules in a biosensor array has been demonstrated recently.

The work presented here has the potential to develop similar arrays using visible light. We have demonstrated this technique for immobilization of a phospholipid on polybutadiene-coated glass surface. While photopatterning has been accomplished in several polymers, many of them are toxic and unsuitable for biomedical applications. Polybutadiene is known to be free from toxic additives. It is biologically benign and thus suitable as a platform for biosensing-related immobilization. The biomolecules are labeled with NBD dye. Immobilization is accomplished in an aqueous medium containing the NBD-labeled biomolecules of interest. The technique has been used to attach these biomolecules to polybutadiene-coated glass substrate which is kept immersed in the aqueous cell. Immobilization is accomplished in a microarray pattern by exposing the polybutadiene substrate to 488 nm light through a lithographic mask. This micro-array is fabricated by exposing polybutadiene coated substrate in phospholipid-containing aqueous-cell for about 20 minutes with 488 nm laser light of 10-15 mW continuous-wave power through lithographic masks. The

micro-array is an exact replica of the light intensity distribution through the micromesh. Typical concentration of these biomolecular species in water is kept around 1 mg/mL. In our technique, the dye-labeled phospholipid attaches only to areas of light exposure. The patterning technique and the nature of the immobilized biomolecules are characterized by surface enhanced Raman spectroscopy (SERS) and Atomic Force microscopy (AFM). *[Acknowledgment: This work has been supported in part by the NSF HBCU-UP Grant #HRD-0928904.]*

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Subcategory: Astronomy and Astrophysics

Characteristics of Non-Flux-Rope Coronal Mass Ejections and Driven Shocks

Christopher Wilson, Alabama A&M University

The most fundamental solar activity, which severely affects the space weather system of the Earth environment and human activities, is the coronal mass ejections (CMEs). CMEs refer to the ejections of plasmas and magnetic fields from the solar corona to the heliosphere at speeds from hundreds to thousands of kilometers per second. According to their magnetic structures, the CMEs observed at 1 AU can be classified into two categories: (1) flux-rope CMEs (one third of the events), and (2) non-flux-rope CMEs (two third of the events). The flux-rope CMEs are associated with magnetic clouds and have been extensively simulated over three decades; while the non-flux-rope CMEs have disordered magnetic fields and have been rarely done in numerical modeling. Recently, my mentor, Dr. T. X Zhang, and his colleagues have successfully discovered a common mechanism that can simulate both the flux-rope and non-flux-rope CMEs with a three-dimensional, magnetic flux emergence and reconnection, magnetohydrodynamic (MHD) model. These were done through emerging magnetic fluxes from the photosphere near an open closed magnetic field line region for the non-flux-rope CMEs and a closed magnetic field line region for the flux-rope CMEs. It is still not yet fully understood how the non-flux-rope CMEs initiate from the magnetic emergence, evolve with time, propagate to the heliosphere, and drive shocks to accelerate particles. This work gives a comprehensive study of the non-flux-rope CMEs. The poster will present our new results from the analysis of the MHD simulation data for the properties of non-flux-rope CMEs and driven shocks. *[Acknowledgment: NSF HBCU-UP Grant# HRD0928904]*

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Science and Mathematics Education

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Subcategory: Air

On-line Health Monitoring of Pneumatic Cylinder

Deric Eley, Virginia State University

Linear pneumatic cylinder is one of the most commonly used actuators in pneumatic systems in manufacturing production and assembly lines. As a result of long term operation of these actuators, the sealings of the cylinder wear out and cause internal air leakage. This leakage degrades performance of the cylinder and leads to the failure of the system. A health monitoring of the cylinders may help the manufacturer to replace the cylinder prior to its failure. This paper provides a method of pneumatic cylinder leakage on-line detection and level estimation. Leakage air flow rate is evaluated by acquiring pressure patterns of the cylinder through a by-pass system which includes a high pressure control volume to relate pressure drop rate to mass flow rate. *[Acknowledgment: HBCU-UP]*

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Subcategory: Plant Research

Physiological Responses in Common Bean (*Phaseolus vulgaris*) to Rust Infection

Khadijah Friday, Delaware State University

Sathya Elavarthi, Delaware State University

Being produced mainly in Latin America and Central Africa, *phaseolus vulgaris* also known as the common bean, is very important economically and is grown all over the world. The *basidiomycete fungus Uromyces appendiculatus*, (rust race 53) is a common bean rust pathogen that affects plants during the early stage of development. Rust infection occurs mostly in areas where it is humid, and this leads to reduced effective photosynthetic area and photosynthetic capacity of plants. Losing photosynthetic area and capacity results in yield lost, causing the impairment of the biochemical processes in the mesophyll. This study focused on the ecophysiological stress responses of two common bean varieties known as Sierra (resistant to the disease) and Olathe (susceptible to the disease). A total of eight seeds were planted in potting soil (four being the Sierra variety and four being Olathe). The plants were then equally separated into two groups known as the control group and the experimental group. The experimental group was inoculated with *Uromyces appendiculatus* race 53 rust spores during the two-leaf stage and both groups were treated the

same and left in the same conditions. Recording and comparing data of the photosynthesis measurements helps identify how plants respond to stress and if the rust infection affects the photosynthesis of the common bean. Rust spores were identified in the Olathe plants and the results showed that the net photosynthesis rate, stomatal conductance and transpiration rate declined over seven days; proving that the Olathe plant is susceptible. Future research includes determining the oxidative responses in the common bean. *[Acknowledgment: This study was supported by NSF SMILE Program]*

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Subcategory: Education

Applying Common Core State Standards in Grades 4th-10th Using LEGO Robotics

Derrick Jones, Mississippi Valley State University / Elizabeth City State University

Common Core Standards includes critical content for all students in American education. Forty-eight of the fifty states have adopted the standards as of 2012. Previously, every state had its own set of academic standards and students in each state were learning at different levels. In the new global economy, all students must be prepared to compete with students from around the world. Students are expected to develop a deeper mastery of content and demonstrate what they know through writing and other projects. Changes to curriculum and instruction are more student-centered with greater focus on skills, abilities, and a shift towards more performance assessments. This research was designed to apply mathematical processes of the Common Core Standard in a lesson plan for fourth through tenth grade students. The REU Mathematics team used NXT LEGO® Robotics to teach various scientific, mathematical, and design concepts, through designing, building, and programming the robots at each level. The students received hands-on experience with physics, mathematics, motion, environmental factors, and used problem solving in a collaborative group setting. The data was collected through observations. Due to the harsh environments in which CRE SIS research has been done, the use of robotics has become very necessary. The use of robots can take the place of human researchers who would like to explore these places. Teaching K-12 students to build and program robots will vastly shape the future of where robotics technology will go and how data will be collected. The main focus of this research project was to apply the principles of the Common Core Standard adopted by the state of North Carolina while using the 5E lesson plan format and inquiry-based learning. The overall goal of this project was to examine the effectiveness of this Standard as it is implemented in the classroom setting and compare it with the

old standards of North Carolina Mathematics Standard Course of Study. Observations were done at the elementary, middle, and high school levels to perceive how the students learned and responded to the Standard. The teaching strategies used assessed the students' independent learning abilities, enhanced thinking skills, and produced cooperation in the group setting. Further research on the applications of the Common Core Standards in mathematics needs to be done to on this project to get a clearer analysis of the effectiveness of the Common Core Standard. [Acknowledgment: Research Experience for Undergraduates in Ocean, Marine, and Polar Science; National Science Foundation; Center of Excellence in Remote Sensing Education and Research; Center for Remote Sensing Education and Research]

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Subcategory: Chemistry (not Biochemistry)

Development and Evaluation of Water Quality Laboratories for Increasing Student-Centered General Chemistry Curriculum

Clyde Joseph, University of the Virgin Islands

Micadel Hazell, Tamika Caines, and Justin M. Shorb, University of the Virgin Islands

Domin et al. elucidated a rubric for evaluating various styles of laboratory exercises and their respective efficacy for teaching laboratory skills and learning objectives.¹ Using the review by Johnstone and Al-Shuaili, this project evaluated the current laboratory curriculum at a small institution in the Caribbean and found the curriculum to be nearly entirely focused on expository style laboratories. This research focuses on the literature-based evaluation of the current curriculum and the generation of a culture- and location-specific pedagogical framework for evaluation of the general chemistry curriculum.

Using a culturally sensitive and literature-based pedagogical framework, can a list of design and evaluation criterion be elucidated that guides the effective refinement of general chemistry laboratory curriculum? Given the location of the university and the dominant local interest in Marine Biology and rain-water harvesting for potable water, water quality tests were adopted as a field for developing new cohesive laboratories. The effectiveness of the laboratory curriculum within the defined framework is evaluated with an aim toward continued improvement. The chemistry laboratory curriculum can be enhanced by pedagogically-effective uses of data acquisition interfaces and analysis software.

Prior to this work, oftentimes the devices were used as mere tools, not part of the learning objectives nor integrated in student-centered activities. Milner-Bolotin has shown that these

can be incorporated into a laboratory curriculum to increase the student engagement and cross-discipline experiments.² The work here involved the use of MicroLab interfaces to develop inquiry-based and project-based laboratories that use local environmental concerns to pique students interest, following the descriptions in Johnstone *et al.*^{3,4} To guide development, a full listing of all content knowledge and laboratory skills learning objectives has been compiled and each laboratory allotted to cover various objectives. This list will be used in evaluation of laboratory skills at the end of the general chemistry curriculum in the form of a laboratory practical oral exam. The content learning objectives will be evaluated within the results of the American Chemical Society (ACS) Standardized Test scores on selected items. Retention of laboratory learning and student attitudes will be evaluated within an end-of-semester survey. Data from prior years on similar surveys and ACS exams will be used as comparison data, controlled for aptitude by looking at entrance exam scores. By refining the curriculum in terms of content knowledge and laboratory skills, learning objectives within experiment styles, the result of this project will be a refined evaluation tool to be used within the institution for maintaining effective teaching in the laboratory while new data collection tools and software become available. The evaluation of the prior laboratories used will be discussed, along with the implications for improvement garnered from the evaluation instrument. The design of the new culturally-relevant laboratories will be highlighted to address shortcomings in the curriculum, and the plan for successive iterative evaluation will be described. It is the goal that this work creates a model for iterative evaluation of general chemistry curricula at other institutions.

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*Subcategory: Astronomy and Astrophysics***Study of Exoplanetary Atmospheric Properties from the Kepler Public Data****Mercedes Maldonado, New Mexico State University**

The primary objective of my research project regards atmospheric properties of exoplanets through the analysis of photometric data obtained by the Kepler space-observatory (NASA) up to quarter 12. Kepler's main goal is the detection of new planets, in particular in the habitable zone, using the transit method, which is when a planet orbits a star, the light Kepler measures is the sum of the stellar and the planetary fluxes. The planetary flux is the sum of the thermal emission and the reflected stellar flux. If the contribution from the planet is almost negligible, it nevertheless was detected on few tens of stars, through the detection of the secondary transit (when the planet is eclipsed by the star) and in rare cases of the sine-modulation associated with phase changes of the planet along its orbit. The measurement of both secondary transit and phase change is able to constrain both planetary temperature and atmospheric albedo, helping in constraining their composition, interior structure, atmospheric dynamics and their formation processes. The objective of the present research project is to search for secondary transits and phase changes in Kepler's planetary candidates to obtain a set of statistics of planetary albedos and effective temperatures. *[Acknowledgment: Astronomy Department at New Mexico State University]*

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*Subcategory: Computer Engineering***Game Development Using Kodu Game Lab****Zachary Walls, Norfolk State University**

James Dickerson, Norfolk State University

This project used Kodu, a new visual programming language platform, to develop an educational game to help students pass the Virginia Standards of Learning tests (SOLs). Video games can be extremely effective at teaching and reinforcing basic academic skills. They may also be used to teach lessons through active learning. There are many games that have been developed to teach basic math and science skills, however, there aren't any official SOL Released based games developed using Kodu Game Lab. The first step of the gaming development process was to determine specific characteristics, i.e., land or water based mazes for the 3rd, 5th, and 8th grade level environments. In this design, each level displayed different questions, but the type of design and bots are similar. A Kodu

bot is an object built to navigate through each path of the maze. Extra paths were created in the upper levels to make them more challenging. Multiple versions of SOL games were developed (3 - math and 3 - science) for each grade level. Future work will include involving SOL student participation by testing and evaluating the validity of the games. *[Acknowledgment: This research was supported, in part, by a grant from National Science Foundation Grant #0714930 to the College of Science, Engineering, and Technology at Norfolk State University, Rasha Morsi, Ph.D, Director of Creative Gaming and Simulation.]*

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Social and Behavioral Sciences

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*Subcategory: Social Sciences/Psychology/Economics***21st Century Gatekeepers: Protections from Research on Genetics and Crime****Robert L. Banks, University of the District of Columbia**

This pilot study is qualitative research whose purpose is to examine the psychological effect and bioethical responsibility to secure human subject protections in the age of the Human Genome. Our study will accomplish this goal by examining current policies and procedures designed to safeguard research participants' rights, proposed rules changes to the Department of Health and Human Services guidelines for informed consent, and issues that are not consistent with sound research design. Flawed theories in philosophical and psychological schools of thought resurface through history under different names and in the guise of scientific advancement. The specter of assigning a predisposition for criminal behavior through the use of the Human Genome harken the methods and analyses related to pseudo science conclusions reached in 18th through 20th century Atavism and Eugenics. Consequently, this study will highlight the growing use of the Human Genome as scientists move towards the employment of DNA in diagnosing and treating various psychological concerns. Our presentation will investigate the deep impact and historical legacy of genetic research in predetermining criminal behavior in African American and other minority communities and the need for culturally congruent bioethical principles as 21st century gatekeepers. *[Acknowledgment: MARC U *STAR, National Institutes of Health, National Institute of General Medical Services]*

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Subcategory: Education

Stress Reduction Among American Indians, an Underserved Population

Gina Bearfighter, Fort Peck Community College

Angela Cole, Kendra Teague, Shayna Long, and, Christine Holler-Dinsmore Ph.D., Fort Peck Community College

American Indians are an underserved minority, and have higher suicide, diabetes rates and lower life expectancies than other ethnic groups. High poverty rates, suicide rates, chemical dependency rates, domestic violence, diabetes and death rates all contribute to individual stress on reservations. Furthermore, reservations in general are underserved by the health care system, especially in rural Montana. Both Mindfulness-Based Stress Reduction (MBSR) and exercise have been shown to reduce stress. We hypothesized that combining the two modalities would decrease stress more than education or MBSR alone would for tribal members of the Fort Peck Reservation. A MBSR alone group and an exercise and MBSR group received ten weeks of intervention. Pre- and post-treatment stress and mindfulness self efficacy tests were administered.

Our results showed no significant differences between the two groups, however, both groups showed significant decreases in stress and increases in mindfulness self efficacy from pre- to post-tests. These differences were maintained over a year. Controls who received no intervention showed no significant changes from pre- to post tests. There was, however, a significant difference between the combined experimental groups and the control group - mean changes.

Our results suggest that MBSR has the potential to provide a non-pharmacological and inexpensive treatment for stress on the Fort Peck Reservation. We wish to continue this research so as to strengthen our data with a larger sample. Given the relationship between many diseases and stress, the reduction of stress and the increase in mindfulness could lead to better health outcomes for both the individual and the community.

[Acknowledgment: INBRE]

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Subcategory: Cell and Molecular Biology

Examining Spatial Working Memory in Rats Using the Radial Arm Maze

Dayna Blake, Johnson C. Smith University

Sarah Hamilton and Julio Ramirez, Johnson C. Smith University

The Radial Arm Maze (RAM) was first introduced by Olton and Samuelson in 1976 and was designed to test the ability of rats to orient in space. This comparative study investigated the effects of different delay periods (30 seconds and 120 seconds) on the performance of rats in an eight- arm radial maze. After being gentled for 9 days, the rats were trained to acquire the spatial working memory task in the maze. It was hypothesized that the rats with 120 second delays in each arm would commit more spatial working memory errors (re-entry into a previous visited arm), and would take a longer time period to reach the criterion for acquiring the task. The acquisition criterion for the task was defined as completing 7 out of 8 correct arm choices for 5 out of 6 consecutive days. The longer delay period was not sufficient to decrease the performance of rats on the Radial Arm Maze. Contrary to the hypothesis, rats with 120 second delays did not commit more spatial working memory errors than the rats experiencing 30 second delays and did not require significantly more days to reach the criterion for acquiring the task ($p>0.5$). *[Acknowledgment: This project was funded by Davidson Research Initiative and Howard Hughes Medical Institute.]*

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Subcategory: Social Sciences/Psychology/Economics

A Study on the Need for an Improved STEM Student Retention Strategy in Small and Medium Size Historically Black Colleges and Universities (HBCUs)

Tevon Bond, Talladega College

The U.S. economy is based on having effective professionals in Science, Technology, Engineering and Mathematics (STEM) fields. The U.S. possesses one of the most innovative and technologically advanced economies in the world. STEM degrees are vital to America's competitiveness. The U.S. degree attainment in STEM fields is plummeting. America's low production of effective and efficient leaders in STEM disciplines jeopardizes its economic and global competitiveness. According to Lee (2012), the overall U.S. graduation rates are stagnant at 50%. The average 6-year college completion rate for African-American students nationwide is significantly lower at 42% compared to 62% for their white peers. Small and medium size HBCUs continues to suffer from decreasing retention rates among black students. There are 103 HBCUs in the nation. Only 22% of them exceed the national average for African-American degree attainment. Published articles in the literature have identified factors that contribute to low retention rates at small and medium sized HBCUs. This project focused on retention at Fisk University, Philander Smith College and Talladega College. It closely examines the factors responsible for increased attrition rates. As a result, a strategy was developed to increase retention at Talladega College. It will be applied during the 2012

-2013 academic year. Data collected will be assessed at the end of the 2013 Spring semester. *[Acknowledgment: This Study was supported by NSF/HBCU-UP Grant #HRD-0811157, Talladega College, Talladega, AL 35160]*

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Subcategory: Cancer Research

Prostate Cancer Screening and Informed Decision Making in the African-American Community

Shiann Bradley, Claflin University

Cheryl L. Holt and Darlene R. Saunders, University of Maryland

Prostate cancer is the most commonly diagnosed cancer in the United States among men, especially in the African-American community. Studies have shown that African Americans have lower screening rates compared to Caucasians. A way to increase the overall participation of prostate screening is introducing informed decision making (IDM) into the communities. The Men's Prostate Awareness Church Training (M-PACT) intervention aims to increase IDM among African-American men in church-based settings. A pilot study of the program's education intervention with women as a "health partner" study condition was conducted at a Prince George's County church in June 2012. The hypotheses for the study were that age, education, family history, income, and marital status will be positively associated with behavioral intention for screening and self-report screening for prostate cancer, while embarrassment and physical discomfort will be negatively associated with behavioral intention for screening and self-report screening for prostate cancer in church-attending African-American males in Prince George's County. A baseline survey was given to male participants (n=17), survey items included questions regarding participants' church involvement, knowledge about prostate cancer, current stage of decision making, knowledge about screening, level of comfort with tests, and demographics characteristics. The men and women then attended separate informational sessions addressing prostate cancer and IDM and were given a follow-up survey. Results show age, education, relationship status, income, and family history to be associated with participant's self-report screening. These factors were not associated with intentions to be screened in the next 6 months, and embarrassment and physical discomfort were not reported as barriers for prostate cancer screening. The small sample resulted in non-statistically significant data, and the hypotheses were rejected. The data shows a trend in behavioral intention and self-reported prostate cancer screening with increase of demographics. These trends can be explored when the M-PACT program is introduced in 20 churches with a larger size of male participants (n=480) during

the control trial of the intervention. This can assist in the development of culturally appropriate interventions and materials to help African-American men make an informed decisions about prostate cancer screening. *[Acknowledgment: This research was supported in part, by a grant from the NIH/ACS to Dr. Cheryl Holt.]*

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Subcategory: Social Sciences/Psychology/Economics

The Relationship Between Digit Ratio and Interhemispheric Transfer Time

Wilmon Brown, III, Oklahoma State University

The research investigated whether prenatal exposure to androgens (as assessed by digit ratio, McIntyre, 2006) would be related to how quickly information is transferred between the hemispheres of the brain. Prior research has shown that males are exposed to greater amounts of testosterone prenatally than females (Pfannkuche, 2009) In the present study, we assessed prenatal exposure to androgens using measurements of digit ratio (Manning et al, 1998) and assessed interhemispheric transfer time (IHTT) using Savage and Thomas (1993) interhemispheric transfer manual reaction time task. The participants in the study were 31 students (13 men and 18 women) enrolled in courses at Oklahoma State University. Participants completed the IHTT task (Savage & Thomas, 1993). Participants completed the IHTT task twice, once with their left hand and once with their right hand. Participants started the task with either hand based on their birthday to ensure randomness of hand choice. Later, the lengths of their fingers on each hand were measured using a digital caliper. According to the data that was collected, the IHTT is related to digit ratio on the right hand for both men and women, but in opposite directions. For women, smaller digit ratio on the right hand (which indicates greater androgen exposure prenatally) is related to longer IHTT ($r = -0.496$, $p = 0.05$). For men, smaller digit ratio on the right hand is related to shorter IHTT ($r = +0.659$, $p = 0.03$). The results supported the hypothesis that digit ratio would be related to IHTT. They further indicated that the relationship differed for men and women. Prenatal exposure to androgen appears to slow IHTT for women but facilitate it for men. The relationship between digit ratio and IHTT has future implications that digit ratio may be an external physiological indicator of other cognitive processes, such as learning ability. *[Acknowledgment: Funding was provided by the National Science Foundation for the Research Experiences for Undergraduates program at Oklahoma State University.]*

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Subcategory: Social Sciences/Psychology/Economics

A Model Designed to Increase the Number of African-American Women in STEM Fields at Small and Medium Size Historically Black Colleges and Universities

Deirdre Childress, Talladega College

Science, Technology, Engineering and Mathematics (STEM) professionals are widely regarded as critical to the national economy. Expanding and developing the STEM workforce is a critical issue for government, industry leaders, and educators. Workforce projections for 2018 stated by the U.S. Department of Labor showed that nine of the ten fastest-growing occupations require at least a bachelor's degree in a STEM field. Many science and engineering occupations are predicted to grow faster than the average rate for all occupations, and women currently hold one-quarter or fewer positions in those fields. Various studies identified a pipeline problem in STEM fields. Those studies indicated a shortage of women and minorities for engineering, information technology, physics, biology, and other natural science fields. Despite the tremendous gains and progress that women have made in education and the workforce during the past fifty years, many scientific and engineering disciplines still remain male dominated. Extensive literature searches identified factors contributing to minimal diversity in STEM fields. In this study, a model is proposed that can be used to increase the number of women in STEM disciplines at small and medium size Historically Black Colleges and Universities (HBCUs). The study identified an assessment procedure to validate the model, while also showing the results based on the factors used to create awareness concerning this problem at small and medium HBCUs. As progress continues for minority (African-American) women in STEM fields through increased mentoring programs between faculty and students, research opportunities, and graduate school support will help alleviate the disproportionate number of male and female minorities in STEM fields.

[Acknowledgment: The study was supported by NSF/HBCU-UP Grant #HRD-0811157, Talladega College, Talladega, AL 35160]

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Subcategory: Physiology and Health

A Measure of Obesity in African-American College Students

Quenteisha Eaton, Virginia State University

Julisha Batieste and Vernessa R. Clark, Virginia State University

In 2009–2010, 31.6% of African-American men were obese and 41.2% of African-American women were obese. Obesity is a

known risk for cardiovascular disease especially in African Americans, therefore it is imperative that it is measured accurately in this group. To this end, the purpose of the present study was to determine which measure of obesity (body mass index [BMI], waist circumference, waist-to-hip ratio) is a better predictor of cardiovascular disease in African Americans. It was hypothesized that BMI would be the best predictor of cardiovascular reactivity to stress in African Americans. One hundred African-American college students between the ages of 18 - 30 will participate in this study. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, cardiac output and stroke volume will be measured as the participants view a racially noxious scene on videotape. The scene depicts the horrendous conditions that Africans experienced as they were transported to America for slavery. BMI was calculated from measures of weight and height and was classified into three categories based on the guidelines of the Department of Health and Human Services (2007). The categories are: normal weight (BMI of 18.5 -24.9); overweight (BMI of 25 -29.9); and obese (BMI of 30 or greater). Central adiposity was measured by using waist circumference, which will be taken at the level of the umbilicus by a standard tape measure. For men, a waist circumference of below 94cm was classified as normal risk for cardiovascular disease, a waist circumference of 94cm -101cm was classified as an increased risk for cardiovascular disease and a waist circumference of 102 cm or above was classified as a substantial risk for cardiovascular disease. For women, a waist circumference of below 80cm was classified as normal risk for cardiovascular disease, a waist circumference of 80cm -87cm was classified as an increased risk for cardiovascular disease and a waist circumference of 88cm or above was classified as a substantial risk for cardiovascular disease. Waist-to-hip measurements were taken at the hip (around the buttocks) and around the waist just above the belly button. For males, a waist-to-hip ratio (WHR) above 1 and for females a WHR above .85 indicate high risk of cardiovascular disease, for males with a WHR of .96- 1 and females with a WHR of .81-.85 indicates a moderate risk of cardiovascular disease. *[Acknowledgment: We wish to thank the Virginia State University HBCU-UP grant for supporting this research.]*

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Subcategory: Social Sciences/Psychology/Economics

Effect of Self-Efficacy on Diabetes Self-Management in the Eastern Cape, South Africa

Alania Foxx, Norfolk State University

In the Eastern Cape, the number of South Africans with diabetes is continuing to rise. Diabetes mellitus is a chronic illness that causes really high blood sugar due to malfunctions in the body.

Three major components that are important in effectively managing diabetes are self-efficacy, self-management and resistance to treatment. We investigated the effect of diabetes self-efficacy on (i) resistance to treatment, (ii) diabetes self-management and (iii) diabetes self-management while controlling for resistance to treatment. A 67-item questionnaire was administered. It measured diabetes self-efficacy, diabetes self-management and resistance to treatment as well as demographic and health status. The questionnaire was administered to 113 diabetic patients who signed informed consent at four Eastern Cape community health centers (Ngangelizwe, Mhlakulo, Mbekweni, and Baziya). Diabetic patients with low self-efficacy had a high resistance to treatment ($p < 0.05$). Those diabetic patients with high self-efficacy had high diabetic self-management practices ($p < 0.05$). Patients with low diabetic self-management had high resistance to treatment ($p < 0.05$). Low self-efficacy correlates with high resistance to treatment and poor self-management. We conclude that improving diabetes self-efficacy may be a viable strategy in reducing resistance to diabetes treatment. [Acknowledgment: Funded by NCHMD/NIH Grant #T37 MD 001810-08.]

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Subcategory: Physiology and Health

Effects of Perceived Stress on Cardiovascular Activity

Elijah Gordon, Virginia State University

Amanda Grooms and Vernessa R. Clark, Virginia State University

Cardiovascular disease is the leading cause of death in the United States (Centers for Disease Control. In addition, African Americans are diagnosed with cardiovascular disease later in life and as a result have more risk factors. To this end, the present study will examine the ability psychosocial (perceived stress) risk factors to predict cardiovascular reactivity to stress. Many studies have found that the BMI (Body Mass Index) is a significant predictor for cardiovascular disease (Clark, & Hill, 2009; Aggarwal, Grover, Chakrabarti, Dutt, Avasthi & Kulhara, 2012). The purpose of the study is to examine the effects of perceived stress on cardiovascular activity. It is hypothesized that perceived stress will have a significant effect on cardiovascular activity and that perceived stress will have greater cardiovascular reactivity to stress. Participants with high levels of perceived stress will have greater reactivity to the stressor than participants with low levels. One hundred African-American college students from universities in the South participated in the study. A Hypertension Diagnostic cardiovascular profiling instrument was used to measure heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure. These measures were taken as the participants

viewed a racially noxious scene depicting the horrendous conditions that Africans experienced as they were transported to America for slavery. Measurements were taken prior to each scene (pre-stressor period), during the scene (stressor period) and while the participant recovered from the scene (recovery period). The Perceived Stress Scale was to measure the amount of stress a person experienced within the last month (Cohen & Williamson, 1988). The questionnaire consists of ten questions on a four point Likert scale. Scores can range from 0-40 with 40 indicating high levels of stress. An Independent Samples t-test analysis was used to examine the effects of perceived stress (low, high) on each cardiovascular index. Preliminary analysis (N=19) found no differences in cardiovascular reactivity between participants with high and low levels of perceived stress. These findings may change once data on all 100 participants have been collected. Future research should examine mediators (ie. cholesterol levels) of the relationship of stress and cardiovascular disease. [Acknowledgment: We wish to thank the Virginia State University HBCU-UP grant for supporting his research.]

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Subcategory: Social Sciences/Psychology/Economics

The Role of Phenotype Similarities in the Mate Choice Copying Behavior of Zebra Finches (*Taeniopygia guttata*)

Tranquility L. Gordon, University of Mississippi

Elaine Day, Amy Hribar, and Chelsea Gann, University of Mississippi

Female mate choice copying (MCC) is a type of socially-mediated non-independent mate selection where the probability of a particular male being selected increases if he was previously observed consorting with another female. Zebra finches (*Taeniopygia guttata*) have been demonstrated to engage in MCC. The purpose of this project is to examine whether copying females are sensitive to the plumage coloration of the other females, and whether similarities or differences in this phenotype characteristic influence the usage of the socially-transmitted information seen in MCC. We hypothesize females will rely more on information gathered from females similar in coloration. The study utilizes a binary choice design where females will be simultaneously with two males interacting with either a similar or a dissimilar color morph female. This study does not require a control, because the aviary species are their own controls. The experiment is of repeated measures. The females are prompted to make a choice between the two male species. Test female choices after presentation will be examined to determine which information was more valued. Further research will be performed in the area of mate quality biased experiments. [Acknowledgment: This

project has been funded by Jacqueline Vinson and the Louis Stokes Alliance for Minority Participation program at the University of Mississippi.]

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Subcategory: Physiology and Health

The Effects of Smoking on Cardiovascular Reactivity to Stress in African-American College Students

Shara Hall, Virginia State University

Elijah Gordon and Vernessa R. Clark, Virginia State University

Cigarette smoking has been cited as a major risk factor for coronary heart disease (CHD), and is considered the most important preventable cause of CHD. At least 30% of all CHD deaths in the U.S. are primarily smoking related, and smokers are almost three times more likely to die from CHD as from lung cancer. The purpose of this study was to examine the effects of smoking on cardiovascular activity in African-American college students. It was hypothesized that those participants who smoke cigarettes would have greater cardiovascular activity to the stressor. One hundred and fifty African-American college students between the ages of 18 - 30 participated in this study. All participants were screened for cardiovascular disorders and prescription medications that could interfere with the functioning of the cardiovascular system. Students under the age of 18 and any with cardiovascular disorders and taking prescribed medications were not allowed to participate in the study. The demographic form was used to assess smoking status. Heart rate, mean arterial pressure, systolic and diastolic blood pressure were measured as the participants viewed a racially noxious scene on videotape. The scene depicted the horrendous conditions that Africans endured as they were transported to America for slavery. Cardiovascular measures were taken prior to the scene (pre-stressor period), during the scene (stressor period), and while the participant recovered from the scene (recovery period). Each period lasted three minutes and measurements were taken 80 seconds into the period. An independent samples t-test was used to examine the effects of smoking (smoke, don't smoke) on each cardiovascular index. Preliminary analysis (N=19) showed that smoking had a significant effect on systolic blood pressure during the pre-stressor, $t(14.78) = 4.35, p = .001$, stressor, $t(15.43) = 3.32, p = .004$, and the recovery period, $t(15.70) = 4.51, p < .001$. These findings indicate that participants who smoke had higher systolic blood pressures than those who do not smoke. Future research should examine the effects of various type of cigarettes on cardiovascular health. [Acknowledgment: We wish to thank the Virginia State University HBCU-UP grant for supporting this research.]

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Subcategory: Social Sciences/Psychology/Economics

Towards an Understanding of Diabetes Self Efficacy, Self-Management and Resistance to Treatment in the Eastern Cape

DeAnna Harris, Norfolk State University / Walter Sisulu University

Alania Foxx, Norfolk State University

Malcolm Cort, Athens University

Kera Gwebu, Tidewater Community College

Nomathemba Nonkelela, Walter Sisulu University, Umtata,

South Africa Ephraim Gwebu, Elizabeth City State University

The three concepts Self Efficacy, Self-Management and Resistance to Treatment are all important in effectively managing Diabetes. This current study focuses on these concepts in the area of the Eastern Cape of South Africa where Type 2 Diabetes is on the rise. The objective was to determine the prevalence of Self Efficacy, Self-Management, and Resistance to Treatment among Diabetics in this region of South Africa. Oral questionnaires, translated into IsiXhosa (a common language in this area), were administered to 113 diabetic patients at four clinics: Ngangelizwe, Mhlakulo, Mbekweni, and Baziya. Questionnaires were composed of 67 questions which measured self-efficacy, self-management and resistance to treatment using established scales. Low Self Efficacy was found among 23.6% of the participants, by scoring (< 12) on a 16 point scale, and high Self Efficacy was found among 76.4% of the participants by scoring (> 13) on a 16 point scale. There were four self-management practices: dieting, exercise, monitoring blood sugar and oral medication and/or insulin. With regards to Self-Management practices, over 90% of participants in the study reported that they effectively manage medication and monitoring blood sugar with 95.6% and 92.0% respectively. However, participants were more resistant to eating meals that control their weight and exercising regularly with 73.5% and 56.6% respectively. Prevalence of resistance to treatment was found to be higher among females than males with mean values of 87.8 and 79.8 respectively ($p < 0.05$). Level of education could possibly be a factor for why females have higher resistance to treatment. Among those with education levels of elementary school and below, females had a much higher mean value of resistance than males with 88.6 and 72.6 respectively ($p < 0.05$). Based on our results, there is low self-efficacy among participants. Participants are more resistant to treatment such as eating meals that control weight and exercising regularly; both important factors in effectively managing Type 2 Diabetes. Lower education levels may possibly be a factor behind why females are shown to have a higher resistance to treatment than males. These are all factors that can begin to be addressed to possibly help increase effective managing of Type 2 Diabetes in this region of South Africa. [Acknowledgment: NCHMD/NIH Grant #1T37MD001810-0]

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*Subcategory: Social Sciences/Psychology/Economics***Effects of Educational Outreach Programs on Farmers' Participation in Government Agricultural Programs****Walker C. Jones, Virginia State University**

Agriculture contributes over \$53 billion to the economy of the Commonwealth of Virginia. However, existing literature shows a low level of participation of minority farmers and ranchers in government sponsored agricultural programs. Several efforts have been made to address this anomaly with limited successes. This study identifies factors contributing to the observed low level of participation of farmers and ranchers in various agricultural programs sponsored by the U.S. Department of Agriculture (USDA). The study tests the effect of specific strategies for addressing the identified problems. The main hypothesis of this project is to examine the effects of educational outreach assistance on the level of participation of farmers and ranchers in government agricultural programs.

