

American Association for the Advancement of Science Webinar

Non-traditional Careers in STEM

October 9, 2018

2:00 – 3:15 pm EST



Introduction - Moderator



Dr. Mary Ann Leung

**Founder and President
Sustainable Horizons Institute**

Agenda



- Introduction – Moderator: Dr. Mary Ann Leung
- Panelists:
 - Dr. Angela Whatley – Regulatory Science
 - Dr. Elizabeth Zeitler – Science Policy
 - Dr. Rafael Luna – Science Communication
 - Ms. Tiphany Dickerson - Patent Law

- Take-aways/Closing remarks – Moderator: Dr. Mary Ann Leung

Emerging Researchers National (ERN) Conference in STEM



Award Number: 1645036

- Hosted by AAAS and the NSF Division of Human Resource Development (HRD)
- 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.
- ERN provides STEM majors
 - Chance to present their research
 - Participate in professional development, and an educational/career fair.
 - Will be held February 21-23, 2019 in Washington, DC
 - Abstract submission and travel award application deadline is **October 12, 2018**
 - For more information on ERN visit <http://new.emerging-researchers.org/>
- This session is part of webinar series to share information and resources on STEM career options and pathways

Webinar Set Up & Etiquette



- All attendees are automatically muted, however we plan a very *interactive* session
- Panelists 10 minutes each
- Q&A for 3 minutes after each panelist
 - Type into Questions box OR
 - Click to Raise your hand to ask your question
 - Must have a microphone or connected by phone
 - Wait to be called on
- Poll questions for you to answer throughout
- Additional questions at end, time permitting



Poll Question #1 – Academic Status

- What is your academic status?
 - A. Undergraduate student
 - B. Graduate student
 - C. Faculty
 - D. STEM Professional
 - E. Other

Regulatory Science



Dr. Angela Whatley
Biologist, Scientific Reviewer
Food and Drug Administration (FDA)

Poll Question #2 - Scientific training in regulatory fields



- How much scientific training do you think is required for a regulatory position?
 - A. Very little
 - B. Some
 - C. Moderate amount
 - D. Extensive

Regulatory Career Pathway

Angela Whatley PhD, FDA

Outline

- My Background/
- My current position FDA
- Federal STEM fellowships
- Summary

My Background

- B.S. Biology from Rockhurst University
- PhD in Microbiology from University of Missouri
- Presidential Management Fellow 2012- 2014
 - Department of Veterans Affairs Office of Research and Development
 - Quality Enhancement Research Initiative 2014-2016
- Food and Drug Administration 2016- present
 - Chemistry Manufacturing and Controls (CMC) reviewer for Office of Tissues and Advanced Therapies

Department of Health and Human
Services

Food and Drug Administration

Center for Biologics Evaluation and
Research

Office of Tissue, and Advanced
Therapies

Division of Cellular and Gene
Therapies

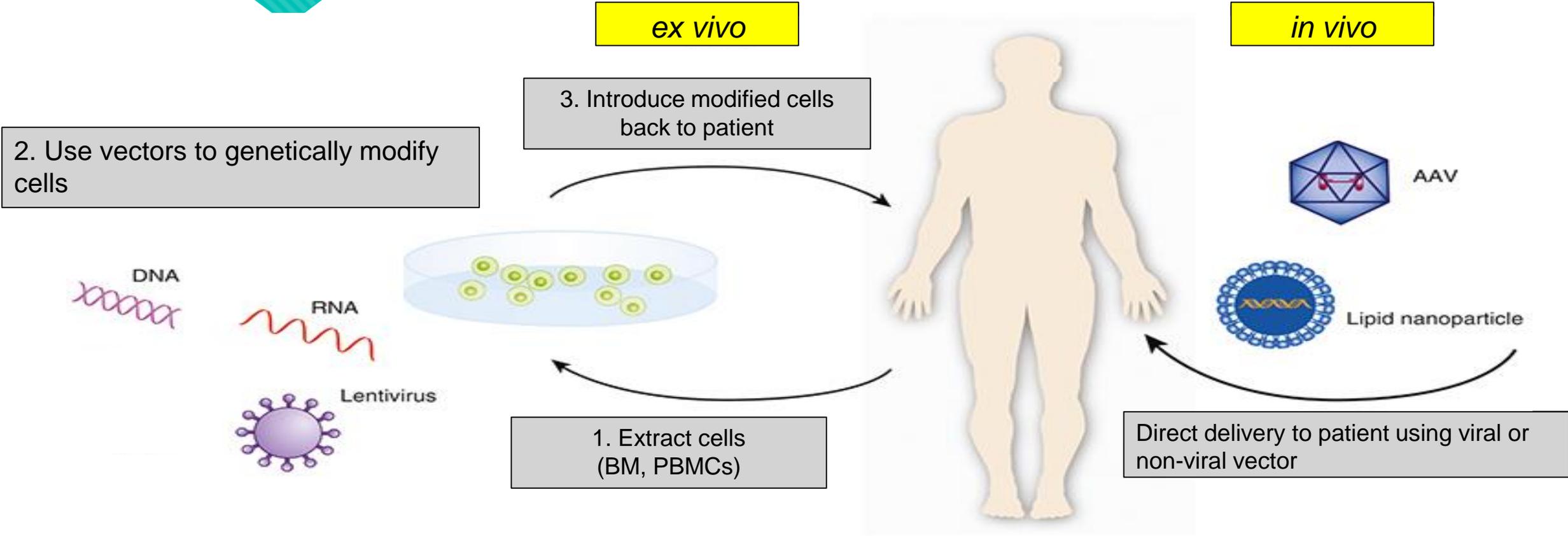
Biologist, Gene
Therapies Branch

Human Gene Therapy

- Human Gene therapy products mediate their effects by transcription or translation of transferred genetic material, or by specifically altering host (human) genetic sequences.
- Common gene therapy products:
 - Plasmids
 - Viral vectors
 - Bacterial vectors
 - *Ex vivo* genetically modified cells
 - Engineered nucleases for genome editing