The project sampled 247 farmers and ranchers in Virginia who are participants and non-participants (control group) in government agricultural programs. Structured surveys from these respondents provide analytical data on which findings from the project results are based. Appropriate qualitative and quantitative analyses are expected to provide useful indicators on the relevant impacts of extension and educational programs on farmers and ranchers. Findings from this study will also provide useful information to policy makers and educational institutions as they try to improve the quality of their outreach programs. *[Acknowledgment: HBCU-UP]*

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*Subcategory: Social Sciences/Psychology/Economics***Using Waist Circumference as a Biomarker for Insulin Resistance in the Eastern Cape****Sara Nelson-Owens, Norfolk State University**

In an insulin resistant state, cells are desensitized to the uptake of insulin, resulting in increased glucose and insulin levels in the blood. Therefore, insulin resistance is an identifiable precursor to developing Diabetes mellitus. Diabetes affects more than six million people in the country of South Africa. Unfortunately, the cost of diagnosis and treatment is expensive and much of the material needed is not available. An accurate, inexpensive pre-diagnostic method is needed in rural South Africa. Waist circumference has been associated with insulin resistance in other populations and was explored in South Africa to

determine that a large waist circumference may be a predictor of insulin resistance. Demographic information including waist circumference and blood samples were collected from volunteer patients in the Walter Sisulu University NMD Campus Clinic. Components of the blood were allowed to separate and the serum was collected from each sample. The insulin levels in the serum were quantified using Enzyme Linked Immunosorbent Assay (ELISA). Homeostasis model assessment of Insulin Resistance (HOMA-IR) was used to quantify insulin resistance. Statistical Package for the Social Sciences (SPSS) was used to create correlations between observed variables: waist circumference, insulin levels, and HOMA-IR. Results indicate that as waist circumference increases, insulin levels increase among men, but not among women. HOMA-IR values also increase as waist circumferences increase among men; however there is not a significant difference among women. With the collection of additional data, yielding a larger sample size, we expect to see a significant correlation between waist circumference, insulin values, and HOMA-IR values among men and women. We can then hypothesize that a large waist circumference will be a predictor of insulin resistance in the Eastern Cape of South Africa. *[Acknowledgment: This research was funded by NCHMD/NIH Grant #1 T37 MD 001810-08.]*

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*Subcategory: Physiology and Health***Correlation of Organ Donations and Morbidity in Marginalized Communities****Barbara Okeke, Norfolk State University**

Organ and tissue donation by members of minority populations is nominal given the tremendous need for transplantation in these very same racial and ethnic groups. This problem is most clearly demonstrated in the African-American community. In order to increase awareness of this health issue, we initiated a novel relationship between student organizations at Norfolk State University, a Historically Black College and University (HBCU) in an urban setting, and a nationally recognized organ procurement/dissemination organization. In so doing, we aim to increase the organ donor pool in the African-American community, thereby decreasing the morbidity and mortality for the myriad of diseases that can be ameliorated by organ transplant. The initial phase of this undertaking required that we determine key issues that have hindered organ donation by African Americans. Through various venues (i.e. church health fairs, community outreach programs), we conducted a pilot study utilizing surveys to collect demographic data, factors that influence participation in organ donation programs, and knowledge of the disparity that exists in organ donation, specifically in the African-American population. We found that

deeply rooted religious beliefs and a strong mistrust of the healthcare system were the major reasons that persons refused to become organ donors. These issues transcended such variables as educational status, gender, and socioeconomic status. This information will be utilized to establish a model donor awareness community outreach program. It will be implemented through strategic collaboration between a non-profit organ procurement organization and HBCUs, institutions known to serve as effective intermediaries for information dissemination to underrepresented communities. *[Acknowledgment: Dr. Staci Walton]*

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Subcategory: Social Sciences/Psychology/Economics

Perceptions of Uninsured Patients Utilizing an Urban Emergency Department

Michelle Poe, University of Arkansas at Pine Bluff

America is facing a crisis of many of its citizens being uninsured. When these uninsured persons utilize an emergency department, it can be perceived that they are not receiving the same quality of care as their insured counterparts. The purpose of this study was to determine the perceptions of uninsured patients utilizing an emergency department (ED) in an urban hospital. Previous studies have shown that total wait time, the incoming pain level, and/or whether the doctor attentively listened to them could influence the patients' perceptions. This study cross-examined variables such as wait time, incoming pain level, and/or attentive listening by the doctor with whether the patient felt their lack of insurance had any effect on the quality of care they received. The study utilized a 23 question survey to gauge the patients' perceptions. Uninsured persons who had utilized an ED in a local, urban hospital within the last year were surveyed. The results showed a large majority of respondents indicate 'wait time' as the most important factor in their perception of quality care. Most patients who reported 'severe' incoming pain level also feel their lack of insurance has an effect on the quality of care they receive. Almost 50 percent feel the doctor does not listen to them, and almost all of those feel that their lack of insurance has an effect on their care. This data supports the hypothesis that when the patient experiences a long wait time, high incoming pain level, and/or feels the doctor did not listened to him/her, this can have a negative effect on the uninsured patient's perception of the quality of care received. It is suggested that ED staff take time to address these factors. *[Acknowledgment: This study was supported, in part, by the Trio Services through the Ronald McNair Scholars Program at the University of Arkansas at Pine Bluff, Arkansas.]*

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Subcategory: Physiology and Health

Patient-Physician Communication and Medication Adherence in Type 2 Diabetes

Karen Santoyo, University of California, Irvine

Linda Nguyen, Tim D. Vu, Jaclyn Spinner, Joselyn Diaz, Katie Walton, Johanna Herrera, Adriana Cuevas, Linh Vu, Salvador Arriaga, Mei Chang, Sana Moosaji, and John Billimek, University of California, Irvine

Type 2 diabetes requires lifelong care through a complicated regimen of medications, doctor visits, and more. If the patient leaves the doctor's office without a clear understanding of the necessary lifestyle changes and the reasons behind them, it is unlikely that the patient will follow through, or adhere to the regimen the doctor has recommended. It has been previously shown that patients who practice poor communication with their doctors during visits have poorer adherence to their disease management regimen, and consequently worse health outcomes. Our research study focuses on understanding what elements of doctor-patient communication translate to better adherence for the patient. We observed the association between patient-physician communication and patient adherence to their diabetic regimen by analyzing audio recordings of patients (N=60) speaking with their physicians during the medical visit to test the following hypotheses: Compared to adherent patients, patients who report medication nonadherence would: (1) spend a smaller percentage of the interaction time during the visit talking versus the percentage of time the doctor was talking, (2) raise the most barriers to medication adherence (such as financial problems or side effects) during the visit, and (3) would have the smallest percentage of barriers addressed during the medical visit. Medication adherence was measured from patient self-report. Contrary to the hypothesis, analyses showed that adherent patients spoke significantly less during the visit (38.7% of the interaction), compared to nonadherent patients (47.7%, $p=.03$). Nonadherent patients did not differ significantly from adherent patients in the number of barriers raised, but did have a marginally lower percentage of barriers addressed during the visit (67.6% barriers addressed as opposed to 85%, $p=.17$). Further analyses of additional recordings will explore whether the additional time the doctor spent talking to the adherent patients was used to address a larger percentage of the barriers raised by the patient compared to the nonadherent patients, and will examine impact of patient-physician communication on blood sugar control (hemoglobin A1c). An improved understanding of the role of patient-physician communication will allow for improved diabetic care and improved medication adherence in patients. *[Acknowledgment: This study was supported, in part, by a grant from NIDDK that was awarded to Sheldon Greenfield MD, Health Policy Research Institute (HPRI), 100 Theory, Suite 110, Irvine, CA 92697 and by an*

Undergraduate Research Opportunities Program Grant from the University of California, Irvine]

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Technology & Engineering

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Simulations of the Flow Around an Accelerating Circular Cylinder

Bereket Abraham, Princeton University

Kunihiko Taira and Chiang Shih, Florida A&M/Florida State University

Two-dimensional flows created by an accelerating circular cylinder in initially quiescent flow are numerically simulated to investigate symmetric wake formation at low Reynolds numbers. The early time evolution of drag and wake geometry are examined for different acceleration profiles to provide insight into the effect of unsteady motion of bluff bodies on the surrounding fluid. The flow field is simulated by solving the incompressible Navier-Stokes equations using the immersed boundary projection method. The velocity profile of the cylinder is chosen to be a power of time. While we observe that the flow field and the drag on the cylinder are strongly influenced by the acceleration profile and the Reynolds number of the flow, the data are found to collapse well if they are plotted as a function of travel distance of the cylinder, instead of the instantaneous time variable. Using distance traveled, we find that the onset of separation occurs when the cylinder travels approximately half its diameter. As the cylinder further travels, the wake grows and the center of the recirculation advects downstream roughly at a constant rate based on the travel distance. Both the separation angle and the height of the center increase rapidly and then level off as the cylinder moves. Characteristic lengths of the wake, drag on the cylinder, and the contour plots of the flow field will be reported in detail for a wide range of Reynolds number and acceleration profiles. This computational study is intended to provide benchmark data for fluid flow problems with accelerating bluff bodies, in contrast to past benchmark problems that are based on steady flow. Companion flow visualization experiments in a water tank are currently underway. *[Acknowledgment: This study was supported by a grant from the National Science Foundation (NSF) for the NSF-REU Summer Program, No. 1062936.]*

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Subcategory: Air

Miniaturizing IR Spectrometers for Studying Planetary Atmospheres

Antonio Aguirre, New York City College of Technology

A Fourier transform spectrometer is being developed using an ensemble of rectangular waveguides in a Mach-Zehnder configuration. Each waveguide channel has dimensions (10 – 100 μm) – on the scale of the operating wavelength (10 μm). Currently, spectrometers for planetary exploration are bulky, expensive, and take a significant amount of time to fabricate. The proposed method for spectroscopy bears the possibility of reducing the cost, size, and fabrication time. Specifically, our immediate tasks involve measuring the transmission efficiency of the waveguide structures, improving micro-electromechanical systems fabrication techniques, and controlling the desired propagation mode. A blackbody source with a 8-12 μm filter was used to illuminate the waveguides and a HgCdTe detector was used to detect the light transmitted through the waveguides. A MATLAB ray tracing code was used to verify the optimum coupling of light between the emitter, transport optics, and the waveguide. Currently, we are in the process of characterizing waveguide transmission properties. *Acknowledgment: New York State Space Grant Fund. NASA-GSFC--Lunar and Planetary Science Academy.]*

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Subcategory: Physics (not Nanoscience)

Thrust Force Analysis of a Rotating Ionocraft Under High Voltage

Rae-Zan Belen, Kapi'olani Community College

In the early 1920s, Brown and Biefeld discovered that when a very high voltage is applied to an asymmetric capacitor, a force is produced parallel to the electrodes and causes a thrust in the direction of the positive electrode. Modifying the geometry of the asymmetric capacitor results in a lightweight ionocraft, or “lifter,” that may represent a candidate for an alternative novel propulsion system with no moving parts. The potential of this ionocraft to revolutionize future transports has piqued the interest of the US Army, the US Navy, NASA, the British Ministry of Defense, as well as private companies such as the Honda Corporation. To date, the source of this force has been highly speculated on, but is still poorly understood both experimentally and theoretically.

The purpose of this project is to demonstrate the constant magnitude of an ionocraft's thrust force when the ionocraft is moving in a circular motion. The thrust force of an ionocraft system creates a torque when rotating in a circular motion. This torque produces an angular displacement that can be described by a power law. In this experiment, the angular displacement of the ionocraft system in a horizontal rotation is measured, plotted, and compared to the graphical representation of the analytical solution of the angular displacement derived from fundamental physics principles. The polynomial regression between these two graphs is obtained by adjusting the value of the thrust force in the solution of the differential equation that describes the dynamics of the rotating ionocraft. Since friction is present in the system, a separate treatment is conducted to estimate its influence. The inclusion of this treatment allows the effect of friction from the bearings to be considered and integrated in the overall analysis. The ionocraft's thrust force is shown to be constant when the system is rotating horizontally and independently from the force due to gravity.

Further experiments should be conducted employing a vertical rotation in order to estimate the effect of the force due to gravity on the ionocraft's thrust force. If the force remains constant and controlled, this new technology could potentially be adapted to novel propulsion engines that would have the advantage of not requiring any moving parts.

[Acknowledgment: I would like to acknowledge the National Science Foundation and the Kapi'olani Community College STEM Program for their support to helping me conduct this research.]

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Prototype of Networking Robotic Fish

Zain Bhatti, North Carolina A & T / Michigan State University

The purpose of the project is to use a 3D printer for fast prototyping of robotic fish. The robotic fish technology will allow people to sense pollution within water. Water pollution is a long term cause which leads to disease and death, and this issue still persists worldwide. Previous methods of monitoring water quality include manual sampling and ship-based sampling, which are labor-intensive with difficulty in getting continuous and pervasive measurement. Robotic fish will make the water sampling more efficient and effective. The applications of this technology includes water quality monitoring, tracing oil spills and patrolling harbors and coasts. My project aims to use computer software known as Solidworks for designing fish shells, which are then prototyped with a 3D printer. The design will provide an ability to open or close a upper lid (while keeping it waterproof), which will allow anyone to upgrade or change

the parts within a fish easily. Previous generations of robotic fish tend to be sealed with silicone, which causes an issue when one tries to upgrade or fix a part of a fish. *[Acknowledgment: NSF]*

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Subcategory: Nanoscience

Understanding and Exploiting Compromises Between Different Co-Zn Ferrite Nanoproperties

Nicole A. Blanco Vicens, University of Puerto Rico at Mayaguez

Cobalt Zinc Ferrite is an accessible magnetic material that, when doped with a rare earth element, becomes an attractive candidate for magneto caloric applications. One application that is deemed attractive is a magneto-caloric pump for refrigeration systems. The fact that this pump would not require mechanical parts would imply a reduction in maintenance costs. In this work, a statistical experimental design was used to study the effect of the contents of Gadolinium (Gd) and Sodium Hydroxide (NaOH) on different physical properties of Cobalt-Zinc Ferrite nanoparticles. In particular, the objectives were a low demagnetization temperature, a high magnetization level, a low coercivity value and a high pyromagnetic coefficient. The experimental results initially indicated that only coercivity could be manipulated with the variation of NaOH and Gd, which in turn meant that this property could be minimized without statistically affecting the rest of the properties, however, additional experiments accused a dependence of Magnetization on NaOH. Keeping a healthy balance between the material's Coercivity and Magnetization is the key to obtaining the pump's best performance. Our main objective is to understand and work with the conflict between them. Along with the results of the previously mentioned experiment, the analyses of a series of presumed scenarios involving conflict between the different objectives are presented here. A conflict between objectives would imply, for example, that varying Gd in a certain direction would decrease coercivity (a desired effect), but at the same time it would increase the demagnetization temperature (an undesired effect). Considering multiple objectives in conflict entails a special type of optimization procedure called multiple criteria optimization. Having the capability to deal with this kind of situations will enhance the decision-making associated with future experiments that involve tailoring multiple nanoproperties already planned within our research group.

[Acknowledgment: This material is based upon work supported by the National Science Foundation under Grant HRD 0833112.]

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*Subcategory: Mathematics and Statistics***Numerical Convergence Study on Simulated Spaceborne Microwave Radiometer Measurements of Earth****Ka'Ren Byrd, Elizabeth City State University**

This paper describes a NASA case study whose outcome can be implemented in a classroom setting. Through this case study, students can learn numerical interpolation and integration of functions in space as well as the error analysis. A tradeoff expected to be observed is between the speed of obtaining results and getting accurate results. As a result, recommendations are expected for various data sets to ensure fast accurate results. The simulation can also be carried out using MATLAB. The case study discusses numerical convergence of simulated space-borne microwave radiometer measurements of Earth's brightness temperatures so as to get fast results. The results are obtained by numerically evaluating a double integral. The integral relies on antenna pattern measurements and observed brightness temperature distribution over the Earth's surface. Accurate antenna temperatures are obtained by modifying the step sizes while getting faster results. The accuracy of the numerical methods is analyzed and recommendations are given to improve the process. Such recommendations will be seen to vary for different data patterns. The study will also include antenna theory to understand its parameters, and antenna equations that affect the accuracy of the results as well as Antenna Equipment, Radiation patterns and radiation propagation.

[*Acknowledgment: Drs. Jamiiru Luttamaguzi and Akbar Eslami.*]

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*Subcategory: Civil/Mechanical/Manufacturing Engineering***Characterization of Heat Sinks for the Thermal Management of High Power Electronic Systems****Piero Caballero, Florida State University**

Alejandro Rivera and Juan Ordonez, Florida State University
Tallahassee

This study attempts to improve the thermal management of an existing high power electronics system by optimizing its present cooling method. The particular component to be optimized will be a heat sink which is currently attached to a set of thyristors producing moderate heat fluxes in the range of 10 - 15 W/cm². New cooling methods are constantly being designed to accomplish a satisfactory heat transfer within high power electronic systems; however, more simple methods such as heat sinks still show possibilities for improvement. By trying to

optimize certain aspects such as the weight, volume occupied, and peak temperatures, it is possible to optimize these systems even further. This particular research is very important because of the fact that power electronic systems are becoming increasingly more powerful, bringing along thermal management issues needed to be resolved. A computer model of the present heat sink will be produced to be compared with experimental data. The method used for the simulation and optimization process was computational, through the COMSOL software. A series of heat sink configurations were considered, including the simple case with rectangular fins. Certain parameters were varied such as the thickness of the fins t , number of fins N , and the spacing between the fins s . In order to obtain an accurate value for the heat dissipated by the heat sink, an analytical solution for the convective heat transfer coefficient h was found; such values were then used in the computer models. It was then determined that by varying the spacing and the number of fins, the performance of the heat sink could be optimized. Ultimately the simultaneous enhancement of the peak temperature and weight of the heat sink was accomplished. These results also revealed the importance of the proper characterization of the convection problem associated with the problem, and its significance in yielding a more accurate result. Future work will be dedicated towards perfecting this aspect in order to obtain even more accurate results. [*Acknowledgment: This study was done through the Research Experiences for Undergraduates program sponsored by NSF.*]

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*Subcategory: Civil/Mechanical/Manufacturing Engineering***Designing a Capacitor For Directional Microphones****Joseph Cardozo, Binghamton University**

The discovery of a highly innovative mechanism for directional hearing in the yellow nocturnal fly, *Ormia Ochracea*, has led to the design of directional microphones that will advance the technology of current hearing aids. The purpose of this research is to design a capacitor for testing, where we will study its behavior with ranging voltages. A similar capacitor will later be implemented into the design of this rising directional microphone hearing aid. The overall goal of this project is to enhance the design of the hearing aid that will give a significant improvement to today's hearing aid for those people with disadvantaged hearing. The upgraded design is currently under construction. According to the calculations, an inverse relationship exists between the length of the fluorocarbon fishing line and the voltage necessary to enact collapsing plates. In conclusion, the upgraded design allows for the system to act under a more reasonable level of voltage to study its behavior.

Furthermore, participating in such research has allowed me to apply knowledge taught in class to real life applications. The main future research question consists of how can the design of this hearing aid be improved? *[Acknowledgment: Louis Stokes Alliance for Minority Participation]*

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Wood Chile Pepper Stalks-Plastic Composite Production: An Innovative Alternative for New Mexico Chile Growers

Michael Carlock, New Mexico State University

The project intends to investigate the potential for the post-harvest cutting and baling of chile stalks that could be stored and then later used as a source of composite. This research will study the effects of proportions and sizes of fibers of wood and plastic when producing samples. A stress-strain analysis will be presented as well as design of experiments and technologies to find the significant factors affecting mechanical properties of the new material. This project investigates wood-plastic composites as a production alternative for New Mexico chile pepper Growers. Chile pepper is a major crop in New Mexico, West Texas and East Arizona. Wood fibers represent 40% to 60% of an average size chile plant which represent approximately 51% of chile wood fibers after drying (Funk and Walker, 2009; Bledzki and Faruk, 2006). This project will introduce chile pepper leaves and stems as a potential source of fibers as well as coupling agents, UV stabilizers, and fire retardants.

[Acknowledgment: The primary funder is the Undergraduate Research Assistantship section of STEM.]

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Micro-Boiling of Highly Superheated Liquids on Novel Thin Film Platinum Structures

Eric Ching, Cornell University

C. Thomas Avedisian, Cornell University
Richard E. Cavicchi and Michael Carrier, National Institute of Standards and Technology, Gaithersburg, MD

The ability to move fluids on the microscale motivates developing designs that are simple, with no moving parts and that can allow for a high degree of control. A promising approach to this end borrows from the ink-jet printing industry in which microbubbles formed by rapid evaporation of liquids

act as pumps to move fluids through small-dimensioned channels. This concept places a high reliance on measurement and control of the surface temperature that defines the bubble nucleation process under heating rates that can easily exceed a billion degrees per second. Prior research has incorporated microscale metal surfaces bonded to Si support substrates that tend to dampen the thermal response of the metal film, thus compromising measurement accuracy. We hypothesize that thin film structures that reduce back-side heat losses will significantly improve the accuracy of measuring the bubble nucleation temperature while also requiring less power to trigger nucleation.

We have fabricated thin film microheater structures (a few microns wide, on the order of ten micrometers long and a few hundred nanometers thick) that are suspended across an air gap and used to characterize bubble nucleation. The liquids (water and ethanol) were heated by platinum films with square voltage pulses between 0.5-microsecond and 20-microsecond durations. By incorporating the Pt film into one leg of a Wheatstone bridge circuit, the evolution of output voltage across the bridge was recorded and converted to temperature through a calibration process. The circuit incorporated a novel electronic filter to reduce high frequency electrical noise at the beginning and end of the pulses. Backside-etched heaters were found to require less power to promote bubble nucleation than non-backside-etched heaters. Furthermore, the inflection points in the temperature-time profiles that signified bubble nucleation were sharper and more defined for backside-etched heaters compared to conventional structures. When heated under the conditions of our study, fluids can remain a liquid at temperatures several hundred degrees higher than their normal boiling points. For example, water can remain a liquid to over 300°C compared to its 100°C boiling point. Continuing work will refine the method and extend it to an array of organic fluids to develop the concept into a new tool for probing the thermodynamic state of fluids well above their normal boiling points. *[Acknowledgment: Air Products; James Moore '62 EE, Cornell University, Ithaca, NY]*

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Subcategory: Electrical Engineering

Improving a Mono-Silicon Solar Cell with Forming Gas Anneal

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In modern solar cell devices the highest efficiency that has been obtained is still too low compared to the prices of the solar cell. Even though the industry has made many breakthroughs developing solar cells, it is still fairly new. The goal was to

investigate Forming Gas Anneal (FGA) and its potential to improve a mono-silicon solar cell and to create an optimal recipe to improve the overall manufacturing process. The hypothesis is that if one improves the optimal recipe for the manufacturing process, then the efficiency will be increased. Forming gas is 5% hydrogen and 95% nitrogen. The three tested parameters of FGA are with time, temperature, and with having H₂N₂ or just N₂ gas. The times ranged from 15 minutes to 45 minutes, and the temperatures ranged from either 350°C or 450°C. With these, the FGA experiments ultimately produced greatly varying results that can be attributed to differences in substrate processing techniques with the firing recipe, printing, diffusion and the starting materials. The change in efficiency has little dependence on time, but large dependence on temperature.

For further research, it is recommended to work on a firing recipe and analyze how it correlates with the FGA process, and to shift experiments to lower temperatures where they can hold time and the forming gas constant with the time being 20 minutes and the temperatures being 150°C - 300°C. With all of the successes and current challenges of the PV industry, this will make a huge difference if the efficiency is increased. In conclusion, the forming gas anneal process increased efficiency with our change in parameters. *[Acknowledgement: The Quantum Energy and Sustainable Solar Technologies is jointly funded by the National Science Foundation and the Department of Energy.]*

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Subcategory: Electrical Engineering

The Functionality of an Integrated Hydrogen Fuel Cell and Solar Cell System in Near Space Conditions

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Sederra D. Ross, Clark Atlanta University

The High Altitude Research Platform (HARP), consists of an instrumented high altitude balloon that allows students to test experiments in near-space conditions. The objective is to develop a sustainable, lightweight energy source that will be used to power the HARP payload while eliminating the use of heavy batteries and permitting increased payloads. Using Graymark Greentech technology, the research team proposed and developed an integrated system consisting of solar panels connected to a hydrogen fuel cell as the system best suited for HARP. A hypothesis was proposed that if the integrated system is sent to near space conditions, then it will function by producing energy. To measure the performance of the

integrated system, two tests were conducted: a ground level test (control) and a flight test. For the hydrogen fuel cell to perform electrolysis, solar cells were used give initial power. The ground level test consisted of placing the integrated system in direct sunlight until sufficient power from the solar panels was provided to the hydrogen fuel cell for electrolysis. A similar methodology was used for the flight test, where the integrated system's solar panels were wired in parallel to each other and an Arduino microcontroller was programmed to record the voltage generated. The fuel cell generated voltage, which was measured and recorded by a voltmeter. The results of the flight test show a correlation between the voltage produced and the altitude. As the HARP payload reached higher altitudes, the integrated system produced more voltage reaching a maximum of 0.763 volts compared to the ground tests which only reached 0.447 volts. The data indicates that the voltage increased as the payload reached higher altitudes and decreased after the integrated system reached its maximum height of 75,000 feet. Future testing includes testing for current and resistance, testing the integrated system at an altitude higher than 75,000 feet, and evaluating possible weight reductions of the integrated system. These tests will provide more information about power production, the limitations of the integrated system, and will allow the team to make necessary improvements to the integrated system. *[Acknowledgment: This research was made possible by grant awards from the National Science Foundation (NSF) Historically Black Colleges and Universities Undergraduate Program (HBCU-UP/ACE 1043330), and the NSF Partnerships for Research and Education in Materials (PREM) gr]*

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Subcategory: Biomedical Engineering

Assessment of Axial Load Error Present Within an *In vivo* Shear Load Sensor

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Javier Rojas, Jacalyn Ouellette, and John Szivek, University of Arizona

Up to 15% of the population of the United States of age 25-74 years old suffer from the painful and debilitating disease of Osteoarthritis (OA). OA likely represents many diseases that have a similar end point arising from genetic, molecular and environmental influences, particularly biomechanical stress. Biomechanical changes may result in injury or inflammation and cause the loss of the exceptional low friction and wear properties of hyaline cartilage, leading to progressive wear and degeneration. Simultaneously, this wear and degeneration results in biomechanical changes to the tissue and can lead to further pain and inflammation. This demonstrates that OA represents a vicious cycle that gets worse over time. Engineering

hyaline cartilage tissue poses a significant challenge because of the complex material properties of the tissue. Cartilage responds to loading by resistance to interstitial fluid flow through the extracellular matrix (ECM), which resists as much as 95% of the load, and by deformation of the ECM. These responses result from a dynamic, complex structure with zonal variation. In order to produce such architecture, pliable and versatile scaffold technology is necessary, however, scaffold designs that are not utilized with long term in-vitro culture must provide sufficient temporary mechanical support until the host tissue can assume its structural role. "Biomimetic" scaffolds mimicking trabecular bone architecture have been shown to accelerate bone ingrowth. In addition, "sensate" scaffolds implanted with strain gauges can measure *in vivo* loads and help develop rehabilitation protocols and refine *in vitro* bioreactor techniques.

This study aims to alter the design and characterize the mechanical properties of a sensate biomimetic femoral medial condyle surface replacement scaffold. It was hypothesized that gauges meant for measurement of shear loads were picking up axial loads, and that measurements from gauges calibrated for both shear and axial strains can be adjusted by subtracting axial strains to be more accurate. Previous designs were instrumented with axial and shear gauges and loaded *in vitro*. The ratio of axial loads compared to shear loads was determined to be 2.78 - 1.42. This demonstrated that axial strains are not negligible and must be accounted for. Future research includes determining the material properties of the scaffold architecture and modeling the scaffold using Finite Element Modeling. [Acknowledgment: Funded through Grant CMMI - 0855493 (supported through ARRA) and the Howard Hughes Medical Institute through grant #52005889 for partial support of one of the authors (ND).]

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Subcategory: Environmental Engineering

Flow Behaviors Under Surface Shear and Velocity Conditions

Rifat Hussain, City College of New York

Flows with free surfaces are commonly encountered in the nature and engineering applications. We investigate behaviors of flows generated by velocity and shear stress boundary conditions at water surfaces. First, analysis is made for a steady flow between two horizontal infinite plates, and it indicates that the solution for the flow driven by velocity condition at the top plate is exactly the same as that by the shearing condition. Then, an analytical solution is derived for an impulsively started flow initiated by a constant shear stress on a surface using Laplace transform, and it is shown that the flow is distinct from that

caused by suddenly applying a velocity on it. At last, numerical solutions of cavity flows are made, and they indeed confirm the conclusions drawn by the analyses; surface velocity and stress conditions lead to the same results if one only considers steady state flows, whereas they produce flows with distinct velocity profiles if one simulates them as unsteady flows. These conclusions suggest that the conditions at water surfaces should be selected with discretion in studying flows with surfaces such as those in rivers and oceans. [Acknowledgment: NSF Crest-REU Program]

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Subcategory: Biomedical Engineering

Extraction and Synthesis of Keratin-based Nanofibers by Electrospinning for Wound Healing Applications

David D. Jarvis, North Carolina A&T State University

The wound healing process is a complex function of the human body, and at any step is open to infection. By speeding up the healing process, you can reduce the chance that an infection can take hold. A large number of polymeric materials have been used to create cellular scaffolds, including keratin, found naturally in human hair. In this research, keratin was extracted from human hair and electrospun with a polycaprolactone (PCL) solution to create nanofibers, from which scaffolds can be made that can aid in the healing process.

The primary focus of our research is finding a suitable ratio of keratin and PCL that maximizes the cell affinity of keratin and the mechanical characteristics of PCL. First the hair was washed, dried, and measured. Then it was treated for 12 hours with a 2% w/v solution of peracetic acid, after which it is drained and placed in 100 mM tris base solution in a shakebath for 2 hours. Following this, the hair is discarded, and the remaining solution is neutralized with HCl, centrifuged, rotary distilled, and then dialyzed for 24 hours. The remaining solution is frozen and lyophilized for about 2 days, resulting in a yield of roughly 2.5%. After this, the keratin was prepared for electrospinning by creating a 10% w/v solution with deionized water, and ratios of 95/5, 90/10, 85/15, 80/20, 75/25, 70/30, and 65/35 were made with PCL, and then electrospun at 25 kV onto a sheet of aluminum. When the nanofibers were collected, they were sputtered coated in gold and observed under SEM. Some samples (specifically of 90/10, 80/20, and 70/30) were placed in deionized water or phosphate buffered saline solution and the results of degradation were observed after 1, 3, and 7 days. The extraction process had a yield of about 2.5% keratin, from weight.

The process did show that nanofibers can be made from different ratios, and the alignment of the nanofibers can be altered depending on whether the collector is rotating or not. Thus, we showed that using a multistep technique, keratin was extracted from human hair, mixed with PCL, and successfully electrospun into PCL/keratin composite nanofibers of varying ratios. Future work will be done to test the mechanical and biological properties of the different ratios. Currently we are preparing samples for toxicity testing. *[Acknowledgment: The i3/iBLEND and ERC-RMB programs at NCAT.]*

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Subcategory: Computer Science & Information Systems

Cloud Computing: The Portability of Educational Tools

Jamal A. Jones, North Carolina A&T State University

The focus of this research is to evaluate the use of cloud computing as a cost effective tool to provide STEM teaching and learning tools in areas where they may be unavailable. A goal is to provide low cost access to hosted cloud services that can be used to further minority educational endeavors within STEM disciplines by using a cloud system equipped with tools essential to fostering a positive learning environment outside of the classroom. The services would be provided in areas where they may not be available due to a lack of financial or technological resources. This cloud environment will also be used to increase minority participation and interest in technology and engineering fields by providing broader access to technology tools. The system is being built on an open source Linux operating system platform because of the resources and security features of the software. Open source software is essential to building this cloud because it will help to curb the building costs, thus curbing the cost of access.

The effectiveness of this research will be evaluated through the use of a test group of students who will have secure access to the cloud. The underlying goal of this project is to increase STEM involvement of a population who is often misrepresented in the areas of STEM education. This cloud is also being used to facilitate effective communication between student researchers and faculty mentors as a central storage site for project data and evaluation tools. *[Acknowledgment: National Science Foundation NC-LSAMP]*

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Friction Stir-Welding of Aluminum Alloy

Phillip Killebrew, Virginia State University

Gregory Mosley and Jahangir Ansari, Virginia State University

Friction Stir-Welding is a solid-state joining process (meaning the metal is not melted during the process) and is used for applications where the original metal characteristics must remain unchanged as much as possible. This process is primarily used on aluminum, and most often on large pieces which cannot be easily heat treated post weld to recover temper characteristics. The Material Testing Machines used to measure the tensile and compressive strength of the material as well as other information need to be gathered in the course of testing. We cut the material down to specific dimensions to see if the friction weld meets the outcome from common welds used in the field of erection or factory use welds. The Instron machine was used to test the tensile and compressive strength along with other application areas needed to follow through with this experiment. We welded similar alloys together to test the strength of the specimen using the Friction Stir Weld versus the Conventional weld to see which was stronger. Using this form of welding will make it stronger than hand welding, with a result of producing strong and durable buildings and other objects used in welding processes. *[This study was supported by a grant from NSF-HBCU UP STEM II program awarded to Phillip Killebrew and Gregory Mosley.]*

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Subcategory: Civil/Mechanical/Manufacturing Engineering

On-line Health Monitoring of Pneumatic Cylinder

Demier Klevitch, Virginia State University

Deric Eley, Virginia State University

A linear pneumatic cylinder is one of the most commonly used actuators in pneumatic systems in manufacturing production and assembly lines. As a result of long term operation of these actuators, the sealings of the cylinder wear out and cause internal air leakage. This leakage degrades performance of the cylinder and leads to the failure of the system. A health monitoring of the cylinders may help the manufacturer to replace the cylinder prior to its failure. This paper provides a method of pneumatic cylinder leakage on-line detection and level estimation. Leakage air flow rate is evaluated by acquiring pressure patterns of the cylinder through a by-pass system which includes a high pressure control volume to relate pressure drop rate to mass flow rate. *[Acknowledgment: HBCU-UP.]*

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Mitigation of the Effects of Water Hammer

Maria Lyon, University of Maryland, College Park

All fluid systems are affected by the phenomenon of water hammer, including home plumbing systems and the propulsion systems of spacecraft. Water hammer is a pressure surge that occurs when a fluid in a system reaches a physical obstacle that prevents its flow, such as the end of a fluid line or a closing valve. These pressure surges can cause strong vibrations along the fluid lines, as well as large pressure spikes within the lines that can burst or disfigure them. NASA's propulsion engineers currently use a variety of cavitating venturis to mitigate the effects of water hammer on their systems. However, using the venturis is not a streamlined process. Weeks of expensive testing on a variety of venturi sizing is currently required to determine which venturi should be used to acceptably mitigate water hammer for a particular space craft's system. The purpose of my project was to test a variety of other devices that could be used in a propulsion system. Some devices were bought, others were designed. This would allow a more efficient approach to more successful water hammer mitigation. *[Acknowledgment: AAAS, NASA GSFC Code 597]*

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Subcategory: Electrical Engineering

Design, Fabrication, and Testing of Microstrip Transmission Lines and Antennas

Henry Mishoe, III, Elizabeth City State University

Henry Lee, Henry Mishoe, Akbar Eslami, and Jamiiru Luttamaguzi, Elizabeth City State University

A Microstrip is a type of electrical transmission line that transmits microwave frequency signals from a generator to load. The Microstrip has a signal conductor transmission line on the top of the dielectric substrate and a ground plane on the bottom. The transmission lines are used to guide low power over limited distances with little or no loss of power. Microstrips can be used in antennas, couplers, filters, power dividers and many more microwave and mm-wave components. Microstrip has been one of the most popular microwave transmission-line formats for decades. It is lighter and less expensive than traditional waveguide technology and hence preferred in many NASA's space instruments. Furthermore, it is advantageous for the space applications because of their low power requirements. In the present project, we designed, fabricated, and tested: (1) a Microstrip transmission line that passes

through many substrate layers, and (2) an L-band dual polarized wideband antenna. The measured results for both cases (Microstrip transmission line and L-band antenna) are found to be in excellent agreement with our design. *[Acknowledgment: Drs. Akbar Eslami and Manohar Deshpande]*

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Fabrication and Testing of Green Composite Materials for Concrete Reinforcement

Carl Montgomery, Jr., California State University, Long Beach

It is becoming popular to reinforce concrete structures with carbon fiber material that is versatile and extremely strong. However, there are concerns that this carbon fiber material can lead to adverse environmental toxicity as the materials decompose with age. We aim to create a sustainable green alternative for the application of concrete reinforcement. In this research project, we used both the hand lay-up and vacuum resin infusion chemical processes to fabricate composites made from woven hemp or flax fabrics, along with purely synthetic resin as well as a "bio-resin". Hemp and carbon fiber fabrics were chosen because of their lightweight and exceptional mechanical properties. Briefly, for the chemical procedure we employed to prepare the composite panels, first swaths of fabric were measured, cut and set on a hard surface that was the mold. In the hand lay-up process, the resin and hardener were poured over the fabric, and a plastic trowel was used to evenly distribute and remove excess resin and unwanted air pockets. After the resin was infused in the fabric, another fresh piece of cut fabric was laid on top of the wet one, and the aforementioned steps were repeated until the desired blade thickness was achieved. The wet panels were then sealed in plastic sheeting, and a vacuum was applied at room temperature. The vacuum served to remove unwanted pockets of gas within the plies of fabric and to compress the panel. After curing overnight under vacuum, the panels were then ready to be trimmed to the specified dimensions. For the vacuum-infusion process, all the fabric swaths were simultaneously infused with the resin, and then left under vacuum overnight for room-temperature curing. The hardened panels were consequently adhered to concrete beams, and we measured the force-versus-displacement curves. Our preliminary results indicate that the green composite panels do impart additional mechanical strength to concrete beams. The introduction of green composites to the concrete will be beneficial to the environment because for one, you will not have to worry about it being environmentally toxic, and it cost much less than carbon-fiber materials. Although carbon-fiber has the advantage of being stronger than green composites, the disadvantage is

potential toxic exposure to humans. In the future, we will further refine the chemical process to fabricate the concrete reinforced structures with green composites, and hope to apply green composite to concrete structures. *[Acknowledgment: Chemical Engineering Department at California State University, Long Beach]*

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Subcategory: Civil/Mechanical/Manufacturing Engineering

A VAR System for Teaching and Learning in Mechanical Engineering

Benjamin W. Morton and Stephanie Starling, Tennessee State University

Hands-on experience can bring a concept off the page and into an interactive, practical understanding for the participant. In many fields, there is a need for demonstration and development models, which can be used to train or test concepts without a full commitment of finances and materials. Recent developments in hardware utilizing a Tangible User Interface (TUI) and real-time physics engine software make it possible to develop, test, and train myriad applications using a single piece of touchscreen hardware and a software module tailored to the task. This approach is a form of Virtual and Augmented Reality (VAR) and offers the user a rich contextual environment while optimizing use of resources. The objective of the proposed VAR environment is to create a Virtual Assembly Design System to allow Tennessee State University's Mechanical Engineering students to plan, analyze, and evaluate mechanical systems as a part of their matriculation. Students will be able to use the module individually on a tablet computer, or as a group on a large tabletop touchscreen. While the software application will support a library of models capable of generating many different mechanisms, we will first focus on a six-bar quick return as a test case. The student will be presented with an assembly field and a materials library on the screen. The program's tutorial options can be toggled for training or evaluation. The student will touch and drag pieces of the assembly from the materials library to the assembly field and attach them to the field or to other pieces via specific interaction points on the piece. These interactive points will have qualitative options such as whether the joint is fixed, free to rotate, or drives rotation. The display of lengths, angles, and ranges of motion will also be available for numerical analysis of the assembly. The Android Software Development Kit will be used to develop a software application for a 10-inch tablet computer system's TUI. The application will then be adapted to NUI TEQ for use with a GestureTek 42 inch multi-touch table system. *[Acknowledgment: This study was funded by the NSF Targeted Infusion Award awarded to Dr. S.K. Hargrove, Dean, College of Engineering, Tennessee State University.]*

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Subcategory: Electrical Engineering

Soil Moisture Active-Passive Radiometer Digital Electronics System Analysis Tool

Shawn Mull, Virginia State University

Marcus Thornton, Virginia State University

VSU students, Shawn Mull and Marcus Thornton, working at NASA Goddard Space Flight Center designed a graphical user interface (GUI) in MATLAB for the Soil Moisture Active Passive (SMAP) Radiometer Digital Electronics system that does various analysis tests to see if the radiometer is working correctly. The Radiometer will be used to measure the amount of moisture in the ground. These measurements will be used to enhance understanding of processes that link the water, energy and carbon cycles, and to extend the capabilities of weather and climate prediction models. SMAP data will also be used to quantify net carbon flux in boreal landscapes and to develop improved flood prediction and drought monitoring capabilities. The GUI consists of five tests: time analysis, histogram analysis, spectrum analysis, and an analog to digital converter (ADC) analyze test. From these tests we found that the ADC was bias which made the mean of our data a little bit off from what we expected it to be. From our results, the team was able to compensate for the ADC bias. For future study, we would like to add a "real-time analysis" button that allows the user to analyze the data in real time. Lastly, the GUI will compute parameters such as effective number of bits, spurious free dynamic range harmonics, maximum tone frequency, sample statistics and display the results to the user. *[Acknowledgment: NASA]*

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Subcategory: Mathematics and Statistics

Beating the Curse of Dimensionality through Manageable Experiments: Preliminary Results

Kasandra Ramirez, University of Puerto Rico, Mayaguez

Modern computer and biological experiments require the simultaneous manipulation of hundreds of variables for characterization, modeling and, ultimately, optimization purposes. Most experimental design software packages are able to prescribe experimental arrays, however, the number of variables is usually limited to a few dozens. This work describes the first ideas on the generation of experimental designs

involving a large number of variables with clustering techniques. The aim is to formulate a generation strategy that is implementable in a desktop computer with initial target applications to polymer computer simulations and microarray analysis for cancer characterization. A first experiment is presented here with a full factorial of nine variables sampled at three levels each entails 19,683 experimental runs. The target number of runs in this work is 60, which would provide the 55 minimum numbers of degrees of freedom to estimate a complete second order regression. Three strategies were tested to generate 60 runs: (i) Purely systematic, (ii) Mostly random, and (iii) Mostly systematic. A k-means clustering procedure was performed with k=60 to then prescribe the 60 runs using the centroids on each strategy. A second experiment consisted of using the design generated with the strategy selected as the most attractive from the first experiment to assess its capability on estimation in the presence of gradually induced noise. Only (iii) resulted in a feasible design that explored all nine dimensions and estimated all 55 terms perfectly, and moreover, it provided some control over the structure of the resulting design. The design generated with the third strategy showed a remarkable performance by keeping prediction levels above 90% in all cases in spite of not all coefficients being determined perfectly. In the first study, it was possible to estimate all coefficients of a second order regression model using 60 runs generated using a clustering procedure instead of the 19,683 needed with a full factorial design. Moreover, the 60-run design performed very competitively in the presence of noise. These first results are very encouraging and motivate the exploration of experiments involving more than 9 variables. If successful, the methods would indeed constitute a way to beat the curse of dimensionality in modern experiments. *[Acknowledgment: This material is based upon work supported by the National Science Foundation (NSF) under Award HRD 0833112 and NSF REU Award 0851879. K.L. Ramirez also acknowledges the support of PRLSAMP as well as Lockheed Martin Scholars Program.]*

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Subcategory: Nanoscience

Phase Equilibria Measurement and Thermophysical Property Prediction of Model Biodiesel Fuels

Obedur Rehman, North Carolina A&T State University

Oala W. Omer and Kenneth L. Roberts, North Carolina A&T State University

This project will utilize fundamental phase equilibria and solution thermodynamics to predict the composition and properties of biodiesel (BD) fuels. Model parameters to be investigated will include the effects of biodiesel composition,

solution temperature, and solid precipitates. This project will examine Regular Solution Theory, Flory Huggins Theory, and other common activity coefficient models to predict liquid phase behavior for multiple component systems. Estimates of primary and secondary phase transition enthalpies will be predicted using the literature data and compared with collected experimental data for model biodiesel fuel systems. The results of the BD property models will be compared with literature and experimental data. *[Acknowledgment: Talent-21 National Science Foundation]*

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Subcategory: Electrical Engineering

Experimental Evaluation of a UCA Smart Antenna Performance for Wireless Communications

David Scott, Norfolk State University

This project presents the results for an evaluation on the performance of a multiple antenna circular array system in a long distance application. This research was conducted in order to provide connectivity to rural, sparsely populated areas while maintaining both an economical and energy efficient advantage. The testing was conducted using RT -1944/U SeaLancet™ radios and a narrow band patch antenna. The results describe performance from the laboratory in close quarters with nearly ideal conditions to rooftop testing and long range testing up to 2 miles. For the long distance testing, we believe that the signal strength was too weak for the radio to pick up. The apparent cure to mitigate this problem is using amplifiers at both ends. *[Acknowledgment: National Science Foundation Research Experience for Undergraduates program.]*

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Studies on Energy Harvesting using Pyroelectric Materials Embedded in Soils

Meseret Sima, Alabama A&M University

Ashok Batra, Alabama A&M University

Power harvesting is the process of extracting useful electrical energy from ambient low-grade energy sources such as solar energy, mechanical energy and thermal energy using smart materials such as transducers. These materials have the ability to convert one form of energy into another. The present work aims at thermal-electrical energy converters based on

pyroelectric effect for energy harvesting, and examines its possible use in ultra-low power devices. Efforts have been made to investigate and validate the analysis of energy harvesting capacity of a single electric-energy harvesting unit using candidate pyroelectric materials such as PVDF and nano-composites. For this purpose, few pyroelectric devices will be fabricated and embedded in various types of soils. Their performance will be investigated via simulating thermal conditions of pavement in the laboratory. The results obtained will be presented along with possible future work.

[Acknowledgment: This research has been supported in part by the NSF-HBCU-UP Grant #0928904]

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Subcategory: Electrical Engineering

Controlling the Liquid Layer During Electron Beam Induced Deposition

Brencis Stanford, Johnson C. Smith University

Focused electron beam-induced deposition using bulk liquid precursors (LP-EBID) is a relatively new nanofabrication technique developed in the last two years as an alternative to conventional EBID, which utilizes cumbersome gaseous precursors. If successful, this technique will further understanding of EBID in liquids. It is also important because LP-EBID provides higher purity, faster process rates, and far greater material flexibility than its gas-phase counterpart. It is currently done by cooling a substrate and working in a high humidity environment. Typically the substrate is partially wetted, and droplet sizes are controlled by eye. There is no way to determine the liquid layer thickness nor is there a way to provide feedback control. We will interferometrically measure the liquid layer thickness and provide feedback control to maintain its thickness. If necessary, we will introduce surfactants to reduce the liquid layer thickness at which the film dewets. In the initial creation of the liquid layer, we first attempted to form this thin liquid layer at atmospheric pressure then move into the vacuumed environment. In our first test, we found that although water was condensing on the silicone stage; it was in the form of small water droplets and not in the uniform liquid layer that we are looking for. Upon further investigation the reason for these water droplets forming was the hydrophobic surface of the silicon wafer, which in turn did not allow for that uniform formation of the liquid layer. To get around this obstacle and achieve our goal of a unified sub-micron thin liquid layer, we chose to use a basic surfactant to make the water more hydrophilic. In the end, we were able to successfully build and set up our vacuum test chamber. The creation of the liquid layer was successful, but due to several issues, stabilizing it was not achieved. The work that was done in this short amount of time

was very productive. With more time and the necessary fixes, I am confident that when this project is worked on by the next person, it will be completely successful. *[Acknowledgment: NSF award number 085170]*

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Subcategory: Materials Science

Containment Materials Reliability/Sustainability in a Thermal Neutron, Molten Salt Environment

Carine Todmia, University of California, Irvine

Thorium fueled energy has shown great promise as it is four times more abundant in the earth's crust than uranium and energy dense and efficient, and nuclear weapon proliferation is extremely difficult. A Liquid Fluoride Thorium Reactor (LFTR) is a thermal breeder reactor that uses liquid molten salt mixtures to generate electricity at ambient pressures and high temperatures. Thorium is the radioactive energy source that is mixed within the salts. This technology was proven to be feasible in the 1960s and 1970s by Alvin Weinberg with the Molten Salt Breeder Experiment. The experiment ran for 4 years and used Hastelloy-N for a containment material, graphite as a moderator, and the molten salts LiF and BeF₂. The purpose of this project is to characterize potential materials that will contain the nuclear reaction within the LFTR. The materials selected must be damage resistant to fluoride, salt corrosion and radiation, have a low diffusion coefficient, and operate between 506°C and 704°C. The candidate materials tested include alumina ceramic composites, SiC/SiC composites, zircaloy, graphite, Hastelloy-N, and stainless steel. For the radiation test, 0.5"x0.5" sample material will be exposed to a neutron flux and tested for changes in dimension, weight, hardness, crystallinity (SEM), and morphology (XRD). In another test, pure carbon salt carrier vessels will be fabricated and exposed to ZrF₄-NaF at 600°C. ZrF₄-NaF was chosen for the molten salt test because of its low neutron absorption coefficient to thermal neutrons and low eutectic and desirable salt properties for LFTR application. The carbon vessel will be examined for the same changes in properties from the radiation test. In addition, diffusion profile measurements will be taken. In the future, we would like to expose all candidate materials to the molten salts. We expect the SiC/SiC composite to exhibit the most superior damage resistance due to its low induced activation/low decay heat properties, low neutron absorption cross section, higher operating temperatures than alloys, and tolerance against neutron irradiation at elevated temperatures. Our results will allow us to analyze the reliability of these materials, in particular, if they can withstand the harsh environment of the LFTR over a period of 50 years.

[Acknowledgment: This study was supported by the California

Alliance for Minority Participation, UC Irvine, Irvine, Ca, 2012.]

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Multicriteria Optimization in the Construction Field

Giovanni Torres Suárez, University of Puerto Rico at Mayagüez
Mauricio Cabrera-Ríos, University of Puerto Rico at Mayagüez

Ever wondered how the crack on your wall or ceiling got there? If there is ever an earthquake or another natural disaster will your house be able to resist it? That crack you are worrying about most probably got there due to the quantity of materials selected in the concrete mix used to build your house. The compressive and tensile strength of any concrete structure is based on how one selects our coarse and fine aggregates, cement, water ratios, chemical and mineral admixtures. By focusing on the concrete mix itself, it is possible to help alleviate multiple problems that affect our houses as well as every bridge, building and road that has been built with concrete.

Construction projects, however, always require considering multiple criteria such as cost, manageability, time to delivery and ecological impact. It is expected that multiple trade-offs arise in these performance measures. In this project, formal multiple criteria optimization techniques will be used to characterize trade-offs in construction projects involving normal strength concrete to determine the best concrete mixes considering all important performance measures simultaneously. The initial ideas are discussed here.

[Acknowledgment: This work was supported by the National Science Foundation (NSF) grant number 0833112 through the NSF UPRM NCBEDSA and Lockheed Martin for their 2012 research scholarship.]

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Spherically Symmetrical Droplet Combustion of n-Octane in a Microgravity Environment in International Space Station and Ground-Based Facilities

Koffi N. Trenou, Cornell University

Combustion of single isolated droplets of pure n-octane was studied in a reduced gravity environment to eliminate the influence of convection and promote greater understanding of physical and chemical processes of the combustion of normal

octane. The low gravity environment is attractive because it simplifies a complex burning process, thereby facilitating detailed numerical modeling of chemical kinetics coupled with transient multiphase heat and mass transfer. Heat losses and soot formation are believed to relate with the dimension of flame scale.

Therefore, our aims are to investigate the effect of initial droplet size to multiphase burning characteristics and to explore possibilities of controlling them. Data of a wide range of diameters are reported, from 0.5 mm to 3.6 mm, in this study, which include the data from ground-based facilities (a drop tower, with limited experiment times) and from the International Space Station (with no time limit for microgravity conditions). Reported results also include fiber-supported and free floating droplet burning as well as pure evaporation and an experiment with two distinctive burning rates due to radiative extinction. The droplet burning rate generally decreases with increasing initial diameters over the diameter range examined. Local thermal flows are observed around the fuel droplet (2.6 mm) and the support fiber (80 μm), thus it produces a larger burning rate compared to free floating experiments. On the contrary, no thermal flows are observed near the droplet (0.5-0.8 mm) and fiber (14 μm) in the ground-based tests that could enhance the burning rate. Flame and soot stand-off ratios also show dependency of initial diameters.

This study shows that spherically symmetric droplet combustion is a useful and productive experimental design that provides several aspects of droplet burning characteristics for validating detailed models associated with complex heat and mass transfer occurring during multi-phase combustion processes. The future studies will consider n-decane, propylbenzene, iso-octane, toluene, and n-heptane, with a wide range of initial droplet sizes, to obtain a more generalized conclusion for various hydrocarbons. *[Acknowledgment: This study is supported by the National Aeronautic and Space Administration under the Grant Number NNX08AI51G.]*

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Subcategory: Civil/Mechanical/Manufacturing Engineering

Vibro-Acoustic Analysis of MMS and JWST using Finite Element Modeling (FEM)

Andrew Kwok-Leung Tsoi, University of Colorado at Boulder

The NASA Structural Analysis (NASTRAN) software is a validated and proven finite element analysis (FEA) package that calculates the natural frequencies and mode shapes of various structures. Recent projects that utilize NASTRAN include the upcoming James Webb Space Telescope (JWST) and Magnetospheric

Multiscale (MMS) missions. In this study, NASTRAN is benchmarked with other FEA software packages, such as Salinas (Sandia National Laboratories) and MYSTRAN (Bill Case), from various basic plate elements to complex satellite structural frames and instruments. Salinas and MYSTRAN exercise newly improved software capabilities that have greater computational efficiency without sacrificing accuracy or performance. The FEA capabilities will focus on stress and modal prediction accuracy. This study closely studies the PSHELL, CBUSH, and CELAS element property cards and their model translations between FEA packages. Due to IRAD restrictions, results of JWST and specific MMS components cannot be shown. The natural modes and frequency outputs from NASTRAN show a consistent correlation with Salinas and MYSTRAN. Certain parts such as post-column and honeycomb panel undergo a side-by-side comparison and show maximum percent differences of 1.23% and 2.23%, respectively, for 30 modes. When multiple elements are jointed using RBE2 or CBUSH joint fixture elements, the percent difference of natural frequencies increased, especially at higher frequencies (300+ Hz). It is found that certain assumptions made for each joint fixture, pertaining to the degrees-of-freedom for element, greatly affects the mode shapes and thus changes the dynamics of the problem. Additional work requires studying the effects of rotational stiffness for each fixture. *[Acknowledgment: American Association for the Advancement of Science (AAAS)]*

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Subcategory: Mathematics and Statistics

Crash Data Analysis of Las Cruces Safe Traffic Operations Program

Cristina Villa, New Mexico State University

Proposed Methodology: For each intersection, the crash report data will be compiled based on the types of crashes (i.e., angle crash and rear-end crash), levels of severity (i.e., property damage only, injury, and fatality), date and time of crashes, and severity index. Originally, there were eight cameras at four different intersections in the Las Cruces Safe Traffic Operations Program (STOP). However, three of them were shut off in May 2010. Therefore, in conducting the analysis, the crash data will be grouped into three distinct periods, i.e., before the STOP operation, during the STOP activation, and the deactivation periods. Statistical analysis will be performed to prove if there is a reliable significant difference in the crash rates. **Proposed Research Question:** The City of Las Cruces introduced STOP in March, 2009. One commonly applied criterion for evaluating the effectiveness of the STOP is reductions on the crash rates after the STOP operation. Therefore, the major research task on this project is to investigate how the STOP operation has impacted

on the crash rates. **Anticipated Outcomes:** We may answer the following questions: (1) Does the STOP operation have a positive impact on the reduction of the angle collision and/or rear-end collision?; (2) Does the STOP operation have a positive impact on the reduction of property damage only crashes, injury crashes, and/or fatality crashes?; and (3) Does the STOP operation have a positive impact on the Severity Index? *[Acknowledgment: NSF and AMP-URA]*

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Subcategory: Environmental Engineering

Fate and Transport of Chemicals in Stormwater Runoff at Mammoth Cave National Park

Ashley West, Tennessee State University

Mammoth Cave in Central Kentucky is home to unique biological communities that have adapted to cave habitat. These organisms depend on clean water and could be harmed by contaminants carried into the cave system during storm events. Potential threats to the quality of water have been identified and include vehicle petroleum leaks, improperly discarded batteries, the shoe-disinfection stations, road salts in the winter, and general parking lot runoff. The National Park Service, however, lacks some essential quantitative information with regards to contaminant transport from land surface into the cave ecosystem. The objective of this investigation was to characterize storm flow from potential source areas on the surface into the cave. A quantitative tracer study found it took one hour for dye to move from land surface, along the main flowpath, and into the cave. Grab samples were collected and analyzed for constituents, such as quaternary ammonia compounds, chemical oxygen demand, ammonia, and diesel range aromatic ring compounds. These components decreased exponentially along the flowpath to below detection levels in the cave. Zinc, copper and nitrate concentrations were in the lower part per million range and decreased along the surface flow path, but then held steady at PPB concentrations in the cave flowpath. This information is useful when designing a stormwater mitigation plan in the future. Using data from the research analysis, measures will be taken to consistently keep contaminants from affecting the cave visitors and creatures. *[Acknowledgment: Tennessee Louis Stokes Alliance for Minority Participation, TSU-URM, Mammoth Cave National Park Science]*

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Subcategory: Environmental Engineering

Streamflow Prediction Based on Least Squares Support Vector Machine

Charles Williams, University of the District of Columbia
Nian Zhang, University of the District of Columbia

Continuing land development around the world causes irreversible changes to area watershed conditions which eventually result in problems with tracking both water quality and quantity in local receiving bodies of water. This impact of urbanization is more pronounced for highly urbanized areas and associated receiving waters such as the Potomac River within the Chesapeake watershed near Washington, D.C. In addition, it has been recognized that climate change can also have a severe impact on our streams and rivers due to extreme weather events such as frequent flooding. Due to these factors, reliable estimation of stream-flows at various locations is very important from a water resources management viewpoint.

Our research proposes a predictive model based on least squares support vector machine (LS-SVM) to forecast the future stream-flow discharge levels using the past stream-flow data and gage height. The training process of LS-SVM involves the selection of both kernel parameters and a regularization constant. Finally, the prediction capability with different kernel functions are explored to evaluate the impact of the stream-flow discharges and gage height for long-term prediction of flow rates and the accuracy of this method compared to others. We are still comparing the various methods of estimating water quantity, but the LS-SVM technique appears to be a very reliable predictor.

This research will help aid the many agencies that need accurate predictions of storm-water runoff data to facilitate appropriate water resources management around the world. With natural resources becoming increasingly scarce due to urbanization and industrialization, this will be a very important topic in the near future. *[Acknowledgment: This study was supported, in part, by a grant from the University of the District of Columbia STEM Center (NSF/HBCU-UP / HRD-0928444), Washington, D.C. 20008, and grant from the DCWRRRI.]*

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Subcategory: Computer Science & Information Systems

Collision Avoidance of Multiple UAS Using a Collision Cone-Based Cost Function

Lacey Wright, Auburn University

Greater importance is being placed on unmanned aircraft systems (UAS) by both the military and civilian sectors. Currently, human interaction in the form of guidance and control is required for most applications involving UAS. Smart UAS exist to address this limitation; however, in order to be effective in real-life scenarios, several hurdles must be overcome. One such obstacle is the inability of UAS to avoid one another in a limited airspace. The collision avoidance algorithm extends the concept of the collision cone for use with multiple UAS. A cost function based on the collision cones between each UAS and its possible aggressor UAS is computed. Using simulated annealing, the bearings of these UAS are adjusted until the minimum number of near-misses is estimated to occur as determined by the minimization of the cost function.

The algorithm is tested using a simulated environment. Metrics (Efficiency and Effectiveness) include: percent reduction of near misses, ratio of the number of waypoints hit using the collision avoidance algorithm to those hit traveling in shortest paths ignoring collision avoidance, and percent reduction of conflicts. Physical Constraints include: the airspace will be limited to two-dimensions with hopes of later expanding to three-dimensions. The maximum turning angle of the physical UAS has been determined to be 22.5 degrees/second (simulated UAS will also be bound by this constraint). The airspeed has been determined to be 25 miles/hour which will be approximated as 11.176 meters/seconds for algorithmic purposes, and no environmental factors will be considered in this project and no UAS will be removed during simulated runs.

The algorithm presented in this paper can be highly effective for collision avoidance. While not aimed at reducing conflicts, in every case tested except two, conflicts were reduced by at least 90%. In terms of reducing near misses, the principle purpose of the algorithm, the algorithm was highly successful, reducing near misses by 100% in every case tested except for the most stressful case where near misses were reduced by 78%. Avoiding near misses, however, comes at a cost. As the ratio of UAS-to-field size increases, efficiency at hitting waypoints must be traded for safer flight trajectories resulting in low efficiencies on high-density fields because of increasing computation costs. In order to expand this research, the algorithm should be tested with real UAS and incorporated with real-world conditions. *[Acknowledgment: National Science Foundation; Dr. Saad Biaz, Auburn University.]*

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Subcategory: *Electrical Engineering***Rapid Prototyping of Copper Inductor Coils by Mechanical Milling on Rigid and Flexible Substrates for Large-Area Electronics****Therin Young, Savannah State University**

Warren Rieutort-Louis and James C. Sturm, Princeton University
This paper introduces a subtractive rapid prototyping method for the patterning of metal on a substrate for large-area electronics (LAE) applications. Such applications include wireless energy harvesting systems which, as demonstrated recently, can rely on physically large passive components in order to wirelessly transmit substantial power. Conventionally, these components are patterned with methods such as photolithography, metal etching, and inkjet printing. Although these methods are efficient in producing reliable products, subtractive prototyping is an attractive alternative offering the potential for cheaper and faster prototyping and manufacturing based on widely available metal-coated substrates (e.g. copper on polyimide). In this paper, we focus on coil inductors in particular, as these have proven a key passive component for energy-harvesting LAE systems, enabling high-efficiency power transfer. A table-top Computer Numerical Control tool (Roland MDX 40-A), is used to pattern a thin copper layer which was previously coated onto a substrate. A CAD drawing of the desired passive component is created and uploaded, after which the MDX 40-A uses subtractive rapid prototyping via a fast-turn-around milling technique to produce the inductor pattern out of the copper layer. Several process parameters are critical for the production of suitable copper inductors. First, the shape and size of the inductors define key properties such as inductance. In general, physically larger inductors offer larger inductance—we maximize this by using the full X-Y motion available to produce physically large prototypes (12 by 12 by 4.1). Secondly, a larger number of inductor turns also improves inductance, and hence it is highly desirable to minimize the pitch/width of the copper tracks and spaces in the coil to fit in more turns (a trade-off exists with the parasitic series resistance of the inductor increasing as the tracks become smaller, reducing inductor Q-factor). We minimize this by studying the horizontal dimensional resolution limit of the Roland MDX-40A. A final consideration is the desire to produce these inductors from commercially available substrates consisting of thin copper films (<50um) on thin rigid (FR4, glass) or flexible (polyimide) supports (ranging from 25um to a few mm). We thus investigate the minimal vertical (Z) resolution of our rapid prototyping tool to enable patterning on such substrates.

[Acknowledgment: Princeton University, Princeton, NJ; National Science Foundation; Peach State LSAMP Program]

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Graduate Abstracts for Oral Presentation**Biological Sciences****Grad. OA #1**Subcategory: *Microbiology/Immunology/Virology***PLGA-encapsulated *Chlamydia trachomatis* MOMP Induces Th1 Immune Responses in Mice****Stacie Fairley, Alabama State University**

Shree R. Singh, Abebayehu N. Yilma, Saurabh Dixit, Taha Murtada, Praseetha Subbarayan, and Vida A. Dennis, Alabama State University

We have previously shown that the major outer membrane protein (MOMP) of *Chlamydia trachomatis* or its peptide derivatives are potential candidates for vaccine development. In the present study, we investigated the effectiveness of Poly D, Lactic co-Glycolic Acid (PLGA) as a vaccine delivery system for recombinant full MOMP (rMOMP). Recombinant MOMP was encapsulated in PLGA 50:50 (lactic: glycolic acid ratio) nanoparticles (PLGA-rMOMP) and characterized by *in vitro* physio-structural and *in vivo* immunogenicity studies. Encapsulated rMOMP was ~ 100-300 nm in size as assessed by scanning electron microscopy with ~ 60% encapsulation efficiency. Ultra violet-visible spectra further confirmed encapsulation of rMOMP in PLGA due to differences in characteristic absorbance peaks between rMOMP and PLGA-rMOMP. Systemic analyses of sera from PLGA-rMOMP immunized as compared to that of PLGA-PBS non-immunized BALB/C mice revealed elevated IgG and isotype specific IgG2a (Th1) and IgG1 (Th2) antibodies. Sera from immunized mice produced a 64-fold higher IgG2a versus IgG1 antibody titer. Re-stimulation of spleen cells from immunized mice with rMOMP additionally underscored higher Th1 responses such as elevated secretions of Th1 (IL-12p40 and IFN- γ) as compared to Th2 (IL-4 and IL-10) cytokines. Overall our data shows successful encapsulation and characterization of rMOMP in PLGA and the effectiveness of PLGA as a vaccine delivery system. Of significance, PLGA-rMOMP induced heightened IFN- γ and IgG2a Th1 immune responses in mice, which are desirable prerequisites for a *C. trachomatis* vaccine candidate.
[Acknowledgment: This study was funded by NSF-CREST (HRD-1241701) awarded to Shree R. Singh, Ph.D., Director for the Center of Nanobiotechnology, Alabama State University]

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Grad. OA #2

Subcategory: Microbiology/Immunology/Virology

Comparison of Ligand Binding Residues for Length-Identical Chromosomal and Plasmid-Encoded Universal Stress Proteins in *Staphylococcus* Genomes

Shelton Griffith, Jackson State University

The genus *Staphylococcus* contains pathogenic and non-pathogenic bacteria species including strains that are multidrug resistant, found in hospital and food-animal processing settings. Therefore, research to understand the genes that allow certain *staphylococci* to survive unfavorable conditions is a continuous need. The genome sequences of at least 92 strains of *Staphylococcus* are available in public bioinformatics databases. Genes encoding proteins with the universal stress protein (USP) domain are known to provide cells with the ability to respond to various environmental stresses such as nutrient starvation, high salinity, extreme temperatures, drought and exposure to toxic chemicals.