Gene Therapy

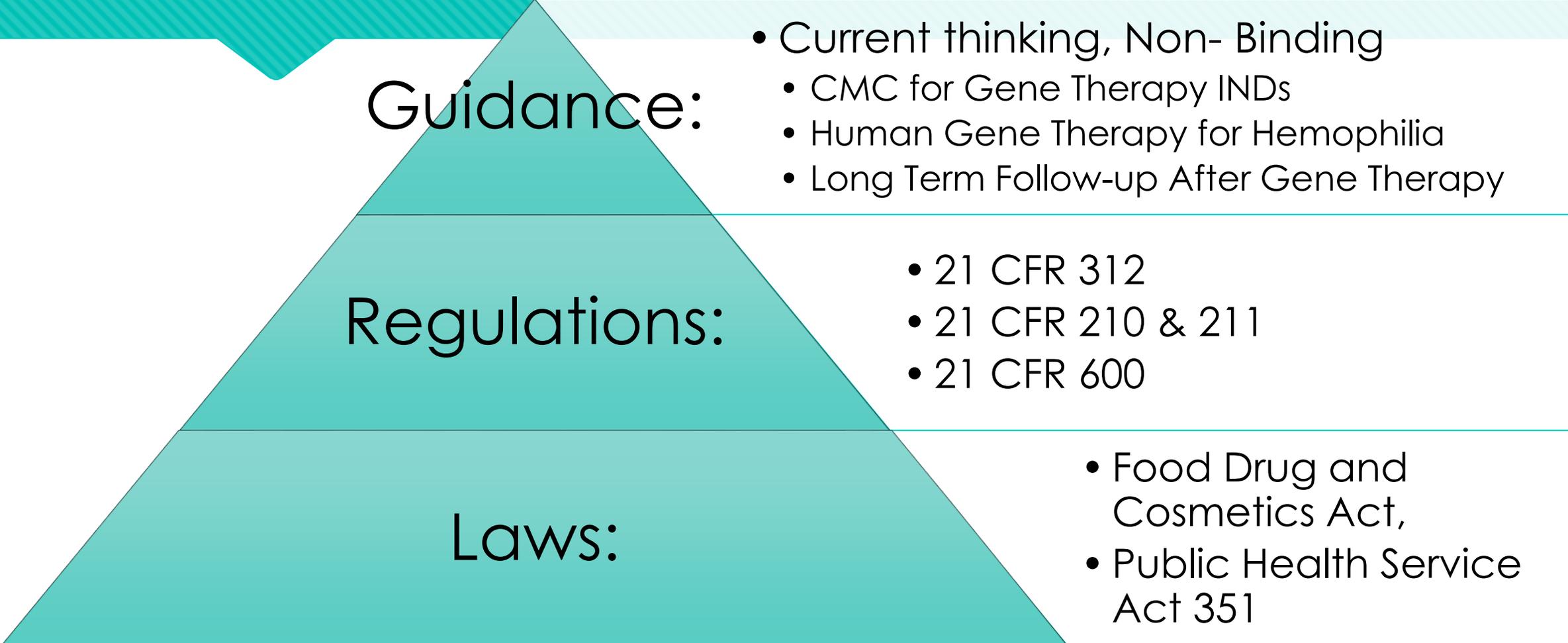
Ex vivo and in vivo Administration



Recently approved Gene Therapies

- LUXTURNA (voretigene neparvovec-rzyl),
 - inherited form of vision loss
- KYMRIAH (tisagenlecleucel)
 - Patients up to 25 years of age with B-cell precursor acute lymphoblastic leukemia
- YESCARTA (axicabtagene ciloleucel)
 - Adults with Relapsed or refractory large B-cell lymphoma

Regulatory Framework



Guidance:

- Current thinking, Non- Binding
- CMC for Gene Therapy INDs
- Human Gene Therapy for Hemophilia
- Long Term Follow-up After Gene Therapy

Regulations:

- 21 CFR 312
- 21 CFR 210 & 211
- 21 CFR 600

Laws:

- Food Drug and Cosmetics Act,
- Public Health Service Act 351

Drug Development Process

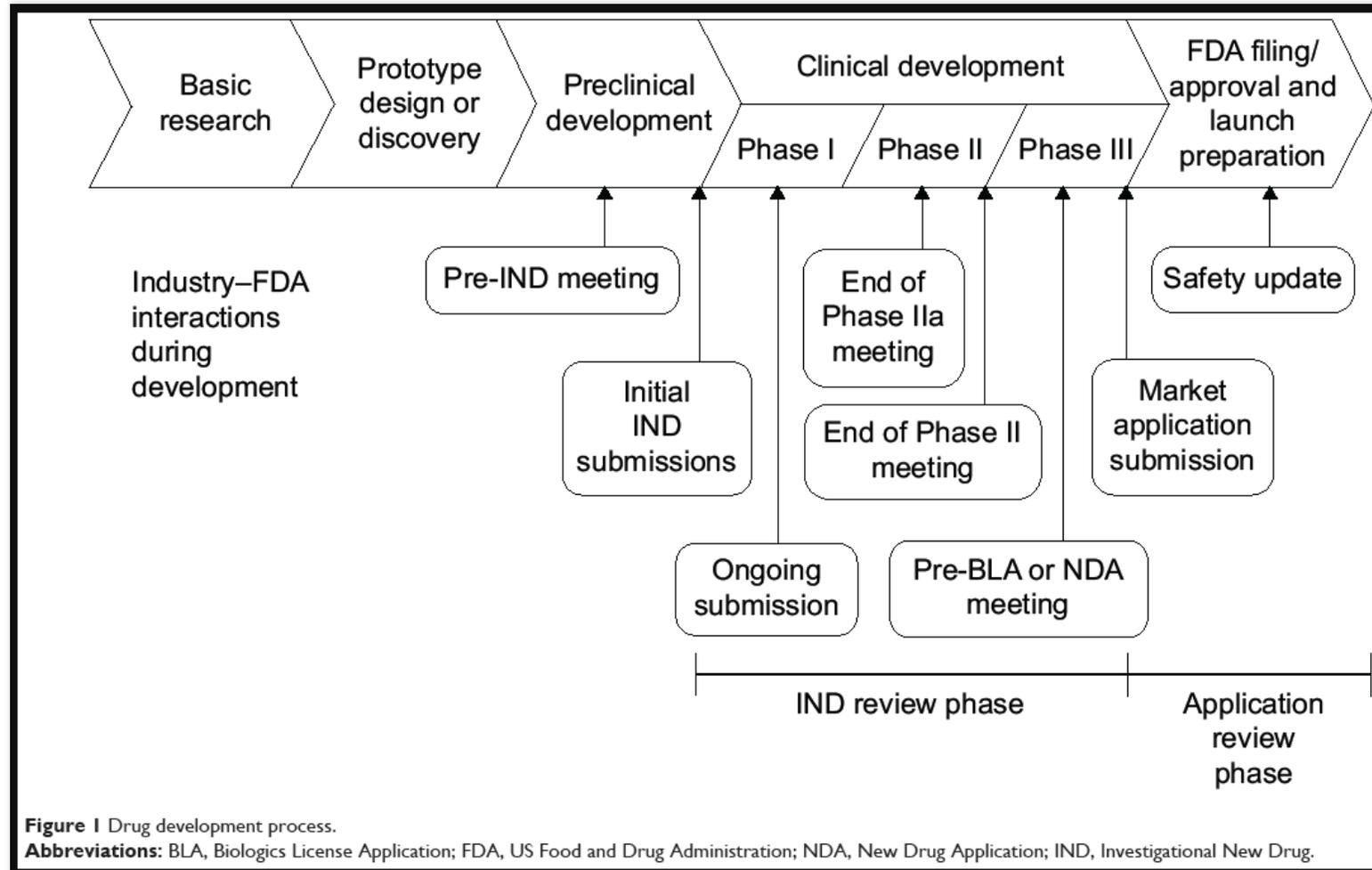


Figure 1 Drug development process.

Abbreviations: BLA, Biologics License Application; FDA, US Food and Drug Administration; NDA, New Drug Application; IND, Investigational New Drug.

What I love about my job

- Cutting Edge Science
- Impact on Public Health
- Professional Development
- Positive Environment
- Diverse
- Work Life Balance

Making the transition

- Make a plan
- Balance Lab work with Career work
- Become familiar with USAjobs
 - Save search
 - Notifications
 - Questionnaire
- Network
 - LinkedIn, Professional Societies, University contacts, Conferences
 - Informational Interviews

Federal Fellowships for STEM

- Presidential Management Fellow - Leadership
- AAAS – science policy
- Interagency Oncology Task Force Fellowship – Cancer Research/ regulatory work
- Commissioner's Fellowship Program – FDA
- Presidential Innovation Fellows – add innovation to government
- ORISE – Research
- CDC fellowships-
 - Epidemic intelligence service
 - Laboratory Leadership Service
- NASA fellowships – NASA
- Pathways program- Umbrella program for students and recent graduates

Fellowship Spreadsheet

Fellowship Name	Website Link	Application Open	Application Close	Eligibility/ Requirements	Contact person	Additional Info
Epidemic Intelligence Service (EIS)	https://www.cdc.gov/eis/application.html	4/16/2018	06-22-2018		eis@cdc.gov	
FDA Commissioner's Fellowship Program (CFP)	https://www.fda.gov/AboutFDA/WorkingatFDA/FellowshipInternshipGraduateFacultyPrograms/CommissionersFellowshipProgram/ucm115802.htm	7-Jun-17	7-Jul-17		fdacommissionersfellows@fda.hhs.gov	
LLS (Laboratory Leadership Service)	https://www.cdc.gov/lls/index.html	04-31-2017	7/17/2017			
Virginia Tech's Future Faculty Development Program-call for applications	http://provost.vt.edu/faculty_affairs/faculty_recruitment/future_faculty.html	06-27-2-17	1-Oct-17		Rachel Gabriele 540-231-4508	
AAAS Science & Technology Policy Fellowships	https://www.aaas.org/program/science-technology-policy-fellowships	May 1,2017	1-Nov-17		fellowships@aaas.org or 202-326-6700	
Leading fellows (netherlands)	http://leadingfellows.eu/apply/calls/	11/1/2017	1/10/2018		leadingfellows@tudelft.nl	
Leading fellows (netherlands)	http://leadingfellows.eu/apply/calls/	9/1/2018	10/31/2018		leadingfellows@tudelft.nl	
Epidemic Intelligence Service (EIS)	http://www.cdc.gov/eis/conference.html	January 16th, 2018	april 16th, 2018-april 19th, 2018			
Commissioner's Fellowship Program	https://www.fda.gov/AboutFDA/WorkingatFDA/FellowshipInternshipGraduateFacultyPrograms/CommissionersFellowshipProgram/default.htm	7/1/2018	7/31/2018	start checking website from this date		
CDC fellowships page	https://www.cdc.gov/fellowships/full-time/doctoral.html				Jeffery.Rexrode@fda.hhs.gov	
Virginia Commonwealth University (VCU) IRACDA postdoc in research and teaching in Richmond, Virginia	http://www.healthdisparities.vcu.edu/Research-Training/Research-Training-Programs/Postdoctoral-Programs/				application process: cohtraining@vcuhealth.org ; IRACDA program and finding potential research mentors at VCU: joyce.lloyd@vcuhealth.org	

Summary

- Regulatory careers are an exciting way to use scientific training in an impactful way.
- Getting a regulatory position can be challenging.
- Planning and networking can improve your chances of getting a regulatory position.