Initially, visual analytics of the functional and sequence annotation data on universal stress proteins encoded in *staphylococci* genomes revealed 193 predicted USP sequences. The USP gene count per *staphylococci* genome (draft and finished) ranged from 1 to 4. Pattern analysis revealed pairs of USPs for 7 strains with identical length of 137 aa. The *Staphylococcus* species and strains with the paired identical length 137 aa USPs were *aureus* (A5948, A9765, MR1); *epidermidis* (ATCC 12228, RP62A, W23144); and *hominis* (C80). Strains MR1 and A5948 are known methicillin resistant isolates. Search for chemical ligand binding residues of the sequences reveal that ATP-binding motif is present in one of the sequences. In the genomes of strains ATCC 12228 and RP62A, the genes are adjacent and in the same transcription direction to a sulfate transporter gene. Additional research is in progress to determine the ligands associated with amino acid residues. [Acknowledgment: Research and Training in the Center for Bioinformatics & Computational Biology are sponsored by National Institutes of Health (NIH-NCRR G12RR13459, NIH-NIGMS T36GM095335, NIH-NIMHD 1P20MD002725-01, NIH-NCRR-P2ORR016476, NIH-NIGMS-P20GM103476-11, and NIH-NCRR-P2ORR016460 U54DA021519); National Science Foundation (EPS-0903787, NSF-DBI-0958179, and DBI-1062057); and US Department of Homeland Security Science and Technology Directorate (2009-ST-062-000014, 2011-ST-062-000048). The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the funding agencies.]

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Grad. OA #3

Subcategory: Microbiology/Immunology/Virology

Persister Isolation in *Staphylococcus Aureus*

Elin Mina, Binghamton University

Staphylococcus aureus is one of the causative agents of chronic infections and nosocomial infections associated with biofilms. Biofilms are composed of a heterogeneous community of cells, considered to be at different metabolic states, that are partially responsible for the intrinsic biofilm tolerance to antimicrobials. It was previously reported that the fatty acid cis-2-decenoic acid (cis-DA), a signaling molecule, is responsible for inducing biofilm dispersion in *Pseudomonas aeruginosa* biofilms. Recently our laboratory has reported that cis-DA is capable of reverting the tolerant state of *P. aeruginosa* persister cells (dormant cells) in relation to antimicrobials. In this work we intended to uncover whether cis-DA is capable of "breaking" the tolerant state of *S. aureus* persister cells both in planktonic (free living cells) and biofilm populations.

To achieve this, initially we characterized the biofilm growth of *S. aureus* in continuous culture using flow cell and silicone tube reactors. With a flow rate that was 6x wash out, *S. aureus* biofilms reached a quasi-steady state at day 5 of growth. Subsequently, we isolated *S. aureus* persister cells by exposing stationary phase planktonic cultures and mature biofilms to 10x and 100x MIC ampicillin concentrations, respectively, for 16 hours. The remaining cell population consisted of persister cells only. Planktonic and biofilm persister cell sub-populations were subsequently exposed to cis-DA (310 nM) alone (control), PBS alone (control), ampicillin alone and ampicillin in combination with cis-DA. It was found that *S. aureus* persister cells lost their tolerance to ampicillin in the presence of cis-DA. In addition, we performed virulence assays in *Arabidopsis thaliana* and *Caenorhabditis elegans* where we found that persister cells isolated from planktonic populations in the presence of cis-DA became more virulent than persister cells treated with PBS alone. This indicates that cis-DA increases the metabolic state of persisters, thus leading to a loss of their tolerance to antimicrobials.

We further intend to determine the effect of cis-DA on the protein abundance on persister cells and on the mRNA transcription of known virulence factors being produced by *S. aureus*. Exploring the results from this work could ultimately result in a higher efficiency in resolving biofilm infections by enabling the eradication of persister tolerant population. [Acknowledgment: This study was supported, in part, by a grant from NSF to Elin Mina, graduate student of Biological Sciences Binghamton University.]

Faculty Advisor: Claudia N. H. Marques, cmarques@binghamton.edu

Grad. OA #4*Subcategory: Microbiology/Immunology/Virology***Poly (lactic-co-glycolic acid) (PLGA)-chitosan Encapsulated IL-10 Prolongs the Biological Half-life and Release of IL-10: Potential for Biomedical Applications****Abebayehu Yilma, Alabama State University**

Shree R. Singh, Praseetha Subbarayan, Francois Villinger, Emory University

Vida A. Dennis, Alabama State University

Cytokines are essential components of the innate immune response, and differences in the production ratios of pro- versus anti-inflammatory cytokines are essential in the initiation and perpetuation of inflammatory diseases. We have reported that the anti-inflammatory cytokine, IL-10, regulates pro-inflammatory responses triggered in innate immune cells by *Borrelia burgdorferi*, the spirochetal agent of Lyme disease and *C. trachomatis*, the bacterial agent of sexually transmitted infections. Several studies also have shown that IL-10 is effective in ameliorating diseases with inflammatory and autoimmune etiologies. However, because of IL-10's short biological half-life, these studies rely on large dosages and frequent administrations of IL-10 to exert its anti-inflammatory effect. The short biological half-life of IL-10 thus makes its *in vivo* biomedical applicability short-coming and problematic. Here, we hypothesize that IL-10 encapsulated in Poly D, Lactic co-Glycolic Acid (PLGA) 85:15 (lactic: glycolic acid ratio)-chitosan nanoparticles will provide slow release, prevent its rapid degradation and prolong its biological half-life.

Our results show encapsulated IL-10 was ~100 nm with > 90% encapsulation efficiency. IL-10 was slowly released from PLGA-chitosan over a 29-day incubation period, indicating its slow release pattern. Encapsulated IL-10 reduced TNF and IL-6 pro-inflammatory levels in mouse J774 macrophages exposed to *C. trachomatis* or LPS, suggesting encapsulated IL-10 is functional by exhibiting its anti-inflammatory effect. This study introduces a novel approach where the biological half-life of encapsulated IL-10 is prolonged, and therefore may circumvent the necessity for its frequent and high dosage administration *in vivo*. Our data further elucidates that encapsulated IL-10 can potentially be exploited in biomedical applications for controlling diseases with inflammatory or autoimmune etiologies. [Acknowledgment: NSF-CREST (HRD-1241701)]

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Chemistry and Chemical Sciences**Grad. OA #5***Subcategory: Materials Science***The Effect of Reaction Conditions on the Hydrolytic Hydrogenation of Cellulose Using Ru/NbOPO₄, Binary and Ternary Metal Oxides Catalysts****Darlene Z. Galloza-Lorenzo, University of Puerto Rico at Mayaguez**

Jose L. Contreras-Mora, Rafael Mendez-Romen, and Nelson Cardona-Martinez, University of Puerto Rico at Mayaguez

Biomass is an abundant natural renewable source of carbon and hydrogen. Cellulose can be used as a renewable feedstock for the production of glucose and/or sorbitol that in turn may be used in a biorefinery for the production of fuels and value added chemicals. Here we report the results of the study of the effect of cellulose crystallinity, cellulose/catalyst ratio, reaction temperature and reaction time on the catalytic performance for the conversion of cellulose into sorbitol. The series of supports studied includes phosphate niobic acid (NbOPO₄) and a ternary metal oxide support SiO₂-TiO₂-WO₃.

The materials used display strong acidic properties. Ru was supported using evaporative deposition on the supports. The catalytic materials were characterized using nitrogen adsorption, X-Ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR). For Ru/NbOPO₄, after 30 min of reaction we noticed that by increasing the reaction temperature from 210 to 230 °C, the cellulose conversion increased from 66 to 96% and the yield to hexitols increased from 13 to 43%. However, for Ru/SiO₂-TiO₂-WO₃, the same increase in temperature causes a proportional increase in the conversion, but a decrease in the yield to hexitols together with an increase in the yields for hydrogenolysis products and gas phase products. For Ru/NbOPO₄ at 230°C, the yield of sugar alcohols is almost constant for reaction times between 5 min and 1h of reaction at an average value of 43%.

Furthermore, at this same reaction temperature for Ru/NbOPO₄, 100% cellulose conversion is obtained at 30min, while for Ru/SiO₂-TiO₂-WO₃, 2h of reaction time are required. Treating Ru/NbOPO₄ in water at 230 °C, 35 bar H₂, for 24 h caused a slight decrease in cellulose conversion and sugar alcohols yield, but a significant increase in hydrogenolysis products yield. Ru/Nb₂O₅ (HY 340) and the equivalent amount of phosphoric acid present in Ru/NbOPO₄ give essentially the same conversion as Ru/NbOPO₄ but a lower yield to sugar alcohols and a higher yield to hydrogenolysis products. Decreasing cellulose crystallinity and cellulose/catalyst ratio increases the cellulose conversion and hexitols yield for Ru/NbOPO₄. [Acknowledgment: We wish to acknowledge CREST Nanotechnology Center for Biomedical and Energy-Driven

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Systems and Applications (HRD-0833112) and Wi(PR)2EM Wisconsin-Puerto Rico Partnership for Research and Education in Materials (DMR-0934115) for the financial support.]

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Grad. OA #6

Subcategory: Civil/Mechanical/Manufacturing Engineering

Thermal Decomposition of Ethyl Acetate by a Film Boiling Reactor

Wei-Chih Kuo, Cornell University

Kyung Hwa Choi and C. Thomas Avedisian, Cornell University

This research concerns development of a new concept for a chemical reactor that uses the film boiling process to promote thermal cracking or pyrolysis of organic liquids. It is illustrated using a model system that builds on earlier studies which demonstrated the process for methanol, ethylene glycol and glycerine. The molecule selected is ethyl acetate (EA) because of its known decomposition chemistry (a simple unimolecular process) and conversion rate that will ultimately facilitate comparisons with modeling efforts. The study examines the complex interplay between the energy to maintain the vapor film and the energy needed to drive the thermal cracking reactions. The conversion process exploits the large temperature gradients that typically exist across the vapor film in the film boiling regime to promote thermal cracking or pyrolysis of organic vapors flowing in the film. The reaction products and unreacted vapors are transported by the bubbles that naturally form as a part of the film boiling process. The geometry considered is an electrically heated horizontal metal tube (inconel) immersed in a pool of subcooled EA, with film boiling being established by the natural transition from single phase convection, nucleate boiling, the critical heat flux condition and ultimately film boiling. Experimental results show a wide range of stable film boiling states (700 to 1500 K), while only above an average heater surface temperature of about 1000 K was chemical change detected. The EA decomposition products were found to be almost entirely comprised of acetic acid and ethylene in keeping with expectations of the known unimolecular decomposition process. Furthermore, while ethylene is a non-condensable gaseous product which passes through the system, acetic acid was condensed in the experimental design and returned to the liquid pool thereby transitioning the liquid from a single component system (EA) to a miscible mixture. This was evidenced by GC/MS analysis of the liquid at various times during operation of the reactor and a bulk liquid temperature that increased over time. Conversion of acetic acid to methane and carbon dioxide was noted by GC analysis of the product gases. The results demonstrate the potential of using film boiling to promote pyrolysis of organic liquids. Ongoing work involves developing a simplified numerical

model to understand the effect of process parameters on product yields. *[Acknowledgment: This study was supported in part by the National Science Foundation under the grant number CTS-0933521; we thank Dr. Wing Tsang of NIST for helpful discussions.]*

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Grad. OA #7

Subcategory: Chemistry (not Biochemistry)

S-block Metal Organic Frameworks (MOFs) for Gas Storage Applications

Peter J. Rosado Flores, Syracuse University

The goal of this work is the construction of MOFs based on light weight metals with open pore geometries for applications as host materials. Lack of studies involving s-block metal organic frameworks may be a result of the absence of systematic pathways towards the desired complexes. Whilst the d-block metals provide well-defined coordination chemistry, the large range in coordination numbers of the s-block metals poses a challenge in structural control. Even more so, obtaining reproducible structures remains one of the difficult aspects of the chemistry. The careful tuning of reaction conditions as well as ligand geometry has been shown to greatly influence the resulting framework topologies. This work is focused on 4-pyridinecarboxylic acid for the construction of novel MOF materials, especially in conjunction with light s-block metals to achieve MOFs with a low weight but large hydrogen storage capacity. Summarized are recent results on the synthesis of s-block MOFs. We are currently evaluating ligand type and reaction conditions in order to successfully obtain microporous materials. *[Acknowledgment: Department of Energy Graduate Fellowship (DOE-SCGF)]*

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Computer Sciences and Information Management

Grad. OA #8

Subcategory: Computer Science & Information Systems

A Modularized Framework for Designing and Implementing Web-Based Learning Environments

Candice Adams, Auburn University

With the popularity of the Internet rising, there are many new types of web-based technologies being introduced daily, such as

social networking sites (i.e. Facebook), online gaming (i.e. World of Warcraft), and simulations sites (i.e. SecondLife). Middle and high school age students spend countless hours on computers immersed in online sites such as the ones mentioned above. Technology has the power to transform the level of education provided by secondary schools because it facilitates an environment that can be tailored to each student. Web-based learning environments provide a low cost and effective way to deliver and engage students in a particular subject. This presentation will describe the formative research conducted to create the modularized framework from system design to implementation. Also, it will describe how the framework was used to build two more web-based learning environments. Preliminary usability testing has been done on the initial application built using the framework which is called ChemiNet. ChemiNet is a web-based learning environment that was designed to reinforce basic chemistry by providing a dynamic web-based environment for students to explore concepts that may or may not have already been introduced through traditional instructional methods. The results from the testing will be presented to form a basis for creating additional applications within the framework. The framework was designed in such a way that it allows novice developers to modify the content areas of the application framework in order to create their own course. The application that is created allows students to interact, manipulate and visually inspect the representation of various images and content. It also allows student access to lessons at home and at school without having their textbooks with them. Based upon the research and usability testing, the ability to utilize this tool to support both formal and informal settings increased its appeal for both teachers and students. Finally, the presentation will include a brief overview of future research in the area of advanced educational frameworks that will provide users a single sign-on access point to all three current applications and any future applications. *[Acknowledgment: My project was partially supported by NSF Alabama Alliance for Students with Disabilities (AASD-STEM).]*

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Grad. OA #9

Subcategory: Computer Science & Information Systems

Cloud Computing-based Detection System to Detect Black Hat Search Engine Optimization and Social Network attacks on Android Smartphones

Husam Adas, Tennessee State University

The growing popularity and adoption of smartphones has made them a target of malicious activities. Malicious activities targeting smartphones are increasing and are projected to continue to increase as they become more lucrative for cyber criminals worldwide. Common malicious activities involve

collecting user information, sending premium-rate SMS messages, credential theft, SMS spam, Black Hat search engine optimization, and ransom. We have found that social malware and Black Hat search engine optimization attacks are very common as they are spread through user interaction with social networking websites and search engines. Most solutions for smartphone security require the presence of anti-virus software or intrusion detection system on the phones. These solutions are constrained by the limited memory, storage, computational resources, and battery power of smartphones.

In this research project, we propose a response mechanism on cloud computing based Hadoop infrastructure to detect web-based malware attacks on Android smartphones. The response mechanism will specifically detect BSEO on Android smartphones. Network traffic traces generated on smartphones will be analyzed on the cloud computing infrastructure. If a malware is detected, the proposed response mechanism will take appropriate action to prevent the attack. This approach will overcome the computational, memory, storage and battery limitations in smartphone devices due to the availability of vast computational, storage, memory resources in the cloud environment.

The contributions of our approach are: 1) Detection of malicious domain names and IP addresses by analyzing smartphone network traffic on Hadoop; 2) Light-weight analyses approach which does not require the replica of the smartphone image or in-depth forensic analyses on the Hadoop infrastructure, and 3) Real-time processing of network traffic on Hadoop by integrating a classifier in our proposed response mechanism. *[Acknowledgment: This study was supported by a grant from NSF Research Initiation grant awarded to Dr. Sachin Shetty, Tennessee State University.]*

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Grad. OA #10

Subcategory: Computer Science & Information Systems

Secure IP Geolocation for Cloud Auditing

Biswajit Biswal, Tennessee State University

Sachin Shetty, Tennessee State University

Cloud subscribers who have entrusted their files to the cloud want to accurately verify where their cloud files are. Recently, a latency measurement based geolocation approach has been proposed to verify storage location of cloud files in the cloud. This approach doesn't verify exact locations of cloud files in the cloud, in addition, there is no proof of secure latency measurements and inaccurate results when cloud files move and are only experimented on a particular geolocation. In this paper, we propose a machine learning-based secure IP geolocation approach for accurately estimating the exact

geolocation of cloud file hosts in the cloud globally, as well as to detect adversary attack by misleading the geolocation system about its true location. Our approach supersedes the existing latency measurement based approach by extracting seven features from network measurements. These unique features allow us to solve the problems of finding exact geolocation of cloud files even when these move and detecting an adversary attack on network measurements. To demonstrate the accuracy of our approach, we evaluate the performance on Amazon CloudFront and Windows Azure using ping and traceroute measurements from all globally available PlanetLab nodes with known geographic placement.

Our results demonstrate that our approach is geolocating cloud file hosts accurately and more closely to the true geographic location and is also able to detect adversary attacks to mislead the geolocation system. *[Acknowledgment: This study was supported by a grant from NSF Research Initiation grant awarded to Dr. Sachin Shetty, Tennessee State University.]*

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Grad. OA #11

Subcategory: Computer Science & Information Systems

Assessment of Performance Impact of Linux Audit Framework

Brittany J. Brown, Virginia State University

Auditing is the process of constructing and examining events happening on a computer. An audit system can monitor and record syscalls, watch files for access, search for specific events, collect events from MAC (Mandatory Access Control), also trusted apps that have been designed to send events. Latest releases of the Linux Operating System are commonly equipped with an audit system to comply with industrial and government security standards, such as the Controlled Access Protection Profile class of the U.S. Department of Defense and the Trusted Computer System Evaluation Criteria. Despite the benefits of providing oversight and assurance to the organization, the performance overhead of the audit system remains a concern to many system and network administrators as audit systems are crafted to record system events and can consume much of system resources such as memory, storage, and CPU.

This work is to quantify the performance overhead introduced by Linux Auditing system. We design experiments to measure the performance overhead under various configured setups and host usage patterns. For instance, a benchmark program is created to issue system calls, such as open and close a file on the local file system at various frequencies and the elapsed times are recorded when the program is run with the audit system being on and once being off respectively. The experiments lead to an understanding of the performance overhead as related to many system variables. Based on the

understanding, future work will be dedicated to the reduction of audit system performance overhead. *[Acknowledgment: This study was supported, in part, by a grant from NSF/LSAMP.]*

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Grad. OA #12

Subcategory: Computer Science & Information Systems

Traffic-Aware Time Division Multiple Access (TA-TDMA)

Sovandara Chea, Texas Southern University

In Wireless Sensor Networks energy efficiency is a key to prolonging the life of the network. One of various ways to create an energy efficient network is to optimize the network's Media Access Control (MAC) and routing protocol. Low Energy Adaptive Clustering Hierarchy (LEACH) is a cluster base protocol that can be implemented in both MAC and routing layers of the networks. LEACH has setup phase and steady phase. In steady phase, LEACH uses Time Division Multiple Access to communicate within its cluster and Carrier Sensing Multiple Access for cluster head to cluster head communication with interference filtered by Direct Sequence Spread Spectrum. To further improve the life time of LEACH, we proposed a new contention-free communication protocol Traffic-Aware Time Division Multiple Access to enhance previous design of LEACH in both inter-cluster and cluster-to-cluster communication by improving throughput via channel utilization, energy efficiency with cluster-head sleep time when no traffic is scheduled, and shorten delay by allowing non-used time slot to be utilized. *[Acknowledgment: This study was supported, in part, by a grant from NSF/CREST Center for Research on Complex Networks to Dr. Wei Wayne Li, Director of the Center and Energy Efficient Wireless Sensor Networks, Texas Southern University.]*

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Grad. OA #13

Subcategory: Computer Science & Information Systems

Flexible Graphlet Kernels for Functional Residue Prediction in Protein Structures

Jose Lugo-Martinez, Indiana University

Esfandiar Haghverdi and Predrag Radivojac, Indiana University

Graph kernels for learning and inference on sparse graphs have been widely studied. However, the problem of designing robust kernel functions that can effectively compare graph neighborhoods in the presence of incomplete and/or noisy data remains less explored. Here we consider an instance of the problem of vertex classification defined as follows: given a

protein structure, we want to assign a probability that each unannotated amino acid is a functional residue. The first step is to construct a protein contact graph from protein structures. In the second step, graph kernels are used to capture similarity between graph neighborhoods, and subsequently used to classify protein residues. In this work, we propose two novel graph-based kernel methods for capturing topological similarity between local graph neighborhoods as a means to probabilistically annotate functional residues in protein structures. Inspired by string kernel approaches, we generalize the concept of labeled graphlet kernels proposed in Vacic et al. [1] by introducing two distinct degrees of flexibility when capturing similarities between local graph neighborhoods. We use a comprehensive benchmark for the prediction of functional vs. non-functional residues from protein structures. It consists of the following four residue-level function prediction problems: (1) prediction of catalytic residues, (2) prediction of phosphorylation sites, (3) prediction of zinc-binding residues, and (4) prediction of DNA-binding residues. We compared our flexible kernels against several established structure-based methods. These methods are representative of many computational approaches for the problem of predicting functional residues from protein structures. The results indicate that our graphlet kernels performed as good as or better than established structure-based approaches. Additionally, we present evidence that the flexible kernels enable simple and principled ways of incorporating evolutionary conservation information into classification while efficiently capturing neighborhood similarities in protein structures. Reference: 1. Vacic, V., Iakoucheva, L. M., Lonardi, S., and Radivojac, P. 2010. Graphlet kernels for prediction of functional residues in protein structures. *J. Comput. Biol.* 17 (1):55-72. [Acknowledgment: This work was supported by a NSF grant to Dr. Predrag Radivojac and a Ford Foundation Predoctoral Fellowship to Jose Lugo-Martinez.]

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Grad. OA #14

Subcategory: Computer Science & Information Systems

Teaching Traffic Safety Through an Immersive Multiuser Environment

Stephen Otunba, Bowie State University

Virtual worlds are becoming ever more prevalent in today's society and have been used to create entire social worlds such as in Second Life. Multiuser virtual worlds can also be a useful tool for training and education. This project focuses on creating a virtual city in which new drivers can learn about traffic safety and the various traffic laws. Our environment implements a multiuser interface to allow multiple users to log in as a user controlled vehicle or as a pedestrian and navigate a virtual city. The virtual city is equipped with everything one would find in a

real world city such as traffic lights, signs, pedestrians, public vehicles, and other drivers. This environment will allow users to prepare for driving exams, and we hope that it could possibly become an alternative or replacement for the traditional driver's handbook. The aim of this project is to create a virtual city environment that can be used by new drivers to help them learn about traffic laws and traffic safety in a safe, controlled environment. Our hypothesis is that users of the application will be able to gain skills and knowledge in the virtual environment that they will then be able to apply to the real world due to the sense of presence and realism a virtual environment can provide. Our virtual city was created using a combination of inbuilt models from a game development tool called Vizard and models exported from 3D Studio Max. Vizard was used to implement character and environmental behaviors and the inbuilt Vizard physics library was used to apply real world functionality to the user controlled car. Multiuser functionality was added using Vizard networking scripts and users are given the option of entering and navigating the virtual city as a pedestrian or car via a dropdown menu. The environment also includes a chat feature that will allow users to communicate in real time. Users will be able to interact with the environment through traditional inputs such as a keyboard and mouse as well as more immersive methods such as a head mounted display or 3D monitor or wall. We are currently conducting user studies to assess the effectiveness of our virtual city in teaching new drivers about traffic safety and the various traffic laws they must know before obtaining a driver's license. This project could also possibly be used as a supplement for driver's education courses. [Acknowledgment: The authors would like to thank the National Science Foundation for supporting the project. This work is funded in part by grant awards: HRD-1137541 and HRD-1238784.]

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Grad. OA #15

Subcategory: Computer Science & Information Systems

Unsupervised Learning Classification Prospective Candidate Structural Modeling

Nathaniel Taylor, Bowie State University

Pattern recognition aims to classify data patterns based on either *a priori* probabilistic knowledge or statistical information extracted from the patterns. The patterns to be classified are usually groups of measurements or observations, defining points in an appropriate multidimensional space. It is rare to have complete knowledge of the probabilistic structure of the problem. This paper proposes prospective candidate structural modeling that proceeds in two phases: (I) Use unsupervised learning classification to classify past prospective candidate data gathered from job recruiting services into two categories-- matching and non-matching ones; and (II) Use an extraction

mechanism that computes numeric and symbolic information from the matching candidates and establishes the classes itself based on the statistical regularities of the patterns in an unsupervised fashion. Expectation maximization clustering algorithms will be utilized to model the data by dividing candidates into groups and using the clusters to understand data relevance and improve classification performance. The choice to use expectation maximization clustering algorithms stems from the density estimation theory, which states that any distribution can be effectively approximated by a mixture of Gaussians. The past observed attributes of N different job seekers found that candidates based choice on various variables. Those variables will tend to cluster fairly closely around the mean. This model assumes that the attributes are accurately described by a mixture model with K different components, each distributed as a normal distribution with an unknown mean and variance and each attribute specifying a particular combination of candidate/job type. The model was trained to predict a probability rate of 96.71% accuracy for candidates who will accept an offer with implementation algorithm asymptotic complexity of $O(n^2)$. This paper also presents experimental results on real-world data for job requirements and job seeker data for the purpose of comparing prediction approaches. The model is compared to algorithms, such as Decision Tree, Bayesian, and Association models, and there was found to be a significant difference in the model prediction performance which is non-negligible and guaranteed to find a local optimum of the candidate's likelihood to accept an offer since the algorithm iterates, the $(m + 1)$ th, guess $\theta(m+1)$ will never be less likely than the m th guess $\theta(m)$.

[Acknowledgment: This study was supported, in part, by a grant from NSF/AAAS awarded to Bo Yang, Ph.D., Bowie State University, Computer Science Department.]

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Grad. OA #16

Subcategory: Computer Science & Information Systems

Traffic Flow Analysis and Energy Efficiency Optimization of a Cluster-based WSN Subject to Cluster Head Rotation

Zhao Zhang, Texas Southern University

In the past decade, the research of wireless sensor networks (WSNs) has gained great attention due to their enormous potential in military and civil applications. A typical WSN consists of a large number of sensor nodes that are able to probe the event and report to the sink in wireless manner. Battery powered nodes are involved in most WSNs, which for technical and practical reasons are not convenient for recharging or replacing. Thus, energy efficient protocols and mechanisms have been needed for the design of WSNs. In some applications, sensors are grouped to form clusters, thus providing inherent optimization capabilities at cluster-head (CH) level. In these

cluster-based WSNs, we noticed that several works have been focusing on distributing the energy consumption by applying CH rotation. However, how to further enhance energy efficiency by controlling clusters' sizes has never been discussed. In this research, we consider a cluster-based WSN deployed to the area of interest. The clusters are assumed fixed, and their nodes are deployed per homogeneous spacial Poisson process. The nodes in each cluster are identical except for the predefined transmission powers. To fulfill the CH rotation algorithm, each node has two working modes, the CH mode and the sensor-node (SN) mode. The operation of the network is divided into "rounds". In each cluster, a node is elected to be the CH via predefined protocol at the beginning of each round. To preserve energy, we set each node with two predefined transmission powers, one for each working mode, based on the sizes of relevant clusters. An analytic model for traffic analysis in such cluster-based WSN with CH rotation is developed through a queueing theoretic framework. Each node is modeled as an $M/M/1/K$ queue that can switch between two working modes. The dynamics of the traffic along the flow path is modeled by a number of tandemly linked CHs. The data blocking effect and the impact of CH rotation are taken into account. Critical quality of service (QoS) metrics, such as the data blocking probabilities (DBPs), are further derived.

Based on the analytic results, an iterative optimization method that recursively determines the optimal sizes of clusters along the tandem WSN is proposed. Numerical analysis and simulation are conducted to validate the accuracy and effectiveness of our analytic model as well as the proposed energy efficiency optimization method. In the future, we plan to extend our model to planar network. [Acknowledgment: This study was supported by a grant from NSF/CREST awarded to Wei Wayne Li, Ph.D., Director of the Center for Research on Complex Networks, Texas Southern University.]

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Ecology, Environmental and Earth Sciences

Grad. OA #17

Subcategory: Ecology

Apple Snails (*Pomacea maculata*) Facilitate Alligator Weed (*Alternanthera philoxeroides*) Invasion, But No Evidence of Invasional Meltdown Occurs in Wetland Communities

Maria Meza-Lopez, Rice University

Invaded habitats often contain multiple exotic species which may reflect positive invader-invader interactions. The Invasional Meltdown Hypothesis proposes that exotic species increase the

success of other exotic species, often those on different trophic levels, resulting in a highly invaded habitat. To fully understand the causes and effects of multi-trophic invasions, invader-invader interactions must be considered. In a 16-week mesocosm experiment we investigated whether there was mutual facilitation between an exotic plant (*Alternanthera philoxeroides*--alligator weed) and an exotic herbivore (*Pomacea maculata*--apple snail) consistent with an invasional meltdown. Forty freshwater wetland communities were subjected to single (snails or plants), successive (snails then plants or plants then snails), or simultaneous invasions (snails and plants), or were left as uninvaded controls.

We collected data on native plant biomass and diversity, alligator weed biomass, native snail abundance, and apple snail size and abundance. Reductions in native plant biomass and diversity compared to controls were greater for communities only invaded by apple snails compared to those only invaded by alligator weed. This suggests that exotic herbivores have greater impacts on these native wetland plant communities than do exotic plants. Apple snails fed preferentially on native plants so that even though they significantly reduced alligator weed biomass, they significantly increased the proportion of plant mass that was alligator weed. This suggests that these exotic herbivores may facilitate exotic plant invasion in these ecosystems. Apple snail growth, survival, and fitness were all independent of the presence of alligator weed.

This study shows that apple snails directly damage wetland ecosystems by consuming native plants and indirectly damage such ecosystems by providing opportunities for exotic plants to invade. However, we did not find mutual facilitation between these exotic plant and herbivore species as predicted by the Invasional Meltdown Hypothesis. *[Acknowledgment: This study was supported by Alliances for Graduate Education and the Professoriate, Ford Foundation Predoctoral Fellowship, Houston Conchology Society Graduate Student Research Grant, Society of Wetland Scientist Student Research Grant, Constance E. Boone Research Grant, and Western Society of Malacologists Student Research Grant.]*

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Grad. OA #18

Subcategory: Pollution/Toxic Substances/Waste

Presence and Distribution of Organic Pollutants in the San Juan Bay Estuary, Puerto Rico

Xochitl Perez, University of Puerto Rico

Loretta Roberson and Liz Diaz, University of Puerto Rico, Rio Piedras

Mark Miller, University of Puerto Rico, Medical Sciences

Recent studies have identified contaminants of emerging concern (CECs), compounds that are potentially hazardous and

persist in the environment for long periods of time. Their impacts on organisms and whole ecosystems and the effects of synergistic exposure are unknown. The San Juan Bay Estuary (SJBE) in Puerto Rico is surrounded by a densely populated urban area (1.2 million people total) that introduces large amounts of wastewater, solid waste, and other anthropogenic inputs in the bay, affecting both water quality and associated organisms. To characterize possible CECs within the SJBE, we sampled nine sites throughout the estuary to determine their distribution and concentration. Sediments, water, tissue and hemolymph from locally important blue crabs, *Callinectes sapidus*, were analyzed using gas chromatography-mass spectrometry.

Two methods were used for extraction of contaminants: solid phase micro extraction and solid phase extraction. In tissues, florisil was used for sample cleanup and Oasis HLB® for extraction of pollutants. Similar matrices with known pollutant concentrations were analyzed as a control. We identified 94 organic pollutants in water and sediment samples and a total of 67 pollutants in the blue crab. Some compounds, such as phthalates, were present in most samples. Concentrations of dibutyl phthalate, the most common pollutant, varied between 0.13 - 229 µg/L in water samples, 0.001 - 0.2 µg/g in crab tissue, and 0.03 - 0.24 µg/L in crab hemolymph. Oocytes and heart contained the greatest number of contaminants with 15 and 14 organic compounds, respectively. The concentration of Benzenamine, the most abundant pollutant in water samples, was 367 µg/L. Many of the identified compounds are considered to be neuroactive or have unknown neurological effects. Future studies should include measurements of the impact on neural systems such as the crab heart circuit to provide a better understanding of the sublethal effects of these contaminants on estuary organisms and ecosystem function. *[Acknowledgment: NSF/CREST/Puerto Rico Center for Environmental Neuroscience, 2011; Department of Environmental Science, University of Puerto Rico, Rio Piedras, 2011]*

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Grad. OA #19

Subcategory: Ecology

The Reliability of Spectral Metrics in Multi-dimensional Ecological Network Structures

Kehinde Salau, Arizona State University

Fluctuations in the climate and anthropogenic pressure such as industrialization and urbanization are leading to an unprecedented increase in habitat fragmentation. The maintenance of dispersal corridors between habitat patches has been identified as a promising strategy for mitigating the

adverse effects of landscape fragmentation on species. Recently, there is an increased use of network approaches to conservation of both marine and terrestrial species and landscapes. The ability to index large-scale ecological networks with connectivity metrics, developed in the fields of network and graph theory, gives conservationists an extra tool for indicating preferred sites for endangered populations. However, there is little consensus on how the results of such characterizations must be interpreted in light of the numerous ecological processes and interactions taking place on the landscape.

The goal of this study is to evaluate the usefulness of connectivity metrics in predicting species persistence outcomes and trends across large-scale fragmented landscapes. We develop agent-based representations of simple single- and multi-species habitat networks and focus on three main ecological processes: spread, survival, and coexistence of individuals on patchy landscape. We focus on connectivity metrics drawn from the spectral properties of a network and use these measures to search for a discernible pattern between structural connectivity of landscapes and persistence of one or more of the aforementioned ecological processes. We find that although spectral measures do hold important information about network structure and can sufficiently characterize an intuitive relationship between landscape connectivity and persistence outcomes in cases of low and high connectivity. However, this is seldom the case for a large population of the networks indexed with intermediate levels of connectivity as model outcomes vary largely between low and high persistence levels.

Furthermore, the interpretation of the metrics change when comparing results from different ecological process; this is crucial as large-scale conservation involves the persistence of a multitude of ecological processes simultaneously. Knowledge from the underlying ecological dynamics on a landscape and other structural properties of a landscape are most likely necessary for adequately predicting the desirability of ecological networks. [Acknowledgment: Alfred P. Sloan Foundation More Graduate Education at Mountain States Alliance, Alliance for Graduate Education and the Professoriate National Science Foundation.]

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Mathematics and Statistics

Grad. OA #20

Subcategory: Computer Science & Information Systems

Probability of Connectivity of Random Graphs

Kenyon L. Coleman, Texas Southern University

We investigate the probability of connectivity for random graphs given the number of vertices and edges. The problem is

that a formula is not known to calculate the probability for all possible edges given the number of vertices. Through investigating the number of ways that a graph may be disconnected, we determined a formula to calculate the exact probability. A computer program is created to calculate the probability for large graphs.

Future research will investigate the implication of the probability of connectivity of randomly distributed wireless ad-hoc networks. [Acknowledgment: CREST]

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Grad. OA #21

Subcategory: Mathematics and Statistics

Dynamics of Triatomine Infestation in a Population of Houses

Komi Messan, North Carolina Agricultural and Technical State University

Trypanosoma cruzi is the causal agent and parasite of Chagas disease, a neglected tropical disease transmitted mainly by blood-sucking triatomine insects in Latin America. Because of the unavailability of a cure for Chagas disease, disease control relies on the control of the vector population. In this work, we developed deterministic and stochastic mathematical models for the dynamics of bug infestation in a community of houses. We used a Levins metapopulation approach in which houses are considered to be patches that can be in one of three states: empty, infested, or treated. First, we considered spatially implicit models for homogeneous and heterogeneous populations. We studied the effect of differences in housing quality in infestation dynamics and the effect of heterogeneity in the distribution of the houses. Then, we developed more realistic spatially explicit, agent-based, metapopulation models. The models were used to assess the effect of different control strategies on house infestation.

The results obtained from both spatial and non spatial models show that house infestation is more controllable in a randomly mixed community. The models also predicted that spraying only the bad houses is more efficient than treating just part of the total houses at random or spraying the whole community. A further level of realism can be achieved by considering different levels of infestation. One question that can be derived from this is to see the effect of infestation in the community when very low percentages of pesticides are applied to low infested houses. Because of the short life span of the *T. infestans*, one may also incorporate the life cycle of the vector in the model and look at the period of time that the pesticide takes effect on the vector population and when it mostly affects the vectors and decreases infestation in the community. [Acknowledgment:

I would like to give special appreciation to Dr. Carlos Castillo-Chavez, Executive Director of the Mathematical and Theoretical Biology Institute (MTBI), for giving me the opportunity to participate in this research program. I also want to thank Co-Executive Summer Directors Dr. Erika T. Camacho and Dr. Stephen Wirkus for their efforts in planning and executing the day-to-day activities of MTBI.]

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Grad. OA #22

Subcategory: Mathematics and Statistics

Constructing a Solution to the Initial Value Problem for a Generalized Diffusion-type on the Entire Real Line in Terms of Solutions of Riccati-type Systems

Jose Vega-Guzman, Arizona State University

A method to construct a solution to the initial value problem for a generalized diffusion-type on the entire real line in terms of solutions of certain Riccati-type systems is discussed. Explicit transformations are used to reduce the equations under study to their corresponding standard forms. Some examples will be presented in order to corroborate the utility of the solution method and to emphasize the importance this kind of solution may have when testing certain numerical schemes.

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Nanoscience

Grad. OA #23

Subcategory: Biomedical Engineering

Synergistic Potentiation of Cisplatin with Magnetic Fluid Hyperthermia (MFH) in Caco-2 Cells Is Correlated with an Increase in Cell Membrane Fluidity

Merlis P. Álvarez-Berrios, University of Puerto Rico, Mayaguez

Amalchi Castillo, Janet Méndez, Orlando Soto, Carlos Rinaldi, and Madeline Torres-Lugo, University of Puerto Rico, Mayaguez

Clinical studies have demonstrated the effectiveness of combined hyperthermia and cisplatin treatment. However, challenges related to effective heat transfer have limited its clinical application. Magnetic fluid hyperthermia (MFH) poses an attractive alternative to surmount these challenges. Studies have shown that MFH in combination with cisplatin (cDDP) was more effective in producing cell death in Caco-2 cells when

compared to hot water hyperthermia (HWH) at the same temperature conditions. We hypothesized that this enhanced potentiation between MFH and cDDP is related to an increase in membrane fluidity caused by magnetic nanoparticles on the cellular membrane. In order, to test the hypothesis, we minimized the hCTR1 mediated active transport of cDDP by exposing cDDP treated Caco-2 cells to extracellular copper, thus maximizing passive transport. Surviving fraction, viability ratio and uptake studies were performed. In addition, changes in membrane fluidity were determined by fluorescence anisotropy measurements, as well as the uptake of acridine orange. Surviving fraction results showed that cells treated with MFH and cDDP with and without copper did not show significant differences. HWH treated cells in combination with cDDP showed significant copper dependent variations in surviving fraction. Platinum uptake studies agreed with the previous results, indicating that cells treated with MFH had higher platinum uptake than those cells treated with HWH. Fluorescence anisotropy measurements and acridine orange uptake demonstrated that MFH induces higher membrane fluidity than HWH at the same temperature conditions, and this is one of the mechanisms involved in cDDP potentiation. *[Acknowledgment: This material is based upon work supported by the National Science Foundation under Grant No. HRD-0833112 (CREST Program)-IRG-1]*

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Grad. OA #24

Subcategory: Materials Science

Fabrication of Poly(methyl methacrylate)/Eggshell Hydroxyapatite Composite Fibers for Bone Scaffold Applications

Vitus Apalangya, Tuskegee University

Boniface Tiimob, Vijaya Rangari, Temesgen Samuel, and Shaik Jeelani, Tuskegee University

The role of polymer-inorganic composite electrospun fibers as tissue engineering scaffolds is well recognized. A suitable scaffold material for bone tissue engineering application should be able to promote the attachment, growth, and differentiation. It should also have high porosity, and pores should be highly interconnected to facilitate the in-growth of vascular network, which will ensure the long term survival of cellular constructs after implantation. Due to the complex nature of the ideal scaffold material, it is unlikely that a single material will satisfy all the criteria, therefore there is a need to develop highly porous, interconnected composite scaffolds for the regeneration of new bone. From the perspective of material science, the natural bone tissue is a composite, mainly consisting of hydroxyapatite as the inorganic phase and collagen

as the organic phase. Electrospun fibers offer those excellent properties such as porosity, interconnectivity, very narrow fiber diameters and good mechanical properties for initial support of cells. We report here on the fabrication of electrospun nanofibers from Poly(methyl methacrylate) (PMMA) and hydroxyapatite synthesized from eggshell. The ability of the electrospun composite nanofibers to support the attachment and growth of mammalian cells was examined *in vitro* by culturing the transformed SW480 cell line (ATCC CCL-228) and ATCC CRL 11372 on the as-prepared composite fibers. The cells were interacted with PMMA fibers with and without hydroxyapatite nanoparticles. They were immersed in growth medium (ATCC McCoy's medium) and incubated in a humidified tissue culture incubator at 37°C and 5% CO₂. The cell attachment and growth were followed by light microscopy. The as-prepared composite nanofibers were analyzed using Field Emission Scanning Electron Microscope and revealed that the nanoparticles were distributed uniformly over the entire volume of the fiber. The energy dispersive spectrum confirmed the inclusion of the nanoparticles in composite fibers. X-Ray Diffraction, Fourier Transform Infra-red showed the particles are highly crystalline and matched with hydroxyapatite. The light microscopy showed that SW480 cells and bone-osteoblast cells (ATCC CRL-1372) can both attach and grow very well on the fibers, but the osteoblast cells took a longer time. Further studies are in progress to assess the potential of the composite fibers for bone tissue engineering. [Acknowledgment: This work was supported by a NSF CREST 1137681 grant awarded to Dr. Vijaya Rangari, Tuskegee University Center for Advance Materials.]

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Grad. OA #25

Subcategory: Nanoscience

Effect of Single-Walled Carbon Nanotubes on the Transport Properties of Poly(styrene-isobutylene-styrene) Membranes

Sonia L. Aviles-Barreto, University of Puerto Rico, Mayaguez
Stephanie Ortiz, Ishar Rosado, and David Suleiman, University of Puerto Rico, Mayaguez

In this study, the transport properties of poly(styrene-isobutylene-styrene) (SIBS) membranes were measured as a function of sulfonation level and single-walled carbon nanotube loading in order to obtain more selective membranes for gas sensors and fuel cell applications. Sulfonated SIBS were functionalized with single walled carbon nanotubes to create highly selective polymer nanocomposite membranes. The nanocomposite membranes were characterized using fourier transform infrared spectroscopy (FTIR) and elemental analysis (EA), to confirm and determine accurate sulfonation levels. Thermogravimetric analysis (TGA) was performed in order to evaluate the thermal stability, which increases with sulfonation

level while nanocomposite membranes maintained the same degradation temperature. Absorption limitations and their effect on the membrane transport were investigated for sulfonated and nanocomposite membranes through water swelling and permeability experiments. Although proton conductivity and methanol permeability increase with sulfonation level until a maximum, suggesting an optimum sulfonation, the single-walled carbon nanotubes influence the transport properties based on the changes in morphology and nanochannel size and configuration. To complement the studies, selectivity (i.e., proton conductivity/methanol permeability) of the nanocomposite membranes was determined and compared to Nafion, 117. [Acknowledgment: This work was performed with the financial support of the National Science Foundation through grant No. HRD-0833112 (CREST Program) and grant No. HRD-0832961 (PRLSAMP - BD Program).]

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Grad. OA #26

Subcategory: Microbiology/Immunology/Virology

Polyvinyl Pyrrolidone (PVP) Coated Silver Nanoparticles Demonstrates a Capsule Dependent Antimicrobial Effect Against *Streptococcus pneumoniae*

Ronda Bibbs, Alabama State University

Mamie Coats, Shree R. Singh, and Vida A. Dennis, Alabama State University

Streptococcus pneumoniae (pneumococcus) is an encapsulated gram-positive, catalase-negative bacterium that is a leading cause of community acquired pneumonia in the world. The pneumococcus is associated with high morbidity/mortality, with children under five years of age and the elderly being the most susceptible. The continual rise of antibiotic resistance necessitates the development of new therapies. Metallic nanoparticles are leading candidates as an alternative way to control the morbidity, mortality and spread of infectious pathogens.

In this current study, we hypothesized that polyvinyl pyrrolidone (PVP) coated silver (Ag-PVP) will have antimicrobial effects on various infectious serotypes of the pneumococcus. The bactericidal effects of the Ag-PVP were measured by growing *S. pneumoniae* strains of varying serotypes (10³ CFU/mL) in liquid media in the presence of the nanoparticle. Following incubation, surviving bacteria were quantitated. There was a significant reduction, independent of serotype, in the survival of pneumococci grown in the presence of Ag-PVP nanoparticles compared to its control, phosphate buffer saline. Penicillin resistant patient isolates were also susceptible to the antimicrobial effects of Ag-PVP further supporting the

usefulness of nanoparticles in treatment of disease in an era of multi-drug resistant organisms.

The complete absence of the capsular polysaccharide made bacteria more resistant to the action of the nanoparticle indicating that the capsule is involved in the mechanism of action of Ag-PVP. These data demonstrate a serotype independent, capsule dependent bactericidal activity for metallic nanoparticles in *S. pneumoniae*. [Acknowledgment: This work was supported by NSF-CREST (HRD-1241701) and NSF-HBCU-UP (HRD-1135863) at Alabama State University.]

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Grad. OA #27

Subcategory: Chemistry (not Biochemistry)

Competitive Intercalation of Polystyrene Ionomers in Layered Double Hydroxides

LaDena Bolton, Clark Atlanta University

Ishrat Khan, Clark Atlanta University

Studies of layered double hydroxides (LDHs) have been targeted in biomedical nanocomposite research due to the ease of intercalating organic species within the solid as well as the added control over its dimensions. These inorganic clays have been studied in applications including drug delivery vehicles. LDHs are brucite-like materials, with formula $[M^{2+}_{1-x}M^{3+}_x(OH)_2]^{x+}(A^n)_{x/n} \cdot mH_2O$. Represented in the formula is M^{2+} and M^{3+} , di- and tri-valent metals. The symbol A^n represents the interlayer anion which aids in confining the basal spacing and balancing the positive charges of the layers. Small molecule sulfonates and polystyrene electrolytes have served as a model system to study the anionic exchange capacity, structural properties and intermolecular behavior between guest molecules and LDH. The large gap in chemical structures ranging from ionic small molecules to fully charged macromolecular electrolytes neglects to illustrate adsorption trends among partially charged hydrophobic ionomers.

The short term objective of this work is to study the competitive adsorption behavior of $Mg_2Al(OH)_6NO_3 \cdot mH_2O$ with partially charged straight-chain polystyrene sulfonate (HPSS) at 2, 3, 10, and 28% sulfonation. We are testing the hypothesis that charge density and particle size of an ionomer affects Mg_2Al -LDH's affinity to preferentially adsorb competing sulfonated hydrocarbons. This model will illustrate what properties are affected when adsorbing multiple organic molecules, including biomolecules and pharmaceuticals, within the LDH layers. The polymers were prepared initially by anionic polymerization followed by sulfonation at different reaction times resulting in polystyrene sulfonic acid (HPSS). Pure LDHs were prepared from a mixed salt solution of $Mg(NO_3)_2$ and $Al(NO_3)_3$ maintained at pH 10 with the addition of 2M NaOH. The polymer-LDH

nanocomposites were prepared by co-precipitation in the presence of HPSS. TGA and FTIR confirmed the successful adsorption of each ionomer within the LDH layers. Using DLS, we expect to find that as sulfonation level increases the ease of intercalation will also increase.

Among competing HPSS samples, we expect the higher degree sulfonated samples to be preferentially adsorbed within the LDH layers. However, particle size will become a disadvantage as chain length increases. These effects are attributed to charge density, hydrophobic interactions of the carbon backbone and polymer rigidity due to high degree of functionalization.

[Acknowledgment: The authors gratefully acknowledge the support of the studies by CREST/CFNM program of NSF Grant # HRD-1137751 and MBRS RISE Program-NIH/NIGMS Grant #2R25GM060414.]

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Grad. OA #28

Subcategory: Nanoscience

Investigations into Metal Oxide Decorated Graphene for Supercapacitor Materials Selection

Michael R. Funk, Arizona State University Polytechnic

Synthesis of a large variety of metal oxide nano-particles (MONPs) on different carbon nano-materials (CNMs), including single-walled carbon nano-tubes, multi-walled carbon nano-tubes, and a few-layered graphene has become the focus within laboratories interested in advancing the use and storage of energy. The attachment (decoration) of MONPs on graphene, specifically, is the subject of this paper. There is a great deal of interest in the use of graphene-based nano-materials for energy storage. Research on the use of graphene for energy storage began very recently; growth within consumer product markets and the need for Li-ion technologies for energy storage is a timely solution. For example, the cathode materials used in Hybrid Electric Vehicles (HEVs) pose problems including high cost, chemical instability, and safety hazards. These have become a major concern to battery makers. Such problems in turn stimulate innovation as well as research into better technologies.

The focus of this paper is a study based on several different sets of mixtures made up of metal oxide and graphene samples which were previously prepared and made available. The study involves the comparison of two heating methods used to reduce the metals and decorate the graphene. The metals used were Nickel (Ni), Manganese (Mn), Iron (Fe), and Tin (Sn). All the samples form a matrix with varied percentages of each (10%, 5%, 3.3%, and 2.5%) mixed with the other samples to form all possible combinations. The samples were carefully prepared for

analysis in a Hitachi S-5200 high resolution scanning electron microscope, capable of operation in scanning transmission electron microscope mode. In addition, energy dispersive spectroscopy was utilized to characterize how the metals and substrate interacted as a function of the different heating methods.

The paper will draw conclusions based upon the results of the experiment as well as discuss other possible analysis techniques used to determine which combination(s) of mixtures in what concentrations will have the greatest overall supercapacitance potential, indicating ideal attributes of material choice.

[Acknowledgment: AAAS Entry Point Summer graduate internship sponsorship.]

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Grad. OA #29

Subcategory: Biomedical Engineering

Development of Neural Probes with Nanoelectrode Array on a Flexible Polymer Substrate

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Min Hyuck Kim, Phillisia Sims, and Hargsoon Yoon, Norfolk State University

Larry D. Sanford, Eastern Virginia Medical School

The development of neural recording devices is important to better understanding of the brain and how it communicates with the body. Unit spike recording outside the cell membrane is known as extracellular recording. A major issue in extracellular recording is that the retrieved signal contains a lot of noise. Also biocompatibility of neural recording devices is important to minimize damage to the brain. Existing neural probes also face issues such as loss of a signal after tissue encapsulation. The purpose of this research is to develop a method to improve the quality of the retrieved signal and enhance biocompatibility. We are developing a neural probe with a nanoelectrode array on a flexible polymer substrate. To increase the quality of the signal, the implementation of vertically aligned nanowires on the electrodes was used to increase surface area and improve electrochemical impedance for recording. Also, a microdrive was fabricated to allow vertical adjustment of the probe post-implantation. Tissue encapsulation was addressed by using biocompatible materials and a flexible substrate enabling minimization of immune response to the implantation of a foreign object into the body. Through the processes of electroplating and photolithography, the nanowire structures were imbedded into the probe structure. Investigation of the nanowire enhancements to recording is being investigated after implantation of the neural probe into rat brain.

[Acknowledgment: This study was supported, in part, by a grant from NSF/CREST awarded to Dr. Aswini Pradhan, Director, CREST

Center for Nano & Bio-Inspired Materials & Devices, Norfolk State University.]

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Physics

Grad. OA #30

Subcategory: Physics (not Nanoscience)

Photothermal Lens Imaging and Detection System for Micro and Nano Dimension Samples

Ryan Coote, Delaware State University

Methods for imaging biological samples in micro and nano dimensions have proved either very limited or costly; most techniques suffer from diffraction limitations that don't really give an accurate image of what was surveyed, along with strong scattering that can happen when trying to use methods like Fluorescent, or Raman scanning microscopy. While every technique is not necessarily affected by diffraction or scattering, e.g. Electron scanning microscopy, they may suffer from other limitations such as organic sample preparation methods which can cause cellular damage, or a lack of a reliable resolution in the nano/micro meter (nm/ μ m) based ranges. We present an alternate way of imaging micro organic samples using a photothermal (PT) dual beam setup that is not affected by diffraction limitations and requires no sample preparations that can be hazardous to the specimen.

Additionally, PT method is able to provide a detailed resolution in μ m and nm dimensions. In the nm dimension most objects are smaller than the wavelength of light interacting with them, because this light cannot create an adequate image of the structural details due to it being smaller than the diffraction limit ($R_D \sim 0.61\lambda/N.A.$). The PT method is able to avoid diffraction limitation by imaging the thermal field profile of the object of interest instead of the actual object, where thermal field carries the target parameters of the object, namely size and shape, even during its heat diffusion expansion. In addition to being able to image samples, objects around nano dimensions can be detected by using PT probes that work well with this effect. Metal photo thermal probes, in particular, are very useful thanks to their non-cytotoxic properties, photo bleaching resistance, and binding capabilities to many proteins antibodies. These properties allow metallic nanoparticles to enter a biological sample without fear of biological damage, attaching themselves to the tissue for nanoscopic detection.

In our work, we set up a PT imaging microscope based on this effect that is able to scan a sample in the μ m or nm range. Using motorized stages In the micron dimension, we are able to image different types of samples such as smeared drop of iron

nanoparticles immersed in glycerol, and *C. Elegans* nematodes that were suspended in water. The generated 2.0 x 2.0 mm images from these scans from top to bottom respectively. On the nanometer dimension, we are able to detect and locate strong contrasting PT signals that indicated where PT probes, in this case gold nanoparticles, were in the sample. In addition to making images, we have developed software to process the images, improving the contrast of the image over the background noise. For future work, we hope to make the system faster in scanning by using devices that process the detected signal more quickly. We also hope to test the detection of the photo thermal probes in samples that have high amounts of scattering such as a piece of meat. *[Acknowledgment: Center for Research and Education in Optical Sciences, Center for Research Excellence in Science and Technology.]*

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Grad. OA #31

Subcategory: Physics (not Nanoscience)

Development of a Scanning Laser Detection and Ranging System for 3D Topographic Imaging

Yury Markushin, Delaware State University

Nicolas Calvano, Gour Pati, and Renu Tripathi, Delaware State University

Laser Detection and Ranging (LADAR) is an established optical sensing technology for creating three-dimensional images of a target object using the time-of-flight (ToF) information. LADAR has application in varied fields including geology, atmospheric studies, and remote sensing. For instance, LADAR systems are used to obtain terrain maps during planetary explorations or detecting enemy tanks hiding under camouflaged nets. In this presentation, I will discuss the development of a scanning LADAR (Scan-LADAR) prototype system. The basic system consists of two parts: a transmitter and a receiver. Transmitter arm employs a Q-switched Nd:YAG laser operating at 1064 nm and a fast-scanning two-axis galvanometer mirror which is synchronized with the pulsed laser. The receiver arm employs a large aperture telescope, focusing optics, a light-sensitive discrete amplification photon detector (DAPD) with a fast rise time (1ns), and a multiple-event time-to-digital converter (TDC). The system scans the target object using galvanometer mirrors and multiple laser pulses. Fraction of the scattered/reflected light is collected by using the telescope and focused into the DAPD for detection. The TDC measures the ToF which is a measure of the time it takes for light to hit the target and return to the receiver, thus obtaining the distance of the object from the Scan-LADAR system. Using the intensity information of the detected signal, we create intensity images of the target scene.

Thus, our scan-LADAR system is able to generate both range and intensity images to provide explicit three-dimensional

information about the target object. During the presentation, I will describe the operation of the scan-LADAR system and present the results obtained. The depth resolution of the system is decided by the duration of the laser pulse. Our current setup yields approximately 15 cm depth resolution. The spatial resolution is directly related to the divergence of the laser beam as it propagates in space. The current system has a beam divergence angle of 3 mrad, yielding approximately 30 cm spot size at 100 meter of propagation distance. With the speed constraint imposed by the electronics involved, we are able to obtain a 100x100 pixel image in approximately 10 seconds. The future development of the system will include incorporating an in-line polarimeter into the scan-LADAR system.

[Acknowledgment: [This study has been supported, in part, by NSF MRI grant # 1039675, NASA URC-5 grant # NX09AU90A, and NSF-CREST grant # 0630388.]

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Grad. OA #32

Subcategory: Physics (not Nanoscience)

Comparative Studies of Coherent Population Trapping and Ramsey Interference in Rubidium Vapor for the Development of an Atomic Clock

Zachary Warren, Delaware State University

David Riser, Gour Pati, and Renu Tripathi, Delaware State University

Compact, high-precision atomic clock technology development is of significant interest in aviation and communication applications that require precise timekeeping to support navigation, tracking, surveillance, and information distribution. Vapor cell atomic clocks using all-optical excitations are potentially promising for these applications. Coherent population trapping (CPT) clocks use two-photon resonant transitions, in which two continuous-wave laser fields interact with alkali atoms to produce a coherent, non-interacting "dark state." Power broadening and light shift in CPT clocks fundamentally limit their precision and frequency stability. We have recently developed a new technique for mitigating the above mentioned problems associated with the CPT clocks. This technique is based on using pulsed CPT excitation to produce ultra-narrow Raman Ramsey (RR) fringes in ground-state superposition in an alkali vapor medium. Our studies have suggested RR fringes with significantly narrow width can be produced using a buffer-gas filled vapor medium. We are currently studying the effects of light shift on the RR fringes to compare its performance with a CPT clock. During my presentation, I will discuss our theoretical results obtained using the density-matrix model to describe how the effect of light shift can be significantly reduced in RR interference by using pulse saturation. I will also describe our efforts to generate the RR

fringes using D1 transitions in 85Rb in a vapor medium. I will show experimental results comparing the measured light shift, both in cases of CPT and RR interference as functions of average detuning and intensity of the laser fields, and show agreement of these results with the conclusions drawn from our theoretical model. Our future study will investigate the characteristics of RR interference in D1 transitions of the 87Rb atom, which has fewer magnetic sublevels, and Doppler resolved hyperfine excited states to yield better performance in a vapor cell atomic clock. *[Acknowledgment: This study has been supported, in part, by NSF MRI grant # 1039675, NASA URC-5 grant # NX09AU90A, and NSF-CREST grant # 0630388.]*

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Grad. OA #33

Subcategory: Physics (not Nanoscience)

Group Velocity Dispersion Measurements in Biofluids at Different Analyte Concentrations using Optical Coherence Tomography

Michael J. Williams, Delaware State University

Optical coherence tomography (OCT) is a low-coherence imaging method that produces high resolution two- or three-dimensional subsurface topological images from scattered/back-reflected light from a layered sample under study. This technique uses a Michelson interferometer where the interference of the split fields reflected from a scanning reference arm and from the sample is recorded and processed. The depth (axial) resolution of an OCT system is determined by the temporal coherence of the light source. A typical OCT system utilizes a very low coherence wide bandwidth source to get high resolution (few micrometers) images of the sample. This resolution is, however, marred by the sample dispersion which could be very severe in case of imaging in the presence of specimens such as biological fluids and tissues. The dispersion properties of the sample can be measured from the OCT interferogram. We are developing a time-domain OCT (TD-OCT) system which is aimed at improving the OCT image resolution by cancelling the effect of group velocity dispersion due to the sample by using electronic post-processing. This requires us to accurately measure the optical dispersion (second- and third-order dispersion coefficients) of an aqueous solution of water representing the biofluid containing analytes such as glucose and salt.

During my presentation, I will discuss the development of a fiber-based TD-OCT system which has been used for this study. This system utilizes a low-coherence superluminescent laser diode with a maximum output power of 5 mW and a 3-dB spectrum width of ~ 30 nm, centered at 845 nm. I will present results showing the measurements of the dispersion coefficients of water with different concentrations of glucose and salt near the

water absorption at 845 nm. I will also show how such a method can also be used to measure unknown concentrations of these analytes in water. Finally, I will discuss how these measurements will help us achieve dispersion-free OCT imaging in biological samples. Our future studies will include extension of dispersion minimization in a spectral-domain OCT system for nondestructive bio-imaging applications. *[Acknowledgment: This study has been supported, in part by NSF-CREST grant # 0630388, NIH DE INBRE grant (DSU subaward), and NASA URC-5 grant # NX09AU90A.]*

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Social and Behavioral Sciences

Grad. OA #34

Subcategory: Social Sciences/Psychology/Economics

Career Commitment and Retention in STEM in African-American College Students

Amy B. Berman, Tennessee State University

Carmen Bucknor and Marie S. Hammond, Tennessee State University

Career development in college students has been well documented, resulting in a number of theories. Until recently, relatively little research has been conducted on career development of STEM students, particularly Black STEM students. The extant literature has focused on Black STEM students at Predominately White Institutions (PWI). Historically Black College & Universities (HBCUs) produce one third of all Black graduates in STEM. Thus, our understanding of the career development of Black students in STEM is hampered by the context in which the research was conducted. This study examines the career development of Black STEM students at an HBCU to test the hypothesis that STEM majors increase their commitment and skills in managing their careers as they proceed through the levels of their academic training.

This study uses a cross sectional design (Cook & Campbell, 1979; Heppner, Wampold, & Kivlighan, 2008), analyzed using a multivariate analysis of variance (MANOVA). Data will be collected from all STEM majors at the beginning of the Spring 2013 semester. Measures include STEM-specific measures of career interest and commitment: Self-Efficacy for Technical/ Science Fields, Coping Efficacy, Outcome Expectations, Science Interests, Contextual Supports and Barriers, Educational Goals, and Persistence (Lent et al., 2003), as well as demographic and academic status information (e.g., year in college, math SAT scores). Data gathering is ongoing and will be completed by the end of January with the results to be presented at the ERN conference. Findings from this project serve to inform the field

about the strengths and growing edges among African-American students for planning and managing careers in STEM.

Future research includes analyzing change over the course of the semester and across the entire training period in order to examine the impact of specific interventions and for model building. *[Acknowledgment This study was supported, in part, by a grant from NSF/HBCU-UP/BPR (NSF 12-519), awarded to Dr. Marie Hammond, Program Coordinator, Ph.D. Counseling Psychology Concentration, Tennessee State University.]*

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Technology and Engineering

Grad. OA #35

Subcategory: Civil/Mechanical/Manufacturing Engineering

Fluid Flow in the Perivascular Space

Mikhail A. Coloma, SUNY Binghamton

Paul R. Chiarot and Peter Huang, SUNY Binghamton

The perivascular space (PVS) is an essential pathway for interstitial fluid (ISF) to flow in and out of the brain. A study was conducted to investigate the fluid mechanics and bulk flow in the PVS. There is evidence that pathologies associated with fluid flows in the PVS contribute to the occurrence of cerebral amyloid angiopathy in Alzheimer's disease. An improved understanding of these pathologies may contribute to improved treatment options. The PVS is modeled as a thin, annular, fluid filled medium surrounding a blood vessel. A pulsatile pressure wave applied at the inlet of the blood vessel deforms the surrounding membrane and drives fluid motion in the PVS. The model of the PVS is solved computationally using FLUENT 14.0 to predict the fluid velocity. A parametric study was conducted to investigate the impact of membrane stiffness and applied pressure gradient on fluid flow in the PVS. *[Acknowledgment: The research is funded by the NSF LAMP Bridge to the Doctorate grant.]*

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Grad. OA #36

Subcategory: Biomedical Engineering

In Vivo Biodistribution of Carboxyl Methyl Dextran Iron Oxide Nanoparticles for Localized Magnetic Fluid Hyperthermia in Ovarian Cancer Models

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Mangala Lingegowda, Xioaxia Wen, Chun Li, and Anil K. Sood, M. D. Anderson Cancer Center, Houston
Eduardo Juan and Madeline Torres-Lugo, University of Puerto Rico, Mayaguez
Carlos Rinaldi, University of Florida

Ovarian cancer is the leading cause of death from gynecological diseases. The current high death to case ratio is due in part to late initial diagnosis and recurrence, resulting in tumors that are resistant to treatment. Hyperthermia had been used as a cancer treatment since Hippocrates. This technique consists of heating an organ or tissue to temperatures between 41 to 46°C, which induces damage to cancer cells and triggers cell death and/or cell protective mechanisms. The main challenge with hyperthermia resides in heating the tumor area homogeneously while minimizing damage to normal tissue. Magnetic fluid hyperthermia (MFH) is an alternative to deliver heat at the desired area using magnetic nanoparticles.

One of the major challenges in the utilization of MFH is the need of substantial accumulation of particles in the tumor area. This work proposes the assessment of the temporal and spatial distribution of particles as a function of surface properties. For this purpose, targeted and non targeted particles were employed to understand the *in vivo* particle biodistribution in Nu/Nu mice using orthotopic ovarian cancer tumor models. *In vivo* distribution of iron oxide nanoparticles decorated with carboxyl methyl dextran with five carboxyl groups was analyzed using Nu/Nu mice with HeyA8 Lu orthotopic tumors. These particles have a half life of 6 hours, much longer than similar particles previously reported. These dramatic differences in half life are due to improved colloidal stability.