Science Policy



Dr. Elizabeth Zeitler
Senior Program Officer
National Academies of Science, Engineering, & Medicine

Poll Question #3 - Science Policy Roles



- What roles are most important for effective science policy?
 - A. Government officials
 - B. Academic researchers
 - C. Industry leaders
 - D. Nonprofit organizations

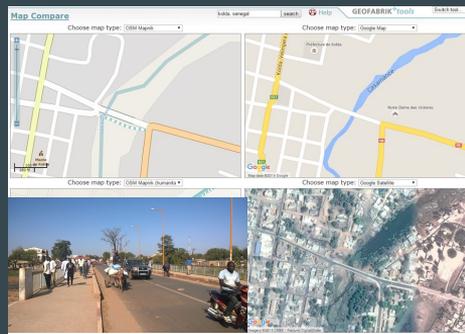
Scientists Working in Policy

Finding your fit



OVERCOMING BARRIERS
TO DEPLOYMENT OF PLUG-IN
ELECTRIC VEHICLES

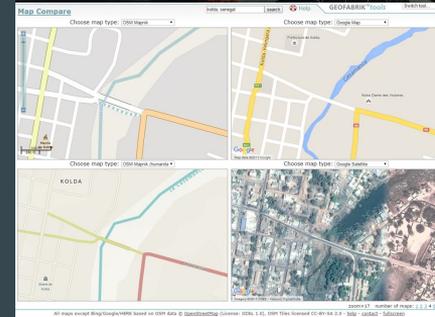
Speaking for myself, not
for NASEM or MCC



NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

In the next 10 minutes, I'll share what my work is like, how I found my way into science policy, and some paths you might walk while you find your fit.

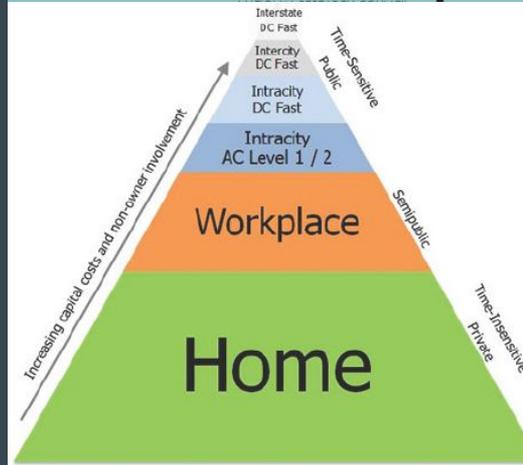
- What do I and others do in science policy?
- How did I explore problems that motivated me?
- How did I find roles where I could fill a need and grow?
- What might be a good fit for you?



What do scientists do in policy?

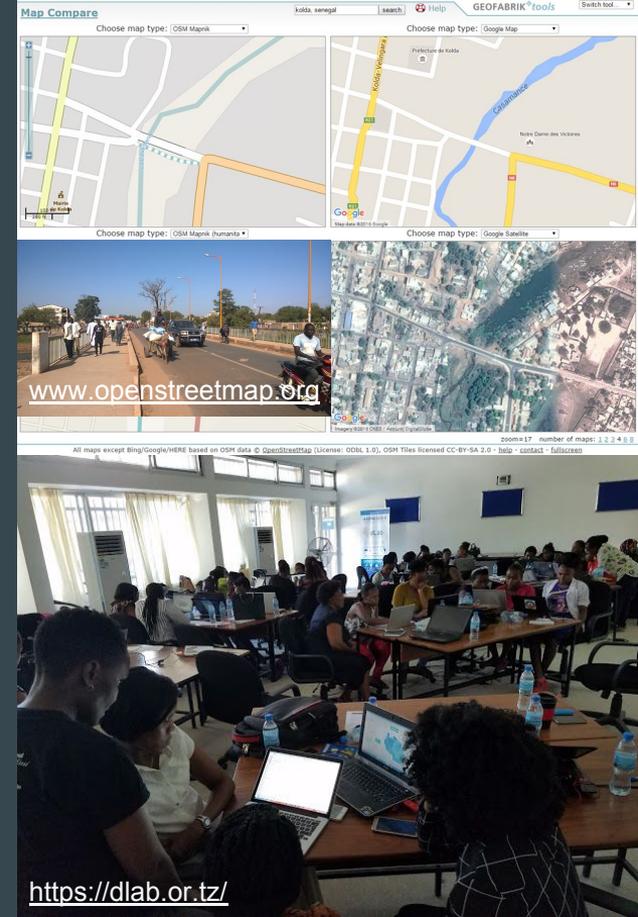
- Advise on policy for science, or science for policy
- Provide technical analysis for policy decisions
- Work and serve in a variety of short and long term roles
- What do I do?
 - At the [National Academies](#), I organize expert committees to advise the nation, advance discussion and connect the frontiers of science and engineering to energy policy.
 - At the [Millennium Challenge Corporation](#), I advise on data for decisions (remote sensing and transportation), and on engaging with data communities worldwide.

OVERCOMING BARRIERS TO DEPLOYMENT OF PLUG-IN ELECTRIC VEHICLES

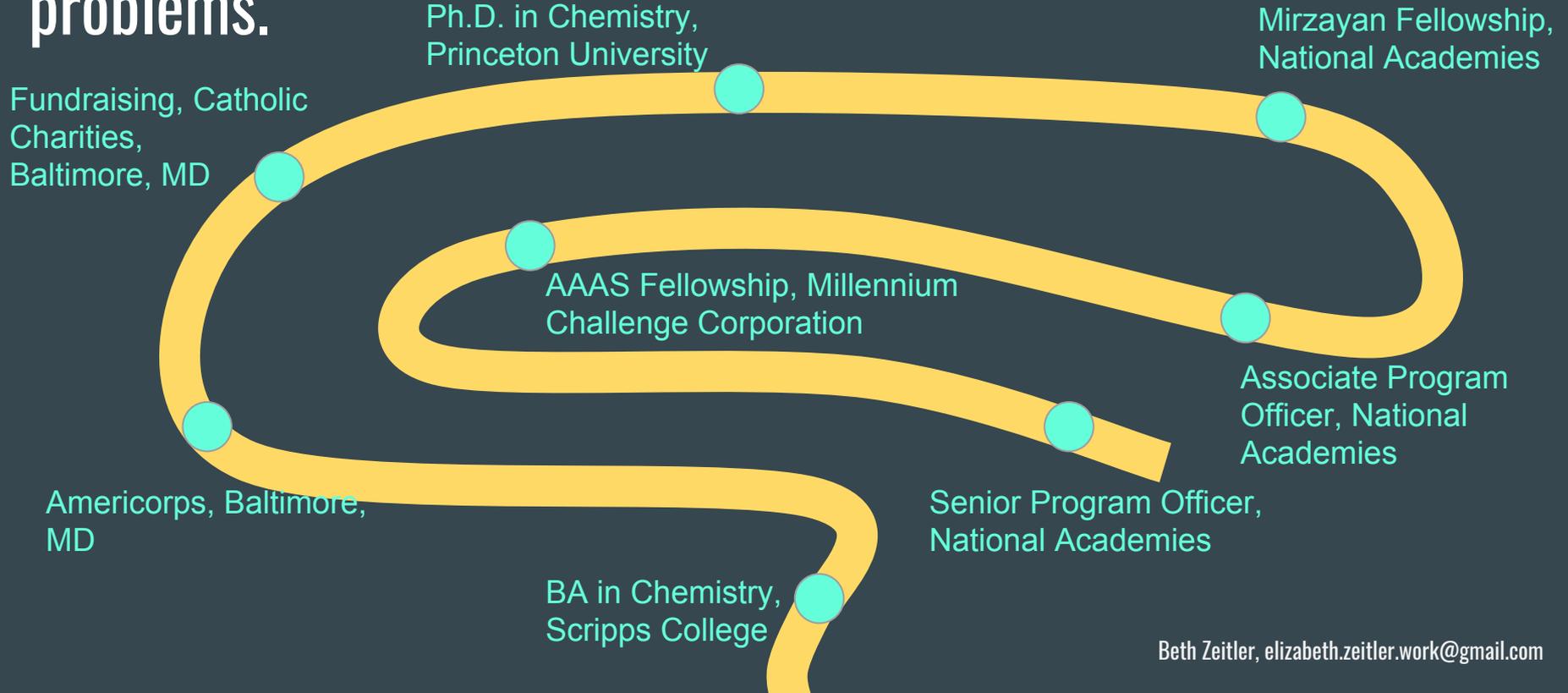


What do scientists do in policy?