It is hypothesized that long circulating particles should have better accumulation in the tumor site. Results indicated that from the injected dose 38.4% was found in the liver, 7.24% in the spleen and 0.74% in the tumor. Targeted nanoparticles with cRGD peptide are under consideration to increase particle concentration in the tumor. *[Acknowledgment: NSF CREST (HRD-0833112) NIH U54 (U54 CA 96300/U54 CA 96297)]*

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Grad. OA #37

Subcategory: Electrical Engineering

Transport Properties for Ionic Liquids and Implications for Li-ion Battery Design

Vyran L. George, Georgia Institute of Technology

Using room temperature ionic liquids (RTILs) as electrolytes in Li-based batteries provides important safety and performance benefits over the more volatile, combustible organic solvents

currently used(1-2). However, in order to gain a better understanding of transport in these electrolytes, properties such as conductivity, transference numbers, diffusion coefficient and salt activity must be measured as a function of salt concentration. A model is proposed to predict the competing effects of each transport property on the discharge behavior of a dual insertion cell. The model is based on concentration solution theory and derived from the work of Newman (3). It is generalized to simulate any cell composed of two insertion electrodes, electrolyte, and an inert conducting material. Our focus is the transport of the species in the electrolyte, which is characterized by the electrical conductivity, the transference number, and the diffusion coefficient of the lithium salt. The results of this model will be used in conjunction with experimental values to optimize the electrolyte properties. Furthermore, experimental methods are explained for measuring a complete set of transport properties for a room temperature ionic liquid system (4). Electrical conductivity, Figure 1 (Figures included in word document), was calculated using impedance measurements across a conductance cell for ionic liquids with varying N-lithiotrifluoromethanesulfonimide (LiTFSI) salt concentrations (0M – 1.5M). In addition to the ionic species within the electrolyte, the transport properties of oxygen in the electrolyte are also examined for use in a Li-air system. Utilization of the cathode material can be hindered by insufficient oxygen permeability through the electrolyte. The rate of oxygen permeation, Figure 2, through the ionic liquids was calculated as a function of the salt concentration. Experimental methods were derived from Nafion® 112 membrane permeability experiments. References: 1. Kuboki, T., Okuyama, T. Ohsaki, T. Takami, N. , J. Power Sources, 146(1-2): p. 766-769 (2005). 2. Xiao, J., Wang, D., Xu, W. Wang, D., Williford, R. E., Liu, J., Zhang, J.G., J. Electrochem. Soc., 156(10): p. A773-A779 (2009). 3. Newman, J., Electrochemical Systems. 2nd ed. 1991, Prentice Hall: Englewood Cliffs, NJ. 4. Ma, Y.P., Doyle, M., Fuller, T.F., Doeff, M.M., Lutgard C.D.J., Newman, J., J. Electrochem. Soc. 142(6): p. 1859-1868 (1995).
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Faculty Advisor: Tom F. Fuller, vyran.george@gmail.com

Grad. OA #38

Subcategory: Biomedical Engineering

Development of Neural Sensing Data Acquisition Algorithm and System

Min Hyuck Kim, Norfolk State University

A neural sensing system has been developed to measure electrical and optical signals from the brain using neural probes, signal amplifiers, analog digital converters, and a micro-controller unit. A well-developed and miniaturized data acquisition system and algorithm is essential because efficient

data processing and presentation are key requirements for obtaining accurate results. In this research, neural signals from the brain of a rat (Wister strain) were measured by a neural probe and the sensing data was processed by a 16 bit analog digital converter and a micro controller unit. The data acquisition system was miniaturized for implantation in the abdominal space for *in situ* monitoring in behaving animals. Since the device is to be implanted, the analog to digital converter and micro controller unit should be as small as possible while maintaining accuracy and performance. In this research, the data acquisition and processing algorithm was studied to enhance sampling rate and optimize power consumption during recording. Neural signals from the rat brain were successfully acquired by the data acquisition system. For wireless data acquisition from freely behaving animals, this neural sensing system requires integration of wireless data communication units. As the number of electrodes will also be increased, the revision of analog digital converter will be required for faster and more reliable data acquisition.
[Acknowledgment: This study was supported, in part, by a grant from NSF/CREST awarded to Dr. Aswini Pradhan, Director, CREST Center for Nano & Bio-Inspired Materials & Devices, Norfolk State University]

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Grad. OA #39

Subcategory: Biomedical Engineering

Airway Epithelial Cell Interaction with Chitosan-based Nanofibers

Christopher Mahoney, North Carolina Agricultural and Technical State University

Polymer and metallic stents have emerged as viable options for airway obstructions such as stenosis. Stents are often coated with tissue engineered scaffolds to enhance biocompatibility, repair and regeneration of several different complex tissues such as trachea, cartilage, and heart valves. Ideally, the scaffold should mimic the target environment and maintain the required tissue-specific mechanical properties. Chitosan (CS), a naturally occurring polymer, is biorenewable, biodegradable, biocompatible, and bio-functional.

Recent studies have shown that CS promotes cell attachment, differentiation and tissue growth, but alone has weak mechanical strength. Polycaprolactone (PCL) is a synthetic biodegradable polymer that is mechanically stronger. CS based composites will demonstrate favorable performance in airway tissue engineering applications. An interaction with airway cells was studied and analyzed. CS/PCL nanofibers (CNF) were prepared using the electrospinning technique. CS molecular weight is decreased using a depolymerization process and

distilled water is added for chitosan solution. PCL solution is produced using trifluoroethanol.

These solutions are combined at different ratios to optimize nanofiber strength and the nanofibers were synthesized via electrospinning. The high voltage source was set to 20 kV, a syringe containing solution was positioned at -50° , and the distance between the syringe and collector was approximately 16 cm. CNF produced were then subjected to scanning electron microscopy (SEM). CNF are cut and prepared for cellular exposure by a sterilization technique that included a repeated ethanol and Dulbecco's Modified Eagle's Medium rinse. CNF are placed on apical surface of fully differentiated normal human bronchial epithelial cells for 24 hours. Cellular responses were evaluated via measuring inflammatory modulators, lactate dehydrogenase, and mucin secretion levels. Nanofibers kept their size and integrity throughout the experiment which can be seen on SEM images. Western blot analysis of inflammatory mediators, IkappB and cyclooxygenase-2, showed no sign of stress, and there was no difference in mucin secretion and LDH levels between unexposed cells and those exposed to NF of PCL/CS, and PCL. The synthesis of CNF from depolymerized chitosan was successful. Taken together, these findings indicate that CNF may be a suitable coating for tracheal stents. Mechanical testing is needed for further confirmation. *[Acknowledgment: NSF ERC for Revolutionizing Metallic Biomaterials.]*

Faculty Advisor: Narayan Bhattarai, nbhattar@ncat.edu

Grad. OA #40

Subcategory: Biomedical Engineering

Endothelial to Mesenchymal Transformation Mechanobiology: Microfluidic Experiments and Multiscale Modeling

Sara Mina, Binghamton University

Gretchen Mahler, Binghamton University

In a tumor environment, endothelial cells can undergo endothelial to mesenchymal transformation (EndMT) and form cancer-associated fibroblasts (CAF). CAF have a myofibroblastic phenotype, produce a reactive extracellular matrix (ECM) that is significantly different from the normal ECM, secrete a variety of factors promoting tumorigenesis, and represent the most abundant cell type in the tumor stroma. CAF are epigenetically and possibly genetically distinct from normal fibroblasts, which makes these cells potential targets of anti-cancer therapy. Tumor growth and progression causes a variety of physical changes in the stroma, and EndMT may be the result of biomechanical changes in the tumor microenvironment.

We are using microfluidic devices to recreate the dynamic growth environment of the tumor stroma and are investigating the role of altered shear stress and altered ECM composition on EndMT. We have fabricated square microfluidic channels (15

mm wide, 50 μ m deep, and 30 mm long) in polydimethylsiloxane (PDMS) and cultured human umbilical vein endothelial cells (HUVEC) within them. Immunofluorescent staining and three-dimensional reconstruction of image stacks taken with confocal microscopy confirmed that HUVEC are capable of forming on all channel walls. *[Acknowledgment: This study was supported, in part, by a grant from NSF BD Fellowship awarded to Sara Mina in the Department of Biomedical Engineering, Binghamton University.]*

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Grad. OA #41

Subcategory: Computer Science & Information Systems

Visualizing Geolocation of Spam Email

Asmah Muallem, Tennessee State University

Viruses and phishing scams, as a result of spam, are increasing. Tools for spam identification and prevention are increasing but lack presentation fundamentals. In this research, a security visualization tool is developed for spam analysis by providing the geographical locations of spammers and spammer information based on the integration of MaxMind and WhoIS databases, and the Google Maps API. A key component in the development of this tool is its extensible framework allowing for the addition of resources for further analysis and retrieving more information about a spammer. Spam emails are flagged and collected for a period. The implementation is developed in C# and utilizes various libraries and open source DLLs to retrieve real-time spam emails from the spam and junk mail folders within the email accounts. An IP address is obtained using C# methods from the email address' domain name, and geographical coordinates from MaxMind are retrieved and linked to each spammer. Who IS information is also gathered during this process using socket programming, and data is formatted properly. All information is stored and manipulated in a MySQL database. The visualization is implemented using data stored in the database and is structured to be used with Google Maps API functions. These functions provide markers and info windows which are manipulated through a process and displayed on a Google Map corresponding with each spammer's location. Our research demonstrated a security visualization framework with a user-friendly interface can enhance capabilities of existing security visualization tools and reduce time for spam analysis. We were able to visualize some spatial patterns of spammers with the subset of data currently available such as spam coming from a particular location or spam coming from one host using different email addresses to solicit spam. With more data and time, a temporal pattern can be visualized. The framework can be extended to offer more capabilities for further analysis. *[Acknowledgment: This study was supported, in part, by a grant from NSF HBCU-UP Targeted*

Infusion HRD #1036307 awarded to Sachin Shetty Ph.D., Assistant Professor in the Department of Electrical and Computer Engineering, and Dr. S. Keith Hargrove, Dean of the College of Engineering, Technology, and Computer Science, Tennessee State University.]

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Grad. OA #42

Subcategory: Materials Science

Dispersing Single-walled Carbon Nanotubes Below the Critical Micelle Concentration

Ben Rael, University of New Mexico

Since their discovery in 1991, carbon nanotubes (CNTs) have revolutionized composite industries with their extraordinary mechanical properties. These physical properties make CNTs ideal candidates as reinforcement phases for a wide range of structural materials used in transportation design. Carbon nanotube metal-matrix composites (MMCs) have the requirements to reduce the cost of transportation while increasing safety, strength, reliability, and functionality. For MMCs, the importance of a homogeneous, stable and long-standing particulate dispersion is of a particular importance when the particulates are of nano scale. The use of surfactants to exfoliate SWCNT bundles have become a popular dispersal route among researchers within the past decade. At and beyond a certain surfactant concentration called the critical micelle concentration (CMC), the surfactants group themselves into 3D structures called micelles. It is the formation of micelles on individual SWCNTs which act as the driving force behind exfoliating SWCNT bundles. However, recent studies have shown optimal surfactant assisted dispersions of SWCNTs to occur below the critical micelle concentration (CMC). In this study, SWCNT bundles are exfoliated with a class of zwitterionic surfactant at and below the CMC. Utilizing powder metallurgy (PM) methods Aluminum/SWCNT composites are fabricated with aqueous CNT suspensions at CMC, 0.7CMC, and 0.5CMC. The sensitivity of material properties of Al/SWCNT PM composites to fractional changes in CMC is characterized through macro indentation testing and transmission electron microscopy (TEM). This study has shown optimal SWCNT dispersion in Al matrix occurs at CMC with corresponding Rockwell hardness of HR15T-56.0±0.7. Compared to monolithic Al, a 12.9% increase in Rockwell hardness is observed for SWCNT dispersions at the CMC. For SWCNT dispersions at 0.7CMC and 0.5CMC, 8.3% and 9.05%, decreases in Rockwell hardness are observed compared to monolithic Al. Furthermore, TEM analysis indicates that SWCNTs are not exfoliated completely into individual SWNTs for suspensions at CMC, 0.7CMC, and 0.5CMC. Instead, there exists a spectrum of SWCNT morphologies which include: aggregates, bundles, ropes, and individual tubes. For further study, it is

recommended that other characterization techniques such as dynamic light scattering or absorbance spectroscopy be employed to quantify distributions of various SWCNT morphologies in aqueous solution. *[Acknowledgment: Louis Stokes Alliance For Minority Participation]*

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Grad. OA #43

Subcategory: Computer Engineering

An Experimental and Computational Study of a Flapping Micro Air Vehicle

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The complex yet efficient flight mechanism of Micro Air Vehicle's flapping bird-like regimes relies upon flexible wings. Effective vortex control when flapping, as well as low-drag gliding, may result from the wing's flapping frequency. This hypothesis was tested by focusing research to capture vortex shedding visualization for the flow over an oscillating 2D cylinder. The cylinder moved up and down for several cycles using the dynamic mesh properties of the Nek5000 CFD solver. In addition, wind tunnel tests were run with a small flapping micro air vehicle. From the wind tunnel test lift and drag, data were collected. Results for the CFD simulations are compared with $Re = 500$ and a fixed motion amplitude of $y_{max}/D = 0.25$.

The simulation was run until Time=100 seconds. An attempt to validate the calculations for the vortex shedding Frequency vs. Reynolds number is studied. A comparison of documented parameters such as those in 'A study of two-dimensional flow past an oscillating cylinder' by Blackburn and Henderson will be compared to the simulations that are discussed in this report. The simulation is 2D and irregular laminar to turbulent regions due to high Reynolds number ($Re=500$). Results for comparison such as vortex shedding will be looked into. Identification of 2-3 regimes and computations for lift, drag, shedding frequency, cylinder pulsation will be studied in the future. The computational model consisted of a single cylinder oscillating in 1 degree of freedom with symmetric boundary conditions. Results are interpreted using an analysis of vorticity generation. Results showed that the embedded vortex size and shape generated over the cylinder depended on the frequency of oscillation. *[Acknowledgment: More Graduate Education at Mountain States Alliance, Western Alliance to Expand Student Opportunities.]*

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Graduate Abstracts for Poster Presentation

Biological Sciences

GP #1

Subcategory: Genetics

Molecular Characterization of Nematode Genes Involved in Insect Pheromone Sensing

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Ray Hong, James Go, and Neomal Muthumala, California State University, Northridge

Chemosensation is vital in nematodes' survival because they do not have eyes or ears for detecting their environments. Since nematodes are one of the world's most abundant and diverse species, this makes understanding chemosensation and neurophysiology from varying nematode species crucial in order to investigate gene function evolution. The greatly studied *Caenorhabditis elegans* model has elucidated many key neurons and proteins required for chemosensation of volatile odors, pheromones, and food. It is also known as a soil-dwelling, free-living organism. In contrast, a more recently discovered nematode species, *Pristionchus pacificus* (*P. pacificus*), isolated from Pasadena CA, have been found to associate with specific beetle hosts. *P. pacificus* has shown preference in associating with the oriental beetle found in Japan and northeastern United States due to attraction towards the beetle's sex pheromone (Z)-7-tetradecen-2-one (ZTDO). It is hypothesized that similar to *C. elegans*, *P. pacificus* utilizes odor-specific receptors expressed on the amphid sensory neurons. To determine the genes responsible for insect pheromone sensing, two *P. pacificus* mutants were identified in the lab in a genetic screen for chemosensory mutants and were named obi-1 and obi-3 (oriental beetle pheromone insensitive). Obi-1 has the stronger chemotaxis insensitivity behavior towards ZTDO and has been identified to carry a nonsense mutation in the open reading frame of a lipid-binding protein. The aim of the study is to pursue the other mutant allele, obi-3, which has a short body length and coiling phenotype. Obi-3, body length was measured and compared to wild-type California strain (PS312) through microscopy and digital photography. The mutation was roughly mapped to two-thirds of Chromosome I (out of 6 linkage groups) using simple sequence length polymorphism markers. Genetic mapping is based on the principle that recombination frequency increases with increasing distance from a given genetic locus. Thus, in genetic hybrid lines between obi-3 mutants in the PS312 genetic background and a mapping line (PS1843), we expected the genetic markers farther from obi-3 to be mostly

PS1843 alleles. These results, along with further fine mapping will determine if the obi-3 locus is linked to a known chemosensory gene. The long-term goal is to determine if obi-1 and obi-3 gene products are part of an unknown signaling pathway for sensing insect hosts. [Acknowledgment: This study was supported in part by a grant from NSF, #HRD-1139803 CSU-LSAMP Bridge to the Doctorate at California State University, Northridge.]

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GP #2

Subcategory: Cell and Molecular Biology

GLUT4 Overexpression Protects Against Insulin Resistance

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Caleb D. King, Oklahoma Christian University

GLUT4 is an important regulator of insulin-mediated glucose uptake. GLUT4 protein levels affect insulin sensitivity and may play a role in the development of insulin resistance and type 2 diabetes, a disease with increasing frequency characterized by fasting hyperinsulinemia and hyperglycemia. GLUT4 protein is down regulated in states of insulin resistance. Yet, the effects of altering GLUT4 protein level are not known. Herein, we test the hypothesis that moderate overexpression of human GLUT4 in mice, under the regulation of the native GLUT4 promoter, can prevent fasting hyperinsulinemia and hyperglycemia resulting from obesity. Transgenic mice engineered to express the human GLUT4 gene and promoter (hGLUT4 TG) and their non-transgenic counterparts (NT) were fed either control diet (CD) or high fat diet (HFD) for up to ten weeks and variables were recorded. Calculation of HOMA-IR scores correlated with fasting glucose and insulin levels and revealed that hGLUT4 TG mice remained highly insulin sensitive while receiving the HFD. Immunoblots show GLUT4 expression was 2 fold higher in TG mice compared to NT mice regardless of the diet fed. Both strains had a decrease in GLUT4 protein in white adipose when fed a HFD, however, hGLUT4 TG retained GLUT4 protein in skeletal muscle and brown adipose tissue. Presence of the GLUT4 transgene did not completely prevent insulin resistance, but rather masked hepatic insulin resistance. This was demonstrated by measuring the loss of insulin-mediated repression of hepatic gluconeogenic gene expression by RNA analysis in HFD mice after a 17 hr fast. Interestingly, hGLUT4 TG mice lost the insulin-dependent regulation of hepatic SREBP-1c mRNA expression in response to the transition from the fasted to the fed state. This change in gene expression, coupled with the diversion of carbohydrate to peripheral tissues suggest that *de novo* lipid fatty acid synthesis and cholesterol synthesis may

be lower in hGLUT4 TG mice. In conclusion, the specific signaling required and the regulation mechanisms used to increase GLUT4 protein expression during different physiological conditions need further understanding. Such understanding is important because this data supports a moderate increase in GLUT4 protein expression and is a good target for treatment of insulin resistance. [Acknowledgment: This research was supported, in part, by NIH DK081545 & NSF HRD 0929135 awarded to Dr. Ann Louise Olson as well as by OK-Louis Stokes Alliance Minority Participation via University of Oklahoma]

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GP #3

Subcategory: Cancer Research

Validation of Pancreatic Cancer Targets

Bezawit B Sumner, Jackson State University

Pancreatic ductal adenocarcinoma (PDA) is the most lethal of all cancers; it is truly devastating disease because no reliable early detection strategy is available. Therapeutic agents targeting PDA have proven to be highly ineffective in clinical setting and disappointing. Our recent strategic effort has focused on identifying novel molecular targets against pancreatic cancer and the signaling mechanism through which they act. We have identified potential pancreatic targets while these targets are variably expressed in pancreatic cancer cell lines; the challenge has been to identify those that engage the downstream signaling components in a functional relevant manner. To ascertain whether these targets were expressed in pancreatic cancer cell lines, several cell lines were immunoblotted with specific antibodies. In our preliminary analysis, we focused on the cell lines that showed robust expression of the targets and determined the role of these targets through loss-of-function studies using specific siRNA and shRNA. Here we showed that the repression of AXL in 8988T cell line inhibited proliferation of BxPC3 cells. AXL had significant cell cycle phase effect on actively growing 8988T cells, causing cell redistribution from G0/G1 to apoptosis. Cell invasion, migration and anchorage independent growth will be assessed to determine the role of AXL in pancreatic cancer progression. These efforts will provide stringent validation of whether this target serves a rate-limiting role in pancreatic maintenance and may provide target-dependent transcriptional and proteomic signatures that may be useful as drug response biomarkers. [Acknowledgment: This research was supported by a grant from Minority Access to Research Careers/Undergraduate Student Training in Academic Research (MARC/U*STAR) Program (Grant No. 5T34GM007672-31).]

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GP #4

Subcategory: Microbiology/Immunology/Virology

Comparative Analysis of Genes Encoding Universal Stress Proteins in Lactobacilli Involved in Inhibition of Type 1 Diabetes

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Certain gut microbes have the ability to mediate autoimmune diseases such as Type 1 diabetes, multiple sclerosis, and lupus. In previous research, Bio-Breeding diabetes prone rats that were fed *L. johnsonii* N6.2 were resistant to the onset of Type 1 diabetes more so than the effects of rats fed *L. reuteri*. In this study, Splenocytes from mice which were interferon-gamma deficient (IFN γ -/-) and suppressor of cytokine signaling 1 deficient (SOCS1-/-) were treated with *Lactobacillus johnsonii* and *Lactobacillus reuteri*. We cultured splenocytes with *L. johnsonii* and *L. reuteri* both at a concentration of 1.5x10⁵ cfu/ml and 4.75x10⁵ cfu/ml. We then examined relative gene expression of SOCS1, SOCS3, IL17, IL10, and IFN γ in splenocytes from C57BL/6 control and each deficient mouse. Real-Time qPCR and data analysis tools quantified the relative expressions of each gene. The observations provided the basis to determine the differences in the stress response capacities of the two species of *Lactobacillus*. A gene family that assists bacteria to respond to stress is the universal stress protein. Our bioinformatics analysis of the gene count of four *L. johnsonii* genomes and six *L. reuteri* genomes revealed differences in the USP gene count. All four *L. johnsonii* genomes had two USP genes. However, four *L. reuteri* had five USP genes, one had four USP genes. Interestingly, *L. reuteri* F275, JCM1112 had 10 USP genes. The differences in USP gene count may account for differential response to stress conditions by the two strains. [Acknowledgment: I would like to thank LSAMP Bridge to Doctorate Program at JSU, Dr. Raphael Isokpehi and National Science Foundation (EPS-0903787, EPS-1006883, DBI-0958179, DBI-1062057); US Department of Homeland Security Science and Technology Directorate (2009-ST-062-000014, 2011-ST-062-000048), and the University of Florida Graduate Schools for making this opportunity possible.]

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GP #5

Subcategory: Microbiology/Immunology/Virology

Formulation and Characterization of a DNA-chitosan Based Vaccine for *C. trachomatis*

Chino D. Cambridge, Alabama State University

Shree R. Singh, Alain B. Waffo, and Vida A. Dennis, Alabama State University

Chlamydia trachomatis is an obligate intracellular pathogen capable of propagating infection within the single cell columnar

layer of the urethra in men and the endocervix of women, and the most reported cause of bacteria sexually transmitted infections worldwide. Thus far, there are no vaccines for controlling this pathogen. The purpose of this study was to develop a nanoparticle-encapsulated DNA vaccine using the major outer membrane protein (MOMP) of *C. trachomatis*. We hypothesize that encapsulation of MOMP DNA in chitosan as a nanovaccine would induce mucosal immune responses and provide protection against a *C. trachomatis* genital tract infection. The full antigenic region of the MOMP gene was amplified and cloned into the pHCMV1 vector. The resulting construct (pHCMV1-MOMP) was then encapsulated in chitosan, a mucoadhesive polymeric nanoparticle known to increase surface membrane permeability, allow for paracellular transport across mucosal barriers, and also enhance mucosal immune responses. To ensure that the recombinant pHCMV1-MOMP was completely encapsulated in chitosan, the complex was subjected to *in vitro* physio-structural and biochemical characterizations including a gel retardation assay, cumulative DNA release, UV spectrophotometry, zeta potential and scanning electron microscopy (SEM) analyses. Our results indicated the ability of chitosan in protecting the DNA from restrictive enzymes degradation. Cumulative DNA release data showed a gradual release of DNA from nanoparticles over a 5-day period. Zeta potential analysis disclosed the nanoparticle's stability and its encapsulated DNA through comparative results obtained from only chitosan nanoparticles (0.148 mv) to that of the encapsulated DNA (8.80 mv). UV-Vis analysis confirmed the properties of the nanoparticles through absorption spectroscopy utilizing light in the visible and adjacent ranges to verify encapsulation. Finally, visual analysis of the encapsulated DNA was conducted via SEM further allowing the confirmation of its complex morphology. Overall *in vitro* analyses of the encapsulated DNA nanovaccine construct revealed its worthiness as a vaccine candidate for further testing *in vivo* in the mouse model. [Acknowledgment: This study was funded by the NSF-CREST grant #0734232 awarded to Shree R. Singh, PhD, Director for the Center of Nanobiotechnology, Alabama State University.]

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GP #6

Subcategory: Cell and Molecular Biology

Determining If the GTPase Rab6 Regulates Cargo Transport at the Trans-Side of the Golgi Complex

Carenza Cezar, Jackson State University, University of Arkansas for Medical Sciences

An important focus of molecular cell biology is the understanding of secretory pathways within the eukaryotic cell. These pathways play vital roles in continuous cellular processes

such as metabolism, protein trafficking and are sometimes the target of toxic bacterial infections. Protein trafficking is the shipping of proteins from the endoplasmic reticulum to the Golgi complex which in turn sends those proteins to their destination in or out of the cell. The Golgi is able to regulate this cargo transport with the aid of other proteins such as Rab6. This small GTPase is involved in the organization and homeostasis of the Golgi, yet its specific role in the mechanisms of protein trafficking is unclear. Here we present preliminary data to determine if Rab6 regulates cargo transport at the trans-side of the Golgi complex via vesicular stomatitis glycoprotein (VSV-G) mutant tso-45. Sequential experiments were conducted to determine separation between cis and trans proteins and determine if the VSV-G tso-45 mutant is an appropriate cargo transport marker for localization of Rab6. Wild-type HeLa cells were stained for cis and trans Golgi proteins. Stained cells were checked for chromatic shifts and separation between the cis and trans-side of the Golgi complex was determined. Results confirmed sufficient separation of cis and trans proteins in the Golgi and the tso-45 mutant as an appropriate cargo marker for Rab6 localization. These preliminary studies lay the foundation for further experiments that will better assess the mechanisms by which Rab6 controls cargo transport at the trans-side of the Golgi complex. Understanding these mechanisms will further clarify the role Rab6 plays in Golgi organization and protein trafficking. [Acknowledgment: NHLBI UAMS Summer Undergraduate Research program to Increase Diversity in Research (R25 HL108825)]

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GP #7

Subcategory: Biomedical Engineering

Q β RNA Coliphage Display Nano-tags as a Platform for Nanoparticles Attachment and Bio-Drugs Delivery

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Jamicia Lewis, Jade P. Grimes, Rana Singleton, and Alain B. Waffo, Alabama State University

There are a growing number of potential therapeutic molecules: oligonucleotides, peptides, natural products. The clinical application of these species presents some serious challenges: *in vivo* degradation, indiscriminate distribution and severe toxicity. Nanoparticles are found to powerfully protect these species of potential drugs called biodrugs. Biodegradable nanoparticles were recently found to aggregate during their preparation and usage. This shortcoming may be overcome by targeted drug-carrying platforms that protect and ferry the drugs to the target tissues. DNA phage has been intensively used and is of large size while RNA phage, with selected features, and well adapted, has never been experimented. We hypothesize that by attaching nanoparticles to the surface of the bacteriophage Q β , which

displays a well know number of nano-tags, the chimera phage platform produced will act as a modular carrier system for biodrug scaffolding and delivery. To achieve this goal, nano-tag genes [histidine-tag (HHHHHHHHGS), streptavidin-tag (GGDVEAWLGARVPLVET) and avidin-tag (GLNDIFEAQKIEVWHE)] were separately inserted to the C terminus of the A₁ minor capsid protein gene of bacteriophage Q β within the plasmid pACpET24Q β containing the complete cDNA of Q β . These tags were successfully synthesized with the primers used for their genetic construction. After sequencing, the plasmid pACpET24Q β was found to contain the end of A1 gene, and these nano-tags were designated as pACpET24Q β (His)₈, pACpET24Q β Strep and pACpET24Q β Avid. The recombinant plasmids produced phage-like plaques upon *E. coli* HB101 bacteria transformation with a titer lower than the wild type (10⁸ – 10⁹ pfu). The correct tag gene size was confirmed by RT-PCR from plaques of each phage type. Ouchterlony double diffusion was performed with phages and the corresponding antibodies, which confirmed the presence of the tags on the phage surface. The Q β (His)₈ phages were analyzed through scanning electron microscopy with anti-His-tag antibodies and has confirmed the success of Q β phage displaying histidine tags. We are currently analyzing other hybrid phages constructed. To our knowledge, this is the first report on RNA coliphage Q β displaying biologically useful surface tags or peptides. Future work will involve attachment of functionalized, biotinylated or conjugated streptavidin nanoparticles to these hybrid phages to assess biodrug scaffolding and delivery in animal model.

[Acknowledgment: We must acknowledge CNBR of ASU for grant # NSF-CREST (HRD-1241701) and NSF-HBCU-UP (HRD-1135863) for supporting this project.]

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GP #8

Subcategory: Cancer Research

Tumor Targeting using Peptides in Vitro on Cancer Cell lines

Lauren A. Lindsey, Tuskegee University

Jesse Jaynes, Balu Karanam, and Clayton Yates, Tuskegee University

The African American population is adversely affected by breast cancer, prostate cancer, and neuroblastoma. African American women are more likely to die of breast cancer; African American men in the US have the highest risk and are more likely to be diagnosed at an advanced stage of prostate cancer, and African American children are more likely to develop high-risk neuroblastoma and subsequently have worse event-free survival compared with white patients. Purpose: Our aim is to design and evaluate lytic peptides for their antitumor activity, determine if peptides and their peptoid versions will target and inhibit the cell proliferation in the cancer cell lines, and finally

determine the molecular mechanism involved in peptide mediated proliferation.

Hypothesis: The peptides and peptoids will be more effective than current standard treatments on the various cancer lines used in the study. Experimental design: Cellular uptake of the peptide and effects on cell viability and cell proliferation will be determined. The peptide was fused to Human luteinizing hormone-releasing hormone gene (LHRH) analogs for the breast and prostate studies. To target neuroblastomas, the peptide was fused to a benzyl-guanidine at the N-terminus of the peptide. The effects of this procedure on cell proliferation will be determined and gross morphological changes among peptide treated cell cultures will be observed.

Preliminary Results: In a previous study it was demonstrated that the LD50 values recorded for D2A21 were significantly lower ($P < 0.04$) in prostate-cancer cell lines when compared to cisplatin, a standard chemotherapeutic drug. This finding suggests the therapeutic efficacy of Peptidyl MIMs. In our current testing of the peptides, JS15 was somewhat effective against the breast cancer cells MCF-7 in culture as well as metastatic breast cancer cell line MDA-MB 231, but further testing and analysis is needed. Conclusion: Lytic peptides represent a novel class of therapeutics that hasn't been utilized clinically for the treatment of common cancers due to their lack of tumor specificity, the possibility of unwanted side effects, ineffective delivery system of peptides to targeted sites, and peptide stability; however, this can be corrected by use of nanoparticle delivery and use of peptoids which are more stable than peptides. [Acknowledgment: MSM/TU/UAB Comprehensive Cancer Center Partnership Research supported by NIH Grant #5U54 CA118948-02A1 awarded to Dr. Roberta Troy at Tuskegee University. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute or the National Institutes of Health.]