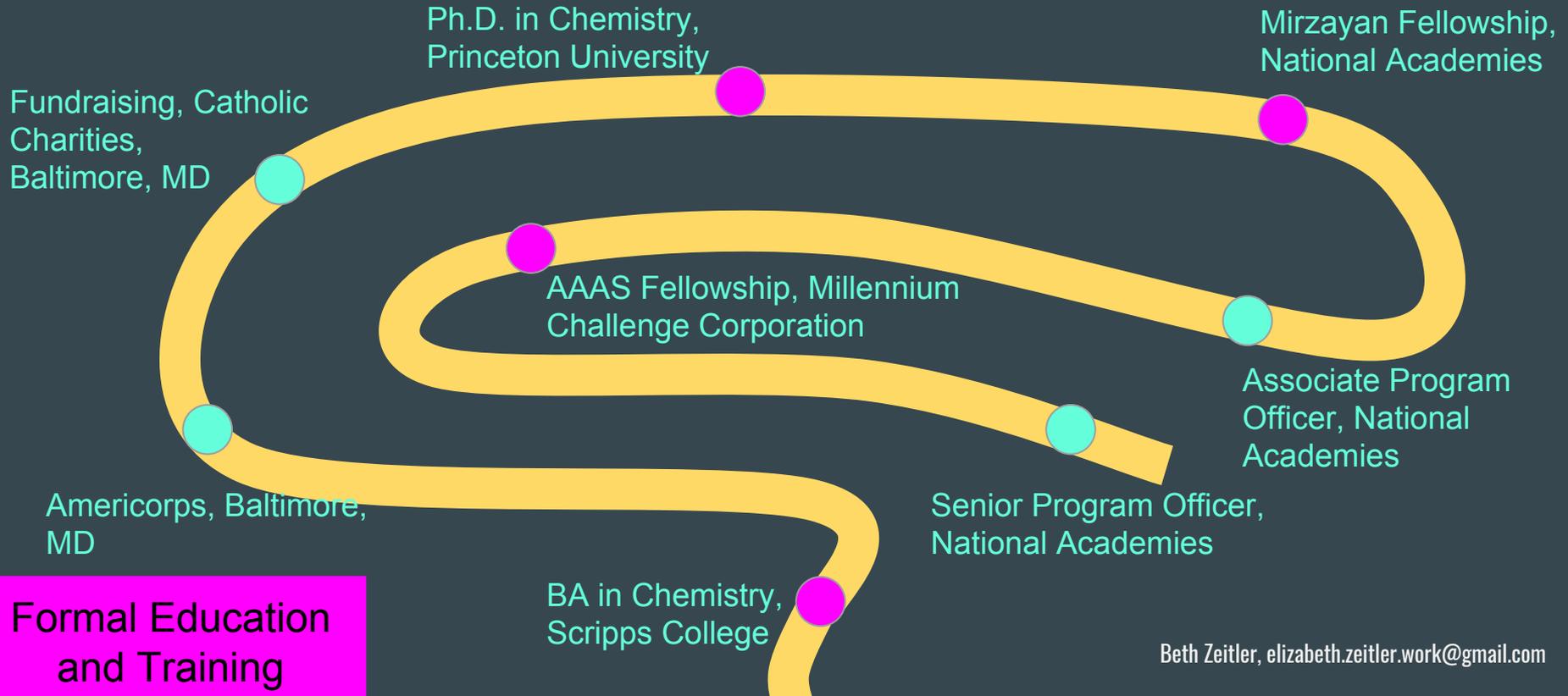
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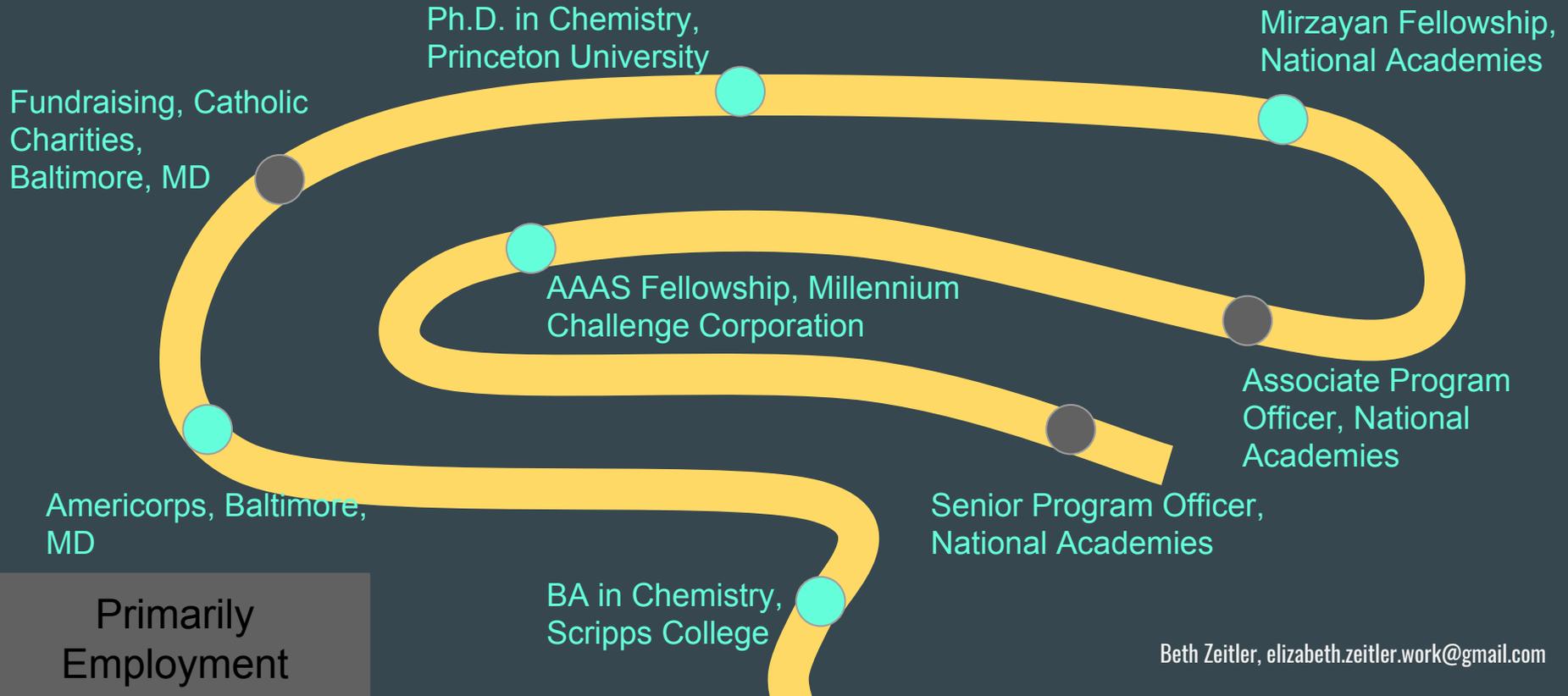
How did I get here? My path is motivated by loving people, hating waste, and irrepressible curiosity to work on hard problems.



My path is motivated by loving people, hating waste, and irrepressible curiosity to work on hard problems.



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I took **initiative** and followed my **curiosity** to solve problems with science needs and societal impact. I was lucky to be **met with opportunities** at all stages of my training.

Undergrad	I added a section to my thesis on the environmental justice aspects of air pollution.	Learning (foundation), mentor support.
Graduate	<p>I returned to grad school to work on science solutions to the most significant issue for the world: energy to do what you want to do without cooking the planet.</p> <p>I sought many formal and informal opportunities to be involved in and lead energy policy discussions, including a DOE fellowship, and an NSF IGERT program in clean energy.</p>	Learning (deepen chemistry foundation, extension into policy topics), connecting to others (collaborating, networking), mentor support.
Post-graduate	I became both a Mirzayan, and later a AAAS fellow, to experience science for policy at the National Academies and in the Federal Government.	Learning (practical policy work), connecting to others (collaborating, networking).

There are many pathways to make contributions using science for policy.



Become a professor or industrial scientist, and be an expert on an government or NASEM advisory committee...

Serve as an AAAS fellow in Congress or an agency, or a Jefferson fellow at State, or in a temporary role at NSF or NASA or another agency...

Find a postdoc or post-undergrad job in an NGO or in government and explore ways to move into policy work...

There are many pathways to make contributions using science for policy.

Universities and Colleges

Companies

National Labs

Government

Become a professor or industrial scientist, and be an expert on an government or NASEM advisory committee...

Serve as an AAAS fellow in Congress or an agency, or a Jefferson fellow at State, or in a temporary role at NSF or NASA or another agency...

Find a postdoc or post-undergrad job in an NGO or in government and explore ways to move into policy work...