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GP #9

Subcategory: Cell and Molecular Biology

Lead Nitrate-Mediated Cell Death via Caspase-3 in Human Leukemia (HL-60) Cells

Ariane Mbemi, Jackson State University

Thaduis Omullo and Clement Yedjou, Jackson State University

Lead poisoning has been extensively studied over the years. Many adverse physiological and behavioral impacts on the human body have been reported due to the entry of this heavy metal. It especially causes the hematological effects to people of all ages. However, the molecular mechanisms of lead causing

apoptosis are still largely unknown. Therefore, the aim of the present study was to investigate the apoptotic mechanism of lead nitrate in HL-60 cells. Human leukemia (HL-60) cells were treated with different doses of lead nitrate for 24 h. The flow cytometry and DNA fragmentation were for apoptosis assessment, respectively. The flow cytometric assessment (caspase-3 activity) showed a strong dose-response relationship between water lead nitrate exposure and early stage apoptosis of HL-60 cells. Upon 24 hrs of exposure, the results of caspase-3 activity showed that the percentages of HL-60 cells undergoing late stage apoptotic were $5 \pm 0\%$, $13 \pm 0.7\%$, $17 \pm 5.7\%$, $22 \pm 4.6\%$, and $18 \pm 0\%$ in 0, 10, 20, 30, and 40 $\mu\text{g}/\text{mL}$ of lead nitrate, respectively. This result was further confirmed by the data of DNA laddering assay showing a clear evidence of nucleosomal DNA fragmentation in lead nitrate-treated HL-60 cells. In summary, these studies demonstrated that lead nitrate represents an apoptosis-inducing agent in HL-60 promyelocytic leukemia cells and its apoptotic mechanism functions via caspase 3 activation, followed by nucleosomal DNA fragmentation. *[Acknowledgment: This research was financially supported by a grant from National Institutes of Health (Grant No. 1G12RR13459), through the RCMI-Center for Environmental Health at Jackson State University.]*

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GP #10

Subcategory: Cell and Molecular Biology

C2C12 Cells MyoD Knockdown to Identify MyoD Function at Regulatory Motif Upstream of Id2

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MyoD is a muscle regulatory factor critical for myoblast determination. MyoD interacts with E-proteins to form heterodimers, then binds to an E-box sequence and transactivates downstream genes. Id2 (inhibitor of DNA binding/differentiation) also binds to E-proteins and inhibits heterodimerization and disrupts transactivation. Id2 acts as a negative regulator of myogenesis. Surprisingly, recent ChIP-sequencing studies reveal MyoD is present at the Id2 promoter during myoblast proliferation. This suggests MyoD regulates Id gene expression. We therefore hypothesize there will be a change in levels of Id2 mRNA accumulation between MyoD expressing and non-expressing C2C12 cells. C2C12 cells were kept in log phase, transduced with lentivirus particles containing different MyoD shRNA target sequences. A range of MOIs was used, and transductants were selected for puromycin. qRT-PCR will be used to determine the relative MyoD mRNA levels in cells transduced with shRNA for MyoD vs. in cells transduced with scramble shRNA and in untreated C2C12 cells. Results will reveal the most efficient MyoD shRNA target sequence(s) and

best MOI for a successful MyoD knockdown. We will then transduce C2C12 cells with MyoD target sequences at this MOI and make a stock of MyoD knock down cells for multiple projects such as determining if levels of Id2 mRNA differ between growth and differentiated C2C12 cells non-expressing MyoD. If our hypothesis is correct, we expect to see lower Id2 mRNA levels during proliferation in C2C12 cells with MyoD knocked down compared to C2C12 cells with full MyoD expression and C2C12 cells transduced with scramble shRNA. However, during differentiation MyoD activates the transcriptional repressor RP58, which represses the Id2 gene. Therefore, it could be that Id2 mRNA levels during differentiation will be higher in the MyoD knockdown cells than in cells expressing MyoD. Identifying the function of MyoD at the Id2 promoter will add to our understanding of the molecular pathway that regulates skeletal muscle development from proliferation to differentiation. *[Acknowledgment: This material is based upon work supported by the National Science Foundation under Grant # HRD-1246662, awarded to Pamela Russell as a LSAMP-BD Cohort X Fellow.]*

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GP #11

Subcategory: Physiology and Health

The Impact of Selective High Fat Diets on Thyroid Altered Sprague Dawley Rats

Venus Welch-White, Tuskegee University

The association of adverse health with higher fat diets has long been recognized; however, due to limited research which incorporates high fat intake, thyroid function and metabolic syndrome, the pathogenesis of high fat diet implications remains poorly understood. The objective of this study is to conduct a comparative analysis of the physiological differences between rats fed various concentrations of saturated and unsaturated fat diets in a normal and a thyroid compromised rat. Adult male Sprague Dawley rats (n=100) were exposed to one control or four diet groups: Control 12% fat, a 25% saturated and unsaturated, and a 35% saturated and unsaturated, respectively. Each diet group contained ten normal and ten altered thyroid animals. A chemical induced thyroidectomy was obtained through the addition of .05% propylthiouracil in drinking water. The study was conducted over a period of 8 weeks. Final body weights of the normal animals were significantly higher than in the altered thyroid groups. Metabolic glucose markers of glycosylated hemoglobin (HbA1c) and urinary glucose values remained normal in all experimental groups both pre- and post treatment. This study may provide a foundation for development of an experimental model for future studies which evaluate the impact of a high fat diets, thyroid and metabolic function. *[Acknowledgment: This*

research was partially supported by George Washington Carver Experimental Station/USDA Evans Allen Grant, Tuskegee University.]

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Chemistry and Chemical Sciences

GP #12

Subcategory: Nanoscience

Beta-Cyclodextrin/Beta-Sitosterol Inclusion Complexes: Drug Delivery Vehicles for Anti-tumor Therapeutics

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Ishrat Khan, Clark Atlanta University

Beta-Cyclodextrin (β -CD) has been widely used as a host molecule for a variety of guest molecules. While the exterior of this molecule is hydrophilic because of the primary and secondary hydroxyl groups on the upper and lower perimeter of this moiety, the interior of β -Cyclodextrin is hydrophobic. These characteristics enhance β -Cyclodextrin's solubility and make it an ideal carrier of hydrophobic drugs. Additionally, functionalization of β -Cyclodextrin with the appropriate groups permits site specific drug delivery. We hypothesize that the β -Cyclodextrin-Poly-(ethylene glycol)-Folic Acid (β -CD-PEG-FA): β -Sitosterol bio-conjugate will be an efficient tumor-specific complex for drug delivery. Since most tumor cells over-express folic acid receptors, inclusion of folic acid in the construct will direct phytosterols to tumor sites. To understand and determine the stability of the β -Cyclodextrin: β -Sitosterol non-covalent complexes, we have studied the complexes with IR (Infrared Spectroscopy), NMR (Nuclear Magnetic Resonance Spectroscopy) and DSC (Differential Scanning Calorimetry). NMR studies reveal an upfield shift of β -CD protons as the concentration of β -Sitosterol is increased. NOESY (Nuclear Overhauser Effect Spectroscopy) NMR studies suggest that most of β -Sitosterol was encapsulated in the β -CD cavity, as evidenced by cross peaks between β -Sitosterol hydrogens inside β -CD's cavity. Additionally, FT-IR and DSC studies also indicate the formation of stable β -Cyclodextrin: β -Sitosterol inclusion complexes. These initial studies suggest that the complexes have potential to be utilized as a target specific anti-tumor drug delivery vehicle. *[Acknowledgment: These studies were supported by the MBRS/RISE Program-NIH/NIGMS Grant #2R25GM060414, in addition to the NSF/CREST/CFNM Grant #HRD-1137751 at Clark Atlanta University.]*

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GP #13

Subcategory: Nanoscience

Heterogenous Catalysis of C-O bond Cleavage for Cellulose Denconstruction: A Potential Pathway for Ethanol Production

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Michael Curry, Albert Russell, Crystal Reeves, and Daniel Abugri, Tuskegee University

Due to global climate change and the anticipated decline in oil production and supplies, there is an intense need for the development of alternative, renewable energy sources. Currently in the United States, 97% of nonrenewable petroleum is used as a source of fuel for vehicles and other gas burning systems. In fact, U.S. energy from transportation consumes 63% of all oil, although half of this oil is imported from foreign countries. Production of ethanol from cellulosic sources has become a promising alternative due to the abundance of cellulose in nature and exclusion from the human food chain providing a potentially lower cost production route.

Methods for the deconstruction of cellulose to generate sugars are varied and oftentimes, lignin and hemicelluloses interfere during the conversion of cellulose to sugar. The process of converting "cellulose to biofuel" often requires harsh pretreatment methods and expensive equipment. We propose that these limitations can be reduced through heterogeneous catalysis. Due to the high reactivity and large surface-area-to-volume ratio of transition metal nanoparticles (NP), catalysts with unique surface properties can be produced that will enhance ethanol production through cleavage of the C-O bond within the lignin-cellulose backbone directly. In this study, the proposed method will not involve a pretreatment step but rather will use transition metal nanoparticles to cleave the C-O bond that links cellulose to lignin.

We propose that a cascade reaction will take place whereby the lignocellulose network is deconstructed simultaneously with the cellulose-sugar polymer. In short, Pt and Co nanoparticles were synthesized via dendrimer-templating and chemical reduction methods. Subsequently, 2.0 grams of crushed peanut shells were added to 40 mL of distilled tert-butyl methyl ether along with the metal NPs (either Pt or Co). The mixture was refluxed for 24 hours. Both TLC and HPLC analysis indicate that upon introduction of the metal catalyst into the cellulose-solvent mixture, separation of the cellulose and potentially depolymerized sugars is evident. This separation, based on HPLC analyses, could be a result of a combination of factors. That is, in addition to C-O bond cleavage to release sugar molecules, either residual cellulose or lignin is present as a result of lack of C-O bond selectivity by the nanocatalyst. Furthermore, analysis of the particle surface and structural properties after C-O bond cleavage are under investigation using XRD, TEM, and NMR. *[Acknowledgment: Funding for this*

project was provided by Tuskegee University Chemistry Department and Tuskegee University Center for Advanced Materials through the CREST award.]

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GP #14

Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Theoretical Calculations of the Ionization Potentials and Electron Affinities of the Tautomers and Methyl Derivatives of Adenine and Thymine and Adenine-Thymine Base Pairs

Noel Matthews-Gardner, Jackson State University

Glake Hill, Jr., Jackson State University
David Magers, Mississippi College

Nucleic Acid Bases (NABs) are responsible for basic biological functions, cellular replications, chemical regulations and other processes crucial to life. Any type of disruption to the NABs can lead to detrimental issues and diseases that can threaten life. Therefore, a much needed thorough understanding of how these NABs operate and regulate these processes and the disruptions that lead to complex and critical changes, has great fundamental value. In this study, we investigate the post-translational effect of methylation and pre-translational effects of tautomerization and ionization of adenine and thymine tautomers, their methyl derivatives and A-T DNA base pairs. We believe the pre-translational effects and post-translational effect are related in some way. Calculations were performed using the DFT functional B3LYP utilizing 6-311G(d,p), 6-311+G(d,p) and 6-311++G(df,pd) basis sets.

The results reveal that all non-methylated adenine and thymine structures show slightly negative adiabatic electron affinities whereas the adenine and thymine compounds are relatively stable with respect to dissociation. The non-methylated adenine structures reveal negative and positive numbers using the three basis sets, while the methylated structures show stability with the attachment of an electron. The adiabatic and vertical electron affinities of the methylated thymine and adenine show a major difference in susceptibility due to electron attachment than that of the thymine and adenine tautomers. In addition, structural and electronic distribution changes upon electron removal and attachment lead to decreased and increased dipole moments, respectively.

The data suggests that the mutagenic sites of each DNA base has increased activity when methylated. We plan to continue our research by pairing other major and minor tautomers of adenine and thymine to determine how stability and susceptibility changes. [Acknowledgment: We gratefully

acknowledge Title III and NSF-CREST HRD0833178 for financial support and the Mississippi Center for Supercomputing Research for grants of computer time.]

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GP #15

Subcategory: Chemistry (not Biochemistry)

The Effects of a Systematic Study of Chitosan Immobilization Matrices and Its Enzyme Stability

Tiffany Gurley, Texas Southern University

Xin Wei, Texas Southern University

In literature, a large variety of polymers have been explored as immobilization matrices for enzymes in electrochemical biosensor assemblies. However, the correlation between the polymer-enzyme interactions and the resulting biosensors' performances has remained largely unknown. The structural design of biosensors presents several challenges concerning their stability and susceptibility to interference. A systematic study on the effects of immobilization matrices, the enzyme stability and the final biosensor's performances were carried out. This research is important because the evaluation on why this enzyme performs better with certain polymers has yet to be studied. A film solution was developed for glucose biosensing. The solution consisted of a biopolymer, chitosan (CHIT), which was chemically modified using glutaric dialdehyde (GDI). The enzyme, glucose oxidase (GOx), was mixed with CHIT and CHIT-GDI solution, and then cast onto the DSC aluminum pan. The fixed enzyme contained 10 μ L of GOx in order to determine the ratio between CHIT and CHIT-GDI. The parallel between excess CHIT and CHIT-GDI was determined through a series of DSC test.

The Differential Scanning Calorimetry (DSC) machine was used in order to measure the heat denaturation of the raw glucose oxidase, along with the thermal stability of each solution. Enzyme stability was enhanced and coupled with the biocompatible chitosan matrix. This enhancement could be further improved by introducing a moderate degree of covalent bonding between the enzyme and the polymer matrix. Furthermore, too much crosslinking might cause unfolding of the enzyme, which results in a significant signal decrease in the DSC test. [Acknowledgment: We would like to thank NSF-CREST for the financial support in this research.]

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GP #16

Subcategory: Nanoscience

Evaluation of Particle Morphology on Toxicity of Titanium Dioxide Nanoparticles (TiO₂ NPs) on *Artemia Salina*

Martha Johnson, Jackson State University

Terriona Cowan, Mehmet Ates, and Zikri Arslan, Department of Chemistry and Biochemistry, College of Science and Technology, Jackson State University

Metal oxide nanoparticles are widely used in both industrial and medical applications. Understanding their properties and the mechanism of the toxicity is important to prevent the detrimental effects on environment and human health. In many instances, toxic effects are mediated by the metal ions released from nanoparticles. Therefore, the detection of particular metal ion concentration is critical to elucidate the mechanism of toxicity. A particularly unknown and concerning topic is the effect of particle morphology on the physiochemical and toxicological properties of particular NP.

In this study, we investigated the effect of particle morphology on the toxicity of TiO₂ NPs through exposures on *Artemia salina*. *Artemia* were exposed to commercially available TiO₂ NPs of three different morphology: anatase, rutile and a mixture of anatase and rutile. The exposure was conducted both short-term (24 h) and long-term (96 h). Cultures were examined for NP uptake through ICP-MS analysis for total titanium. Mortality rates were determined along with malondialdehyde assay (MDA) to elucidate oxidative stress induced by exposure. Mortalities increased with increasing concentration of TiO₂ NPs suspensions. MDA assay also revealed increasing oxidative stress with increasing concentration. Anatase polymorph of TiO₂ NPs accumulated substantially compared with rutile polymorph.

The mixture of both anatase and rutile showed much larger chemical uptake than both anatase and rutile alone. *[Acknowledgment: This project was partially supported by the U.S. Department of Defense through the Engineer, Research and Development Center (Vicksburg, MS) Contract #W912HZ-10-2-004, and by grants from the National Center for Research Resources (5 G12 RR013459-15) and the National Institute on Minority Health and Health Disparities (8 G12 MD007581-15). Funding for this project was also granted by Jackson State and the LSMAMP Bridge to Doctorate Program, under direct affiliation with NSF.]*

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GP #17

Subcategory: Chemistry (not Biochemistry)

Functional Nanofibers: Novel Material for Nanobiosensors and Photonics

Laurisa Lonfon, Clark Atlanta University

Synthetic polymer systems can interact with biomaterial by the use of functional nanofibers where that interaction can be tracked photonically and amperometrically. These functionalized fibers may provide an effective way of developing a broadly applicable antibody detection technique. Conductive fibers decorated with AuNPs and α , ω -bi-biotinylated groups capable of specifically binding with avidin have been prepared by electrospinning. The nanofibers (200nm) were electrospun onto a silicon wafer substrate at a voltage between 10-17kV in benzene. The biotinylated functional groups were tethered to the fibers via oligo (oxyethylene) spacers. α , ω -di-hydroxyl-poly (styrene) was synthesized via living anionic polymerization followed by the functionalization of the di-hydroxyl polymer with the biotinylated functional group. The fibers were deposited as mats and have diameters ranging from 60-800nm as observed through Scanning Electron Microscopy (SEM). Fluorescent Microscopy aided in determining the binding specificity of fluorescently labeled avidin to the biotinylated-functional group. The functional polymers have been characterized by ¹H and ¹³C NMR, FT-IR, DSC, GPC, SEM, and TEM. The success achieved so far in this investigation suggests the possibility of developing functional nanofibers as the active component in biosensors. *[Acknowledgment: This study was supported, in part, by a grant from Nanobiotechnology Center at Cornell University, an STC program of NSF under agreement No. ECS-9876771 and NSF HRD-0630456.]*

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GP #18

Subcategory: Materials Science

Hydrolysis of Sucrose by Ammonia Functionalized Nanoporous Materials

Stephan Mathis, II, Clark Atlanta University

Biofuel production consists of breaking down complex raw materials into simple carbohydrate components. A popular method of this degradation includes using homogenous acid catalysts that exist in the same phase as the products. This increases separation efforts while the separated product is non-reusable. Using heterogenous acid catalysts may prove a more efficient route in the carbohydrate degradation efforts. This is important in maintaining a clean environment while producing renewable biofuels. Using nanoporous heterogenous acid

catalysts can provide degradation of carbohydrates by exposing acid sites to the glycosidic bonds. But acidity depends on the nanoporous materials' structure, which may not include any cationic metals. Functionalizing siliceous materials gives it acidic properties. Ammonia functionalized nanoporous materials can be used in the stead of sulfonic functional groups. Zeolite Y, ZSM-5 and SBA-15 were used in this experiment to compare catalysis performance. Zeolites were functionalized with 3-aminopropyl triethoxysilane, 3-aminophenoxypropyl triethoxysilane and N-[3-(trimethoxysilylpropyl)-ethylenediamine using the post-synthesis grafting method. Commercial zeolites ZSM-5 and Zeolite Y with ammonium and hydroxyl cationic forms were used in comparison. Experimentation was carried out in a 10 mL glass vial with a constant carbohydrate concentration in a 90°C conventional oven for a predetermined time. These functionalized zeolites were then used to breakdown sucrose into glucose and fructose sugars. Zeolites showed up to 60% degradation of sucrose in a four hour period. Varying the combination of functional groups and zeolites produced various degradation results. X-ray diffraction was used to verify the pure crystalline structure of the zeolites. These diffraction patterns were then compared to literature for confirmation. FTIR was used to verify functional groups present on the zeolite structures. Notable bands appeared around 3000 cm⁻¹ and 1500 cm⁻¹. BET surface area was used to identify porosity and surface area measurements. High performance liquid chromatography paired with a refractive index detector was used to quantify the amount of monosaccharides present in the solution after sucrose degradation. Peaks were resolved without deconvolution of chromatographic data. Ammonia chemisorption analysis will be used in future acid site quantification studies.

[*Acknowledgment: This project was funded, in part, by Centers of Research Excellence in Science and Technology at Clark Atlanta University.*]

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GP #19

Subcategory: Cancer Research

Silica-TMPyP for Photodynamic Therapy

Aisha Reed, Jackson State University

Wenbing Li, Wentong Lu, Xianchun Zhu, Shavelle Courtney, Brandon Newton, Papireddy T. Tiyyagura, Shufang Li, Ebonie Butler, Hongtao Yu, Paresh C. Ray and Ruomei Gao, SUNY at Old Westbury

Photodynamic therapy (PDT) is a form of cancer treatment that uses a photosensitizing agent which produces free radicals. Silica-TMPyP is a photosensitizing reversible pH-responsive porphyrin used for photodynamic therapy in cancer treatment. When photosensitizers are exposed to a specific wavelength of

light, they produce a final product of singlet oxygen that kills carcinoma cells. Breast cancer cell lines were treated with photodynamic therapy, viable cells can be counted using a MMT (3-(4,5 dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide) assay. Our work proposed a new strategy to improve the selectivity in PDT for cancer treatment due to pH change. However the utility of SiO₂-TMPyP was restricted in alkaline solutions due to the strong adsorption of TMPyP onto SiO₂ surfaces, which favored charge separation at nanointerface and efficient quenching of triplet TMPyP and/or ¹O₂ by SiO₂nanoparticles. These features make bare SiO₂-attached cationic porphyrin a promising candidate for use in PDT for cancer treatment in which efficient ¹O₂ production at acidic pH and sensitizer deactivation at physiological pH are desirable.

Acknowledgment: National Science Foundation and National Institutes of Health]

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GP #20

Subcategory: Chemistry (not Biochemistry)

Characterization of Functional Polyaniline to Form Metal-Ligand Complexes for Sensors

Tiana Shaw, Clark Atlanta University

James Reed and Michael Williams, Clark Atlanta University

Copper I ligands can be used to detect specific biomolecules from the change in conductivity of polyaniline. Polyaniline has been shown to be an excellent polymer for sensor capabilities. Nanostructured polyaniline has a greater sensitivity and faster time response relative to its conventional bulk counterpart. This is due to higher effective surface area and shorter penetration depth for target molecules. The conductivity of polyaniline can be controlled through the reaction of redox reactive materials. These can be complexed to create metal-ligand composite materials. The change in ratio of the imine to amine groups in the polyaniline should indicate the binding and reduction or oxidation of the polymer when mixed with a metal. In our study, copper (II) nitrate was bound to polyaniline. The copper and polyaniline redox reaction can reduce the copper II to copper I depending on the mole ratio of the complex. Our study investigates the change in the oxidation state and proposes a mechanism for the formation of the complex by varying the mole ratio of the reactants. The metal-salt complexes were characterized using UV-visible spectroscopy, IR spectroscopy, and scanning electron microscopy. [*Acknowledgment: This study was supported, in part, by a grant from NSF/CREST awarded to Dr. Ishrat Khan, Director for the Center for Functional Nanoscale Materials, Clark Atlanta University.*]

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GP #21

Subcategory: Nanoscience

CNT/Gold Nanoparticle Hybrid Surface Enhanced Raman Probe for Selective and Ultrasensitive Melamine Detection

Willie Wesley, Jackson State University

Melamine (1,3,5-triazine-2,4,6-triamine) is an organic base used in production of various amine resins, fertilizers and plastics. Melamine has been reported to be toxic and results in renal disease and death in pets that consume food contaminated by it. In spite of this information, melamine was found to be an adulterant in pet food in North America in 2007 and in milk products in the 2008 in China. In response to the call for more sensitive and selective methods of melamine detection by the FDA and Pharmaceutical industry, we have developed a Carbon Nanotube (CNT)/Gold nanoparticle Surface Enhanced Raman Spectroscopy (SERS) hybrid probe for selective and ultrasensitive detection of melamine in raw materials. In this work, single walled CNTs were functionalized with various gold nanoparticles which were then modified with mercaptoundecanoic acid to be selective for melamine.

Detection is based on the melamine Raman signal increasing due to its interaction with the hybrid probe. Multiple gold nanoparticle morphologies will be tested to determine which provides the most sensitive probe. Operating principles and possible mechanisms of our SERS assay are discussed. Ultimately, this nanotechnology driven hybrid probe could have vast potential application in rapid, on-site selective and highly sensitive detection of melamine as well as numerous other adulterants in products designed for consumption.

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GP #22

Subcategory: Chemistry (not Biochemistry)

The Use of Mass Spectrometry in the Analysis of Ancient Cultural Artifacts

Shawnta D. Woods, Jackson State University and University of California Santa Barbara

Mattanjah de Vries, Marshall Ligare, and Lisa Gulian, University of California Santa Barbara

We have demonstrated a new approach for the first time in a successful study of cacao residue in Mayan pottery. We explicitly identified the presence of theobromine in these samples. Dr. Anabel Ford, director of UCSB's Mesoamerican

Research Center contributed thirteen shreds of Late Classic period (c. 600-900 CE) Maya cylindrical vessels from her Belize River Archaeological Settlement Survey. The Maya elite used these distinctive, elaborately decorated vessels at feasts and ceremonies for drinking various beverages, especially cocoa. Mass spectrometry is an analytical technique used to measure the mass-to-charge ratio of charged particles. REMPI laser mass spectrometry is an amalgamation of resonance enhanced multiphoton ionization spectroscopy and time of flight mass spectrometry. This technique allows for the collection of mass specific optical spectra as well as of optically selected mass spectra. Analytes are jet-cooled by entrainment in a molecular beam, and this low temperature gas phase analysis has the advantage of producing excellent vibronic resolution. Using this system, the analysis of historical samples by means of mass spectrometry can be shortened and upgraded. These listed features allow for more minute sample sizes than that of the commercial MS apparatuses, which in turn will necessitate a lesser amount of impairments to artifacts. This technique offers a promising new approach for tackling unresolved questions in the field of archaeology. *[Acknowledgment: [This research was partially supported by the RISE internship program through the UCSB Materials Research Laboratory Award No. DMR -1121053.]*

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Computer Sciences and Information Management

GP #23

Subcategory: Computer Science & Information Systems

Multi-touch: An Errant Input Deterrent Framework

Amber M. Johnson, Jackson State University

Multi-touch interface technology has become an increasingly effective way for users to interact with software applications. Thus, these applications are controlled by multi-touch gestures implemented by the user. Early studies have shown that gesture recognition frameworks include a set of predefined gestures that can be used in many software applications. While these frameworks include gestures such as drag, zoom, and pinch, they limit users' natural ability to implement hand gestures. Among many issues associated with multi-touch devices is errant touch input. The ability to implement gestures without unintentional execution of program functions provides a means of interacting with touch surfaces seamlessly. Further exploration of methods for implementing an errant input deterrent gesture recognition framework provides an opportunity to enhance and expand gesture libraries as well as user experience.

This research explores the Sparsh UI framework along with Neural Networks integration for the development of an errant deterrent gesture framework. Characteristics such as pattern and direction were considered for gesture recognition. These characteristics increase gesture recognition accuracy rates. This integration provides a framework and foundation for future implementation of gestures that coincide with users natural gestures. A single touch errant input deterrent framework has been developed as a result of this research. Further research is being conducted to extend the current working framework to a multi-touch errant input deterrent framework.

[*Acknowledgment: Funding Agency In-Depth Engineering Corp Budge t# 634967.*]

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GP #24

Subcategory: Computer Science & Information Systems

Crowd Sourced Wheel Map for the Physically Disabled

Emanuel Lin, University of California, Los Angeles

There are various issues regarding safe and convenient navigation for wheelchair users. These include, but are not limited to, difficulty in entering and exiting buildings, inaccessible areas, and inappropriate labeling of accessible areas. There is currently no software application developed that provides navigational options for wheelchair users. The system that we are developing is an innovative mobile application for smart phones and tablets that will facilitate indoor and outdoor navigation for the physically disabled.

It involves two phases: indoor floor plan mapping and crowd sourced path mapping. The first phase requires obtaining floor plans of selected buildings, and then using the wheelchair to travel through each floor of the building to annotate the accessible and inaccessible areas. This data is then plotted on a digital map, which will enable the wheelchair users to identify several possible wheelchair-accessible paths from point A to point B.

The second phase of this project is the crowd source phase. During this phase, several volunteers will travel by wheelchair from point A to point B, choosing different paths. In order to record each travelled path, we will apply a reed-switch and magnets around the rims of the wheels, collecting time and distance data. This entire process will help us to improve our localization algorithm, which is based on the estimation of the wheel's rotation and enables us to determine the position of the wheelchair without the use of GPS. To further improve the "quality" of the path, the experiment will be repeated several times using both manual and electric wheelchairs, and the compiled path information from these individuals will be used to rank various paths by frequency of use. This application is

collaborative, and its accuracy and comprehensiveness depend on the number of users that contribute to the crowd sourced data. The initial testbed for this project will consist of data from buildings and pathways on the UCLA campus.

The ultimate goal, however, is that our application will be adapted by other universities that do not provide indoor or outdoor accessibility information. We hope that the application will be used to facilitate indoor and outdoor navigation for individuals with disabilities. [*Acknowledgment: Funded by resources at Professor Mario Gerla's Network Research Lab at UCLA.*]

Faculty Advisor: Richard Weibl, rweibl@aaas.org

GP #25

Subcategory: Computer Science & Information Systems

Test and Data Orchestration Radio Shielding Integrity for CAT-6 Penetrations

Michelle Robinson, Keller Graduate School of Management

NASA's Constellation Program identified an opportunity to reduce out-year operating costs for system and subsystem integration test operations through automation-assisted test choreography and data orchestration. Although Constellation was cancelled by President Obama, reducing the cost of access to space, including Program operating costs by 90% has been named as the first of NASA's Space Technology Grand Challenges. Automation is the end-game for users of software orchestration. It is programmed processes in place of repetitive tasks. Once a test becomes a part of a continuous integration, it will run without someone having to remember to run it. For example, there are a dozen devices in a prototypical avionics test facility that consolidate control and configuration. Ultimately, artificial intelligence will be integrated into the automation process. Additionally, developers, tech leads and management will analyze engineering data in tabular or matrix form using tools like Excel, MATLAB, R, etc. and possibly use the SQL/SPRQL to pull out the data of interest, and then export to a data file format for analysis.

As a result, it would also be desirable to take the results of the analysis and relate it back to the data source, instead of having the analysis end up on someone's hard drive. Alternatively, it would be wonderful to find a way to take a database full of parametric data and show that it can be summarized into a PDF human-readable "data package" product. To get results from the data orchestration, an assembly of data reduction tools are needed for concurrent analysis and post analysis of test results to provide steering, progress reporting, and conclusions reporting. Currently, the automation system uses PostgreSQL as its Database Management Systems. Additionally, test data will

be analyzed in MySQL and MS SQL and use extract, transform and load processes to migrate the data into the Data Mart.

One such tool is Talend. Talend Master Data Management Server is a tool that holds non transactional data that can be shared across various business departments. It will ensure consistency and control in the ongoing maintenance and application usage of this information. After creating the data mart and its OLAP cube, complex reporting and analysis can be conducted on data from the program. For example, it will identify the fact data and the dimension data. The cube will physically contain the data and become a multidimensional table. *[Acknowledgment: No funder]*

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GP #26

Subcategory: Computer Science & Information Systems

On the Design of Optimal Active/Sleep Scheme for Aggregator Node with Multi-Phase Energy Saving in Wireless Sensor Networks

Chenyu Wang, Texas Southern University

One of the most important issues in wireless sensor networks (WSNs) is to save energy, as the sensor nodes are usually battery powered and the batteries may not be rechargeable or replaceable. To reduce energy consumption, a large variety of methods for hardware design, data processing, network protocols, and operating systems have been developed. It has been proved that executing even a few thousand instructions may consume less energy than transmitting one bit. Based on that conclusion, it is a practical way to prolong wireless sensor network lifetime through data aggregation. In our previous studies, we proposed a stochastic model for data aggregator with active/sleep mode in WSNs. However, the model of aggregator node we established was still relatively simple. In reality, the aggregator may not directly go from active mode to sleep mode. It may have several different energy saving modes in active period.

In this work, we develop a continuous-time Markov model for the aggregator node with multiple active/sleep modes. The multiple modes reflect the aggregator's multiple energy saving phases. And we use this model to derive the steady-state probability for each of energy saving phase. To measure the data aggregation performances, we define the aggregator optimal design metrics such as Complete Aggregation Packet (CAP) rate, Total Aggregation Packet (TAP) rate and Success ratio which is the ratio of CAP rate over TAP rate. The Success ratio indicates the percentage of total data aggregation processes while aggregator receives and aggregates complete packets from all distinct sources. In order to validate the analytical

results, extensive numerical simulations are carried out by using MATLAB. By comparing analytical results with numerical simulation results, we find the analytical results and the numerical simulation results are well matched.

Our future work is to analyze the Quality of Service metrics such as packet delay and throughput and to evaluate how the multiple active/sleep modes affect energy consumption. *[Acknowledgment: This material is based upon work supported by the National Science Foundation under Grant No. HRD-1137732.]*

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Ecology, Environmental and Earth Sciences

GP #27

Subcategory: Materials Science

Analyses of Tsunami Events using Simple Propagation Models

Ashwith Chilvery, Alabama A&M University

Arjun Tan, M. Dokhanian, and Ashok Batra, Alabama A&M University

Tsunamis exhibit the characteristics of "canal waves" or "solitary waves" which belong to the class of "long ocean waves on shallow water". The memorable tsunami events including the 2004 Indian Ocean tsunami and the 2011 Pacific Ocean tsunami off the coast of Japan are analyzed by constructing simple tsunami propagation models including the following: (1) One-dimensional propagation model, (2) Two-dimensional propagation model on flat surface, (3) Two-dimensional propagation model on spherical surface, and (4) A finite line-source model on two-dimensional surface. It is shown that Model 1 explains the basic features of the tsunami including the propagation speed, depth of the ocean, dispersion less propagation and bending of tsunamis around obstacles. Models 2 and 3 explain the observed amplitude variations for long-distance tsunami propagation across the Pacific Ocean, including the effect of the equatorial ocean current on the arrival times. Model 3 further explains the enhancement effect on the amplitude due to the curvature of the Earth past the equatorial distance. Finally, Model 4 explains the devastating effect of superposition of tsunamis from two subduction events, which struck the Phuket region during the 2004 Indian Ocean tsunami. *[Acknowledgment: NSF EPSCoR]*

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GP #28*Subcategory: Ecology***The Effects of Larval Dispersal Behavior on Population Connectivity in the Caribbean****Monica China Diliz, California State University Los Angeles**

Conservation efforts to establish marine protected areas and develop effective fisheries management require greater knowledge of how marine organisms disperse among populations. Due to the difficulty of tracking microscopic, planktonic larvae, researchers typically infer larval movement through computer models or population genetics. Pelagic larval duration (PLD) is often incorporated into oceanographic models of connectivity due to its importance as a biological parameter predicting dispersal and transport. However, recent studies suggest that long-lived larvae do not always disperse far, or in the direction predicted by models, suggesting that larval behavior may play a key role in the biological processes affecting population connectivity. Related species of sacoglossan sea slugs of the Caribbean are a model system because they often differ in type of larvae produced (lecithotrophic vs. planktotrophic), allowing interspecific comparisons of how traits directly related to swimming behaviors, habitat selection and larval transport affect realized connectivity.