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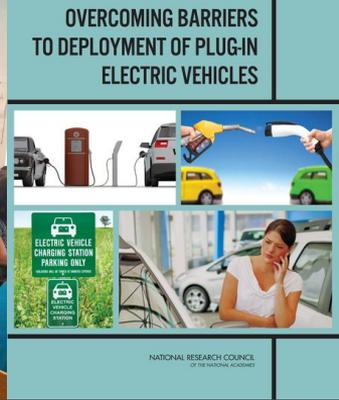


Science Policy NGO
Environmental NGO
Government - in a policy role
Issue NGO, where science is needed
Foundation or grantmaker

Find a postdoc or post-undergrad job in an NGO or in government and explore ways to move into policy work...

My take-it-with-a-grain-of-salt advice: **become a scientist, and use it to help make positive impact on society.**

- **Get involved** in things you care about. Find aspects that need your leadership, and lead.
- **Make connections** amongst people. Be in community with others with different experiences from you. Find and build real relationships with colleagues, mentors, sponsors, friends. Build your team and their capabilities.
- **Ask questions** at the talk. Go talk to the speaker. Get involved with the groups that host or invite the next speaker.
- If you care about issues impacted by science, then **stick with science education** as far as you can. STEM training and expertise provides analytical, quantitative, and subject matter skills that will help you solve problems.
- Look for **different ways to be involved** in work you care about. Maybe you're the expert. Maybe you have the capability and connections to help the expert advise the person making decisions.



There are lots of ways to be involved in science policy

- Follow your curiosity
- Connect with others
- Stick with science
- There are many paths

Work on what matters
You will need lots of diverse teams
Your skills allow you to contribute
It's a system with lots of roles

Questions?

Science Communications



Dr. Rafael Luna
Associate Dean, Morrissey College of Arts & Sciences
Boston College

Poll Question #4 - Science communication

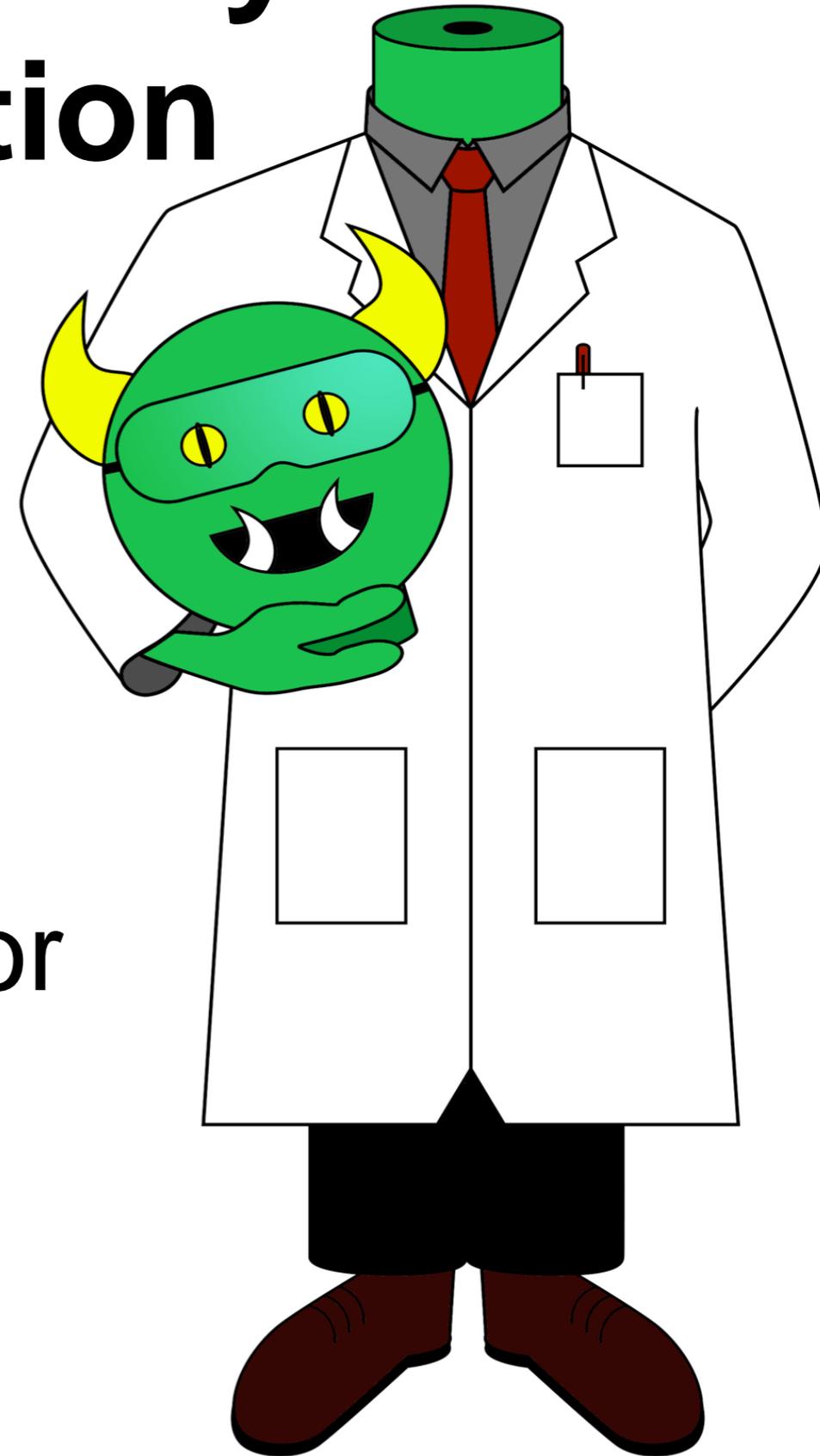


- Do you think there is a place for an antagonist in scientific communication?
 - A. Yes
 - B. No

Telling Your Career Story: Scientific Communication

Rafael E. Luna, Ph.D.