Our study will quantify larval behavior to test the hypothesis that local retention of larvae with long PLD is influenced by differences in swimming behavior. We predict larvae will exhibit active swimming behaviors such as straighter swimming paths and an increased propensity to swim towards the bottom rather than sink passively for locally retained larvae. Larvae were cultured from egg clutches produced by adults collected in Caribbean field sites. A video recording chamber was utilized to quantify larval swimming behavior and Peak Motus software measured larval swimming paths, swimming speeds, and rate of net vertical displacement. Preliminary results include differences in swimming behaviors of under-dispersed and over-dispersed lecithotrophs with highly dispersed larvae swimming upwards (*Elysia papillosa*) in increasingly straighter paths, and the opposite effect in under-dispersed larvae (*Elysia crispata*) which exhibit lower swimming speeds and frequent turns that keep them out of the water column and in closer contact with the bottom thereby supporting our hypothesis. This data will enhance current models of population connectivity and dispersal of marine invertebrate species. Furthermore, it provides a framework in which to study divergence of closely related species life-history traits such as developmental dimorphisms on evolutionary processes. *[Acknowledgment: This material is based upon work supported by the National Science Foundation under Grant #HRD-1246662 and in part by a grant from the National Science Foundation # OCE 11-30072 awarded to Dr. Patrick Krug, California State University Los Angeles.]*

Faculty Advisor: Patrick Krug, pkrug@calstatela.edu

GP #29*Subcategory: Water***The Importance of Flood Heterogeneity for Regionalization in Arizona****Diana Zamora-Reyes, University of Arizona**Katherine K. Hirschboeck, University of Arizona
Nicholas V. Paretti, US Geological Survey

Reliable flood discharge estimates are needed to build safe and cost-effective bridges, delineate floodplains and compute flood insurance premiums. These estimates are currently calculated using flood frequency analysis (FFA) as outlined by the 1982 guidelines of the US Water Resources Council in Bulletin 17B (B17B). Revisions to these 30-year-old guidelines are underway, and improved methods are being incorporated to address the assumptions of flood homogeneity and climatic stationarity. Incorporating climatic information into FFA can be statistically challenging in regions that have noticeable heterogeneity, especially if multiple flood processes and short records are involved. Nevertheless, B17B encourages further exploration along these lines in states that exhibit flood heterogeneity.

In Arizona, flood processes are due to convective thunderstorms, tropical cyclone-enhanced convective activity, and synoptic-scale storms. To explore the influence of flood heterogeneity, US Geological Survey peak discharge records were compiled into a multi-station database and peaks-above-base were classified according to meteorological cause. Flood estimates were calculated through composite FFA using the Expected Moments Algorithm, an alternative flood frequency analysis method for addressing low outliers and historical information that can operate under the existing B17B framework. For each station, populations sorted by flood-causing mechanism were separated out from the systematic annual flood series record and analyzed individually. Then, individual probability (IP) curves for each population were generated and combined using composite probability (CP) equations to create a CP curve. Finally, the IP and CP curves were compared by using their 1% and 0.5% annual exceedance probability (AEP) discharge estimates to assess the influence of heterogeneity. Results showed that sites in southern and central Arizona exhibit a better fit to the systematic data by using their CP curves than those derived from the IP. Also, synoptic storm and tropical cyclone-enhanced floods had the greatest influence on 1% and 0.5% AEP discharge estimates, especially in southern Arizona where convective floods are more frequent.

Our analysis demonstrates that flood heterogeneity can impact regional FFA estimates in Arizona. Furthermore, by linking climate to FFA estimates, we have established a climate-linked framework for making projections about future flooding in the region. *[Acknowledgment: This project was funded, in part, by the Climate Assessment for the Southwest NOAA grant and by*

the US Geological Survey Arizona Water Science Center Flood Magnitude and Frequency Methods project.]

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Mathematics and Statistics

GP #30

Subcategory: Mathematics and Statistics

Numerical Methods in Quantum Mechanics: Analysis of Numerical Schemes on Schrödinger Wave Problems

Marvin Q. Jones, Jr., North Carolina A&T State University

Quantum physics, generally, is concerned with processes which involve discrete energies and quanta, which include single particles such as the photon and the electron. The motion and behavior of quantum processes can be described by the Schrödinger equation using the wave function, $\Psi(x,t)$. The use of the Schrödinger equation to study quantum phenomena is known as Quantum Mechanics, akin to classical mechanics being the tool to study classical physics. This research focuses on the emphasis of numerical techniques (i.e. Fast Fourier Transform, Finite Element Methods, Chebyshev Spectral Methods, Crank-Nicholson Scheme, etc.) used to solve the Schrödinger equation: $i\hbar\partial/\partial t \Psi(x,t) = (-\hbar^2/2m \partial^2/(\partial^2 x) \Psi(x,t) + V(x)\Psi(x,t)$ with various potentials, $V(x)$. Finite element methods are generally the technique that works across multiple platforms, however, spectral methods are very effective in solving numerical problems. The numerical schemes were tested on each Schrödinger wave problem to compare computational efficiency, stability (long-run vs. short-run), as well as difficulty of numerical implementation. As research continues to evolve, quantum mechanics continues to have multiple applications from quantum computing and materials science to finance. It is essential to continue to evolve numerical techniques that solve quantum problems efficiently and have long-range stability potential. The outcome expected is to generate a computational suite of numerical schemes to solve Schrödinger problems given the conditions of the problem. Furthermore, in general the hope is to extend the work to non-linear problems as well as 2-D problems. [Acknowledgment: HBCU-UP - Talent 21 Department of Mathematics - North Carolina A&T State University.]

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Nanoscience

GP #31

Subcategory: Materials Science

Dispersion and Delamination of Graphite by High Torque Melt Mixing with Phenylethynyl Terminated Imide Resins

Lionel Cross Jr., Clark Atlanta University

We have previously examined the distribution and dispersion multi-walled carbon nanotubes (MWCNTs), carbon nanofibers (CNFs), and graphite in PEIT 298 [formulated from symmetrical 3,4,3',4'-biphenyltetracarboxylic dianhydride (s-BPDA), 1,3-bis(3-aminophenoxy)benzene (1,3,3-APB), 3,4'-oxydianiline (3,4'-ODA) and end-capped with 4-phenylethynylphthalic (PEPA)] and PETI 330 [formulated with asymmetrical 2,3,3',4'-biphenyltetracarboxylic dianhydride (a-BPDA) and PEPA end-cap along with mixtures of 1,3-bis(4-aminophenoxy)benzene (1,3,4-APB) and m-phenylenediamine (m-PDA)] by high torque melt mixing. PETI 298 and PETI 330 are imide oligomers that upon curing give high performance polyimides with glass transition temperatures (T_g s) of 298 and 330°C, respectively. The combination of the energy transferred by high torque melt mixing and the formation of charge transfer complexes with these resins causes the distribution and dispersion of the MWCNTs and CNFs and delamination of graphite. In contrast to this, high torque melt mixing of RTM 370, formulated from a-BPDA, 3,4'-ODA, and PEPA end cap, with a cured T_g of 370°C, does not lead to the same level of dispersion and delamination of the graphite as was found with PETI 298 and PETI 330. We attribute this difference in behavior of the RTM 370 to the absence of the electron rich APB component present in other two resin systems.

In this effort, we examined the potential of maintaining the graphene stabilization ability of PETI 298 and the high cured T_g of RTM 370 in order to give high T_g nanocomposites incorporating graphene. Rheological and DSC data show that PETI 298 and RTM 370 are compatible and can be co-cured while maintaining the higher T_g characteristic of the RTM 370. We then examined the dispersion and delamination of graphite by utilizing PETI 298 combined with RTM 370 by high torque melt mixing. The XRD of samples prepared by high torque melt mixing of 2 wt% Asbury Grade 3775 graphite in 50:50 PETI 298/RTM 370 gives a new peak at $2\theta = 18.36^\circ$ corresponding to a d-spacing of 4.81 Å, in contrast to a very strong 002 peak at $2\theta = 26.7^\circ$ for graphite corresponding to the d-spacing of 3.33 Å between two graphene sheets in graphite. Further studies are being conducted to confirm the delamination of graphite in this system. Results of this study will be reported.

[Acknowledgment: NASA Cooperative Agreement NCC3-1044]

Faculty Advisor: Eric A. Mintz, Emintz@cau.edu

GP #32*Subcategory: Materials Science***Synthesis and Attachment of Different Aspect Ratio Gold Nanorods onto SWCNTs****Attilah Edges, Jackson State University**

Bhanu Priya Viraka Nellore, Ashton T. Hamme II, Jackson State University

The shapes of nanoparticles influence their optical, electronic, and catalytic properties. Plate and rodlike nanoparticles are particularly attractive due to their liquid crystalline phase behavior and lack of innate toxicity. Gold nanorods are useful materials for sensing, photothermal therapy, drug delivery, and imaging (medical) for early detection of cancer. The synthesis of varied sized nanorods provides nanorods with different properties, and in order to synthesize the targeted gold nanorods, a synthetic protocol was used. After these nanorods were synthesized, confirmation of their synthesis was determined via Transmission Electron Microscopy (TEM) and Ultraviolet-Visible Spectroscopy (UV-Vis). Thiol capped single walled carbon nanotubes (SWCNTs) were then synthesized through sulfuric acid promoted oxidation and subsequent functional group manipulation through the use of 4-aminothiophenol and other reagents. The resulting gold nanorods were then attached to SWCNTs where the thiol serves to be a link between the gold nanorod and the SWCNT anchor. TEM was used to confirm attachment of the gold nanorods onto the SWCNTs. Through the synthesis and attachment of gold nanorods onto SWCNTs, we can use gold nanorod decorated SWCNTs for photothermal therapy, early cancer detection, or other therapeutic applications. This unique synthesizing is imperative and innovative to research and more specifically cancer research. *[Acknowledgment: This research was supported by a grant from the National Science Foundation through the Chemistry and Biochemistry Department at Jackson State University.]*

Faculty Advisor: Ashton T. Hamme, II,
ashton.t.hamme@jsums.edu**GP #33***Subcategory: Materials Science***Mechanical Properties of Multilayer Ultra Thin Films of BTO/LSMO on STO and LAO****Sha'La Fletcher, Norfolk State University**

Brandon Walker, Casey Gonder, R.M. Mundle, M. Bahoura and A.K. Pradhan, Center for Materials Research, Norfolk State University

Multilayer ultra-thin film devices are the backbone of the electronic and photonic device community. Structures have

moved to sub-micrometer levels, now being created on a nanometer scale due to advanced deposition and lithography methods. While much of today's research focuses on the electrical, magnetic, and optical properties of new devices, this research focuses on the fundamental mechanical properties that leads to the reliability of these multilayered structures. Nanoindentation is explored and utilized to monitor properties such as hardness and modulus of elasticity not only in single layers, but also in multilayers to view the effects of layered materials and manufacturing conditions. Initial research efforts are centered on utilizing the nanoindentation apparatus to understand the effects of indentation on a substrate before and after deposition, as well as using indentation to identify the presence of material layers by their mechanical responses. Ultimately, this research will lead to the exploration of mechanical properties of ferroelastic layer combinations that hold the unique ability of being piezoelectric, ferroelectric, and ferromagnetic. Barium Titanate (BTO) and Lanthanum Strontium Manganite (LSMO) layers are utilized on Strontium Titanate (STO) and Lanthanum Aluminate (LAO) substrates for comparison of both the growth optimization as well as monitoring ferroelectric properties such as ease of polarization. BTO on LSMO/STO and LSMO/LAO substrates were grown. The films show epitaxial layers of both BTO and LSMO. The BTO layer was locally polarized by the application of electric field using electric force microscopy. The mechanical and polarization properties of BTO layers with varying thickness on LSMO will be presented. *[Acknowledgment: This work is supported by the DoD (CEAND) Grant Number W911NF-11-1-0209 and W911NF-11-1-0133 (US Army Research Office), NSF-CREST (CNBMD) Grant number HRD 1036494 and NSF-RISE Grant number HRD-0931373.]*

Faculty Advisor: Aswini Pradhan, apradhan@nsu.edu

GP #34*Subcategory: Materials Science***Computational Study of the Selective Dispersing of SWNTs by ssDNA****Chantel I. Nicolas, Clark Atlanta University**

The separation of single-walled carbon nanotube (SWNT) bundles into metallic and semi-conducting ones is necessary in order to utilize their intriguing electronic properties. Non-covalent dispersion of SWNTs is proven to be one of the most effective methods of separation. While large aromatic planar structures are known for being good dispersants, due to π - π interactions, helical structures show great promise as well. Experimentally, DNA sequences have been shown to disperse and selectively bind to SWNTs of different (n,m) chiralities. It was shown that there exists structure-specific recognition and separation of SWNTs by ssDNA via ion-exchange techniques.

However, a systematic investigation is still lacking to ascertain why ssDNA sequences of specified lengths can discriminate between various SWNTs. This research allows us to better understand the nature of the spontaneous self-assembly of helical structures onto carbon nanotube sidewalls. Through molecular modeling, we have studied the properties of twelve SWNTs interacting with 26 different ssDNA sequences (~1000 atoms). With the use of molecular dynamics and dispersion-corrected density functional theory, our results begin to show that minute differences in physical property dimensions have a significant impact on whether an ssDNA will have selective affinity for a SWNT of a particular diameter. Among the species that we have modeled are (TAT)4 and (ATT)4AT, which select SWNTs (6,5) and (7,5) respectively. These are compositional isomers that can appear to be identical and are able to each select SWNTs that differ in diameter, length, and chiral angle. In order to better understand this phenomenon, we are interested in comparing calculated electronic structures, binding energies, dipole moments, and charge transfer. It has become increasingly necessary to effectively model large systems that have potential applications in nanoelectronics and biochemical sensors and our work supports that effort. References: Tu, X.; Manohar, S.; Jagota, A.; Zheng, M. *Nature* 2009, 460, 250-253. [Acknowledgment: This work was supported by the NIH/NIGMS MBRS RISE Grant #5R25GM060414 and by NSF/CREST/CFNM #HRD-1137751.]

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Physics

GP #35

Subcategory: Physics (not Nanoscience)

Designing and Prototyping Equation-Driven Elliptical Mirrors for PIPER Optics

Kailyn Cage, Ohio State University

The Primordial Inflation Polarization Explorer (PIPER) mission seeks to observe and analyze the polarization in the cosmic microwave background (CMB) from an altitude of 120,000 feet, which is above 95% of the atmosphere. The CMB is the residual radiation that remained after the Big Bang. Proven as the oldest observable light in the Universe, the PIPER mission will delve further into the associated theories. PIPER is a balloon-borne instrument developed with the capabilities of detecting B-mode polarization from the CMB, the analysis of the photons is predicted to either support or denounce the theory of inflation.

The PIPER optics plays a major role in the proper methodology of deflecting photons to ensure an accurate measurement by the PIPER electronics. The optics includes a set of equation-driven elliptical mirrors designed in Solidworks software to assist in accurately directing the photons. The methods used to

properly deflect photons using the designed mirrors are a focal aspect of the optical design. [Acknowledgment: NASA Undergraduate Student Research Program.]

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GP #36

Subcategory: Materials Science

Energy Harvesters and High-k Capacitors Using Pyroelectric Nano-Composite Films

Mychal C. Thomas, Alabama A&M University

The process of extracting electrical power from ambient low-grade thermal energy sources using pyroelectric transducers has been investigated. Pyroelectric material was modified producing lead zirconate titanate: polyvinylidene fluoride (PVDF:PZT) composite films which were fabricated by the solution casting technique. The pyroelectric and dielectric properties of the composite films were examined for their use in energy harvesting and high-k capacitors. The properties measured include: (i) dielectric constants and (ii) pyroelectric coefficient as a function of temperature. From the foregoing parameters, the energy harvesting capacity of PVDF:PZT nano-composite films were theoretically explored by capturing the ambient thermal energy available in harsh environments of Alaska, Saudi Arabia and MARS. The results indicate that the electrical energy harvesting via pyroelectricity holds promise for powering autonomous low-duty electric devices. The data on polymer nanocomposites for use in high-k capacitors will also be presented. [Acknowledgment: This research has been supported in part by the NSF HBCU-UP Grant # HRD0928904]

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Social and Behavioral Sciences

GP #37

Subcategory: Social Sciences/Psychology/Economics

Differences in the Perceptions of Social Community by Female Undergraduate Engineering and Female Graduate Engineering Students

Joi-Lynn Mondisa, Purdue University

Given the national educational call to decrease attrition and increase retention rates of underrepresented populations in STEM undergraduate and graduate majors, it is critical to understand the experiences of these populations which can influence their decisions to undertake and stay in STEM majors. Exploring how different student populations perceive social

community and identifying what are the factors that contribute to social community for these populations can lead to identifying ways to promote community and increase retention. Previous studies in this research area surveyed university students, yet do not focus specifically on the experiences of underrepresented groups such as women in a particular college, such as engineering.

This research study addresses what are the differences in the perception of social community between undergraduate and graduate engineering student populations. The specific populations of interest are female undergraduate engineering and graduate engineering students. An online survey instrument adapted from Rovai's Classroom Community Scale and the Michigan Organizational Assessment Questionnaire (MOAQ) will be administered to both female and male undergraduate and graduate engineering students at a large, Midwestern university. The survey questions are based on the constructs of community, connectedness, and satisfaction as perceived by respondents relative to their affiliations and community choice relations. The intent is to address how connected the student population feels to a social community on campus and how satisfied they are with their perceptions and situations. In addition, with whom and how the participants construe their personal communities will also be surveyed and analyzed. Expected results should indicate what are the differences in how female undergraduate and graduate engineering students perceive and create their social communities as compared to other populations. Conclusions should provide insights into what social community factors should be developed and promoted to assist in creating a larger sense of social community for these populations. Future research may focus on how particular social community factors on campuses can be developed to promote increased connectedness and possibly retention in STEM fields. *[Acknowledgment: This research project is not funded by a particular agency.]*

Faculty Advisor: Sara McComb, sara@purdue.ed

GP #38

Subcategory: Social Sciences/Psychology/Economics

An Analysis of the Impact of Visual Analytics on Collaborative Cognitive Inferences of Health Disparities Data

Diarria Williams, Jackson State University

Shauna-Kay Spencer, Wellington K. Ayensu and Raphael Isokpehi, Center for Bioinformatics & Computational Biology, Department of Biology, Jackson State University

Visual analytics – the science of analytical reasoning facilitated by interactive interfaces – can be a vital approach for analyzing large datasets. However, community input to research on health disparities is often hampered by the inability of non-academic

research partners to make sense of large datasets including epidemiological data. Thus, a series of visual analytics views and dashboards were developed to permit knowledge-building insights from data on Body Mass Index available for states and territories in the United States. Datasets were extracted from the Centers for Disease Control and Prevention, a publicly accessible database: <http://apps.nccd.cdc.gov/brfss/>. The datasets were then converted into formats suitable for designing interactive views using visual analytics software. The 1995 to 2011 data for the United States and territories includes BMI averages divided into 3 categories: neither overweight nor obese (BMI < 24.9), overweight (25-29.9), or obese (BMI > 30). The research will be piloted among college students to determine the cognitive inferences obtained from collaborative visual analytics of health disparities datasets. We expect that the results of the research will enable a better understanding of the pros and cons of using visual analytics as a primary source for making more efficient and coherent inferences – a vital skill needed for higher learning. *[Acknowledgment: Louis Stokes Mississippi Alliance for Minority Participation.]*

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Technology and Engineering

GP #39

Subcategory: Civil/Mechanical/Manufacturing Engineering

Using Approximate Dynamic Programming Model to Optimize Open Access Scheduling System Based Off Clinical Characteristics

Kelli Crosby, Binghamton University

Ahmad Obeidat, Binghamton University

Due to the increasing service demand currently straining the capacity of a pressured health care system, the need for improvement is on the uprise. As a result of the surge in patient demand, many clinics are transforming their scheduling systems from traditional scheduling to open access scheduling. In open access scheduling, patients are seen within one to two days of the appointment, which results in a decrease of patient no-show rate, and increase in continuity of care and patient satisfaction. The objective of this study is to create a transferable scheduling system that will specify the optimal open access scheduling combination designed to increase patient throughput and clinic revenue. Future works of this study will include applying approximate dynamic programming algorithms for open access scheduling with a hybrid scheduling system to output optimal scheduling system. *[Acknowledgment: N/A]*

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GP #40

Subcategory: *Materials Science*

Percolation in Sintered Recycled Glass Designed for Polluted Soil Filtering

Wesley Cuadrado, University of Puerto Rico - Mayaguez

Jasmine I. Figueroa, Liliana M. Hernández, Andrea López, Gerardo Nazario, and O. Marcelo Suárez, University of Puerto Rico - Mayaguez

Soil pollution is a major problem caused by the application of pesticides and fertilizers, fuel and oil dumping, corrosion of underground storage tanks, among others. The present research focuses on producing porous beds made of recycled glass by controlled sintering to study the feasibility of using them for polluted soil filtering. Recycled powdered glass with different particle size (MG-30, 0.60 mm and MG-80, 0.18 mm) were sintered at different temperatures (from 700°C to 800°C) for various times. Water percolation flux across MG-30 and MG-80 sintered samples was determined by measuring the elapsed time for a certain volume change. Brittle MG-30 and MG-80 samples were obtained for low sintering parameters at 700 to 750°C for 10 to 15 minutes. MG-30 highest water percolation flux of 55.14 ml/s was obtained for sintered sample at 725°C for 20 minutes, while the lowest percolation fluxes of 6.79 through 3.36 ml/s were obtained for sintered glass at 775 to 800°C for 20 to 30 minutes. Moreover, MG-80 highest percolation flux of 18.24 ml/s was recorded for glass sintered at 725°C for 25 minutes and the lowest of 1.86 ml/s at 800°C for 30 minutes. We observed an inverse relationship between sintering temperature and time with samples percolation flux. Ongoing experimentation involves sintering samples with different mass ratios of MG-30 and MG-80 powdered glass.

[Acknowledgment: This work is supported by the Center for Education and Training in Agriculture and Related Sciences and the Center for Research Excellence in Science and Technology.]

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GP #41

Subcategory: *Pollution/Toxic Substances/Waste*

The Analysis of Vehicle Specific Power Characteristics in the Houston-Galveston-Brazoria Area

Chelse Hoover, Texas Southern University

Lei Yu, Texas Southern University

Emission output varies due to weather, road type, driving behaviors, location, and several other factors. This study analyzes the characteristics of Vehicle Specific Power (VSP) and emission outputs in the Houston-Galveston-Brazoria (HGB) area. VSP is a widely used proxy for calculating vehicle emissions and is defined as the instantaneous power per unit vehicle mass. In

this approach, several HGB roadways will be driven with GPS devices in vehicles to collect the necessary data for VSP. Once VSP is collected, the results are to be categorized into operating mode bins, a statistical technique that yields vehicle emission output. This research is intended to evaluate VSP and emission trends for the tested roadways in this study. Note that the conducted research is a pilot study, a preliminary test in which the methodology will be applied to more thorough future studies. *[Acknowledgment: This is to acknowledge that this research is sponsored by NSF CREST #1137732 and Tier 1 University Transportation Center TranLIVE]*

Faculty Advisor: Fengxiang Qiao, qiao_fg@tsu.edu

GP #42

Subcategory: *Civil/Mechanical/Manufacturing Engineering*

A Prototype of an Advanced Traffic Warning System in Safety Improvement and Emission Reduction

Jing Jia, Texas Southern University

To value the use of GPS and well realize the Intelligent Transportation System (ITS), [delete this first part?] an advanced Driver Smart Assistance System (DSAS) was developed in this research. Visual warning messages and voice prompts will be provided to drivers based on short-range vehicles and infrastructure communications. By such an innovation, drivers can obtain dynamic messages on traffic and road condition timely. The Visual Basic (VB) programming tool is used to develop the DSAS, and relevant software components are used in this program for proper function. Microsoft Communications Control (MSCOMM) is used to communicate with GPS unit; Microsoft Data Access Object (DAO) is used to communicate with database; Microsoft MapPoint is used to navigate and display the map view; and Microsoft Winsock Control is used to communicate with the short-range communication devices. Those are major components of the software system. The portable and flexible short-range devices are installed on roadside infrastructures. For example, to provide the dynamic information about a work zone, part of the communication devices will be installed in work zone areas. The FRID based DSAS has been successfully tested as pilot studies on traffic signal warnings, work zone lane closed and speed limited information warnings, and e-stop sign warnings. Test results indicate that significant effects on vehicle trajectories, speed and acceleration/deceleration rate, and the Vehicle Specified Power (VSP) were observed. With DSAS, drivers tend to drive even smoother with lower acceleration/deceleration rates. Most subjects agree that DSAS is useful and will eventually help enhance safety and reduce the offense of traffic laws. The subjects feel comfortable with no extra stress or workload. The use of DSAS changes the VSP and associated Operating Mode ID Bins, which results in the reduction of vehicle emissions, per a simulation from the Environmental Protection Agency (EPA)

software - MOVES. The developed DSAS can be embedded into the current GPS system as well as the advanced in-vehicle co-pilot system. The on-going research is to improve the interface of this program and conduct more tests on the human factors. *[Acknowledgment: This study was supported by the National Science Foundation CREST #1137732, Texas Southern University Seed Grant, and Tier 1 University Transportation Center TranLIVE.]*

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GP #43

Subcategory: Civil/Mechanical/Manufacturing Engineering

Using Driving Simulator for Vehicle Specific Power (VSP) Simulation in Vehicle Emission Analyses - A Feasibility Study

Ziyue Li, Texas Southern University

Fengxiang Qiao and Lei Yu, Department of Transportation Studies, Texas Southern University

Emission Estimation by simulation models is developing fast in traffic and environment research area. But these models are difficult in characterizing the driving behavior on the real road. Currently estimated vehicle emissions are hard to be verified and evaluated. In this context, this paper is intended to validate the applicability of driving simulator in vehicle emission estimations based on the explanatory parameter of vehicle emissions - vehicle specific power (VSP). In accordance with VSP and vehicle activity data, the operating mode bin distributions can be calculated, which are directly related to emission rates. A scenario is built in the driving simulator based on the real world including road type, traffic flow, signal time etc. People drive in both the real world and the driving simulator for similar driving behavior. By analyzing the real-world and simulated vehicle activity data, it is found that the operating mode bin distributions are quite different with each other. In order to make proper use of the driving simulator data for emission estimation, this paper proposes a fuzzy logic-based algorithm to calibrate the distributions.

Results show that the error is reduced by 50%. After calibration, the error of total emission is less than 2%. This implies that the fuzzy logic-based algorithm can be applied to vehicle emission estimations. Once the calibration algorithm is validated, the data from the driving simulator can be used for emission estimations. The on-going work includes recruiting more subjects with different ages, genders and driving ages for further tests so as to yield more accurate calibration and validation results. *[Acknowledgment: This research is sponsored by NSF CREST #1137732 and Tier 1 University Transportation Center TranLIVE.]*

Faculty Advisor: Fengxiang Qiao, qiao_fg@tsu.edu

GP #44

Subcategory: Environmental Engineering

Identifying the Advantages and the Possible Problems Using MOVES for Vehicle Emission Estimation

Victoria Ndimele, Texas Southern University

Fengxiang Qiao and Lei Yu, Department of Transportation Studies, Texas Southern University

MOVES (Motor Vehicle Emission Simulator) is a Computer Model designed to estimate air pollution emissions from cars, trucks, motorcycles, and buses. MOVES2010 was designed to replace the previous emission model MOBILE6.2 as the emission model, and the US Environmental Protection Agency (EPA) will maintain and support it. This research will identify the advantages and possible problems using MOVES for vehicle emission estimation. It explains the existing practice in the mobile source emission estimations. MOVES2010 has improved the understanding of in-use emission levels and the factors that influence them. We also conducted a survey designed as a pilot study as part of the research project sponsored by the National Science Foundation CREST Center and the U.S. DOT Tier 1 University Transportation Center at Texas Southern University. The objectives of this survey are to identify the advantages and possible problems using MOVES for vehicle emission estimations. It provides a better understanding of MOVES and determines the state of the art/ practice in the relevant research areas. Based on the research, one can understand why EPA adopted the MOVES2010. The findings from this research will help in the process of understanding MOVES2010, its accuracy and emission estimate. *[Acknowledgment: This research is sponsored by NSF CREST #1137732 and Tier 1 University Transportation Center TranLIVE.]*

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GP #45

Subcategory: Materials Science

Investigation into Thermal Properties of Surface Treated Woven Flax Fibers

Vertonica F. Powell, Tuskegee University

With the ever evolving need for an environmentally friendly alternative material to replace synthetic fibers like glass and carbon in several fiber reinforced polymer composites applications, natural fibers offer an excellent choice, and hence, research on the same has grown exponentially. In the current research, objectives are to find the optimal uses for the natural fiber and to address known challenges, such as a high degree of moisture absorption and poor thermal stability. Surface modification by means of chemical treatment was carried out to

remove components of natural fibers such as lignin, pectin and hemicellulose that contribute to the known challenges of natural fibers. In this research project, two different chemical treatments were used on a commercially obtained woven flax fiber. Alkali and acetylation chemical treatments were chosen for this project at various times and concentrations. The treatment analysis was divided into three phases: 1) Alkali treatment using potassium hydroxide varying the concentration from 1%-5% and time for 30 minutes and 1 hour; 2) Acetylation treatment varying the concentrations between 1% and 2% for 1 hour; and 3) Analyze effects of the surface modification on the thermal properties and determine the best combination. This combination will be used in future work with bio-based composites. *[Acknowledgment: NSF-CREST and NSF-IGERT]*

Faculty Advisor: Mahesh Hosur, hosur@mytu.tuskegee.edu

GP #46

Subcategory: Materials Science

Nano-sensor Construction and Characterization For Detection Of Low Concentrations Of Chemical Vapors

Jonathan Reynolds, Tennessee State University

Jonathan Mallard, Terrence Thompson, Mohan Malkani, Lizhi Ouyang, and S.K. Hargrove, Tennessee State University
Charles Davis Jr. and Hazzan Mafus, Florida Atlantic University

Nanotechnology, the engineering of systems at the molecular scale, is an emerging field in science. This technology is being researched for use in areas ranging from energy generation to biomedical research. One particular advancement in this field is Nanosensors. Nanosensors are nanoscopic sized sensors that can detect events on the nanoscale range. These sensors come in various types and can be used to detect compounds in varying environments. Development of these sensors is under way for Improvised Explosives Device (IED) detection. This project focuses on creating a sensor to detect ammonia, a surrogate for the IED detection.

We propose using a micro-cantilever system that changes frequency when mass is added by various methods. This device uses a functionalized polymer on the cantilever to absorb ammonia. The project has found the optimal parameters to produce consistent, well-structured nanopatterns through nanografting to effectively study the monolayer present on the substrate. Currently the project is focusing on using an Atomic force microscope (AFM) to detect frequency changes in a cantilever system. The AFM uses cantilevers to image surface morphology of samples. A particular mode called "tapping" uses the natural frequency of the cantilever to do this. By adding a thin film to the AFM tips, we can measure the change in frequency. This will allow us to use the AFM as a test platform for our sensors. Preliminary results suggest that we will be able to positively detect chemical vapors with low concentrations.

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GP #47

Subcategory: Environmental Engineering

Transport of Fertilizer-derived Nitrate through Unsaturated Low Conductivity Soil

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Intensive application of inorganic compounds (N,P,K) for agriculture benefits leads to increased percolation into the subsurface and can end up in the groundwater. High levels of nitrate in the groundwater pose a serious health hazard if it reaches the drinking water supply. The U.S. EPA has established the MCL for NO₃ to be 10mg/L (measured as NO₃-N). Previous studies have analyzed the fate and transport of agriculture-derived chemicals on groundwater quality using *in situ* methods, column test or numerical simulations. However, these techniques may take a long time and are difficult to maintain in a controlled environment. The experimental approach to study the transport of nutrients derived from agriculture related activities, for unsaturated soils under different soil saturation levels, is presented. The level of saturation in a sand-clay mixed soil related activities in the laboratory under centrifugation is presented. A 7.0 mM NH₄NO₃ solution was used to study the transport of nitrate through the soil mixture. The solution was pumped into the soil with the volumetric flow rate controlled by an external pump which is connected to a steady-state centrifugation-unsaturated flow apparatus (UFA). Three saturation levels (SH=0.85, SM=0.43, and SL=0.28) were chosen to represent high, medium and low saturations, respectively. Nitrate breakthrough curves were plotted and adsorption coefficients, K_d, were then calculated for the high, medium, and low saturation level; they were 13.5 µg/mg, 2.9 µg/mg, and -8.8 µg/mg, respectively. The data shows a relationship exists between the saturation level and adsorption coefficient for the given soil, suggesting that nitrate will be sorbed more efficiently under higher saturation levels. Future work will include analyzing the sorption of soil mixture with fly-ash. An additional relationship of transport parameters such as dispersion and correlation to saturation level is also of interest for contaminant mass transport. *[Acknowledgment: This work was supported in part by CSU-Council on Ocean Affairs, Science and Technology Federal Work-Study Pilot Program; CSU-LSAMP is supported by the National Science Foundation under Grant No. HRD-0802628 and the CSU Office of the Chancellor.]*

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SACNAS

2013 Summer Leadership Institute



Postdocs and Professionals

The SACNAS Summer Leadership Institute provides premier training for motivated underrepresented minority (URM) scientists who wish to master the skills necessary to lead institutional transformation. Developed in collaboration with the American Association for the Advancement of Science (AAAS), the Summer Leadership Institute is an intensive five-day course featuring small group exercises, keynote speakers, leadership development planning, networking opportunities, and extensive community building among selected participants.

Participants will engage in a comprehensive curriculum led by **Dr. Joseph Garcia**, Bowman Distinguished Professor of Leadership Studies and Director of the Karen W. Morse Institute for Leadership at Western Washington University. Co-facilitators are **Dr. Donna Blancero**, Associate Professor of Management, Bentley University and **Mr. Richard Weibl**, Director, Center for Careers in Science and Technology at the American Association for the Advancement of Science.

Eligibility:

- Must be a SACNAS member at the time of application
- Doctorate degree required
- STEM field preferred
- Postdocs and professionals in academia, industry, government, and non-profits are invited to apply
- Updated current Curriculum Vitae (CV)

For more Information:

<http://sacnas.org/events/leadership>

Application Deadline:

March 2013

Institute Date:

July 2013

Sample Sessions:

- Building and Maintaining High Performance Teams
- Challenges for People of Color in Leadership Roles
- Decisions Making and Delegation Skills
- Creating a Leadership Development Plan (LDP)
- Management and Conflict Resolution



*Advancing Hispanics/Chicanos
& Native Americans in Science*

For more information:

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