Associate Dean Morrissey
College of Art and Sciences
Boston College, Director
Pre-Health Program, & Director
Gateway Program for STEM

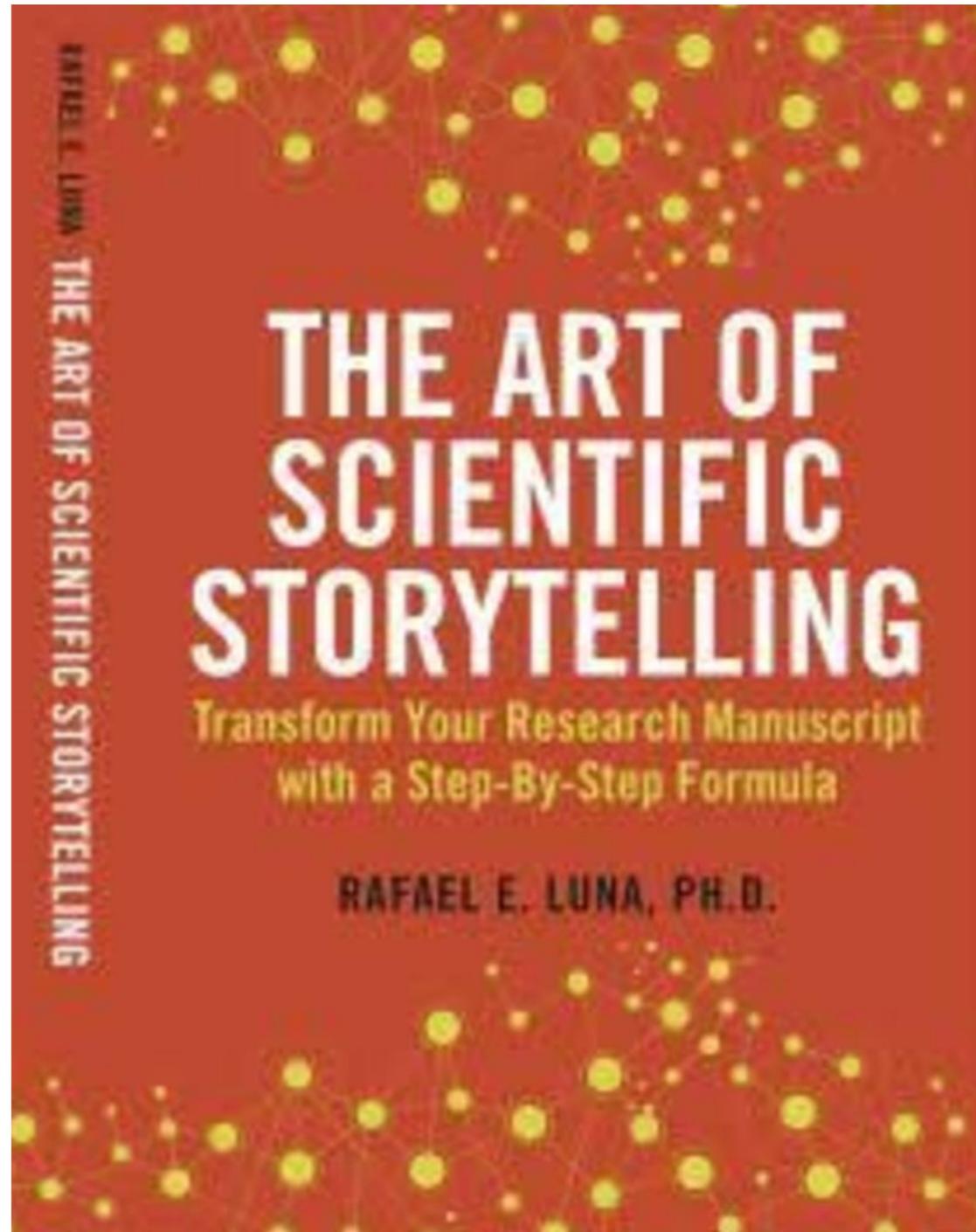


(I) Genesis of Scientific Storytelling

Publish or Perish in Academia

- Challenge to control
the message

(I) Genesis of Scientific Storytelling



One sentence Scientific Storytelling Hypothesis

Narrative Elements:

Protagonist, Antagonist, Conflict,
Scene, Resolution
and Stakes

The C-Terminal Domain of Eukaryotic Initiation Factor 5 Promotes Start Codon Recognition by Its Dynamic Interplay with eIF1 and eIF2 β

Rafael E. Luna,^{1,8} Haribabu Arthanari,^{1,8} Hiroyuki Hiraishi,² Jagpreet Nanda,³ Pilar Martin-Marcos,⁴ Michelle A. Markus,^{1,9} Barak Akabayov,¹ Alexander G. Milbradt,¹ Lunet E. Luna,^{1,5,10} Hee-Chan Seo,⁶ Sven G. Hyberts,¹ Amr Fahmy,¹ Mikhail Reibarkh,^{1,11} David Miles,² Patrick R. Hagner,¹ Elizabeth M. O'Day,¹ Tingfang Yi,¹ Assen Marintchev,⁷ Alan G. Hinnebusch,⁴ Jon R. Lorsch,³ Katsura Asano,² and Gerhard Wagner^{1,*}

¹Department of Biological Chemistry and Molecular Pharmacology, Harvard Medical School, Boston, MA 02115, USA

²Molecular, Cellular and Developmental Biology Program, Division of Biology, Kansas State University, Manhattan, KS 66506, USA

³Department of Biophysics and Biophysical Chemistry, Johns Hopkins University School of Medicine, Baltimore, MD 21205, USA

⁴Laboratory of Gene Regulation and Development, Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, Bethesda, MD 20892, USA

⁵Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139, USA

⁶Department of Molecular Biology, University of Bergen, Bergen 5020, Norway

⁷Department of Physiology and Biophysics, Boston University School of Medicine, Boston, MA 02118, USA

⁸These authors contributed equally to this work

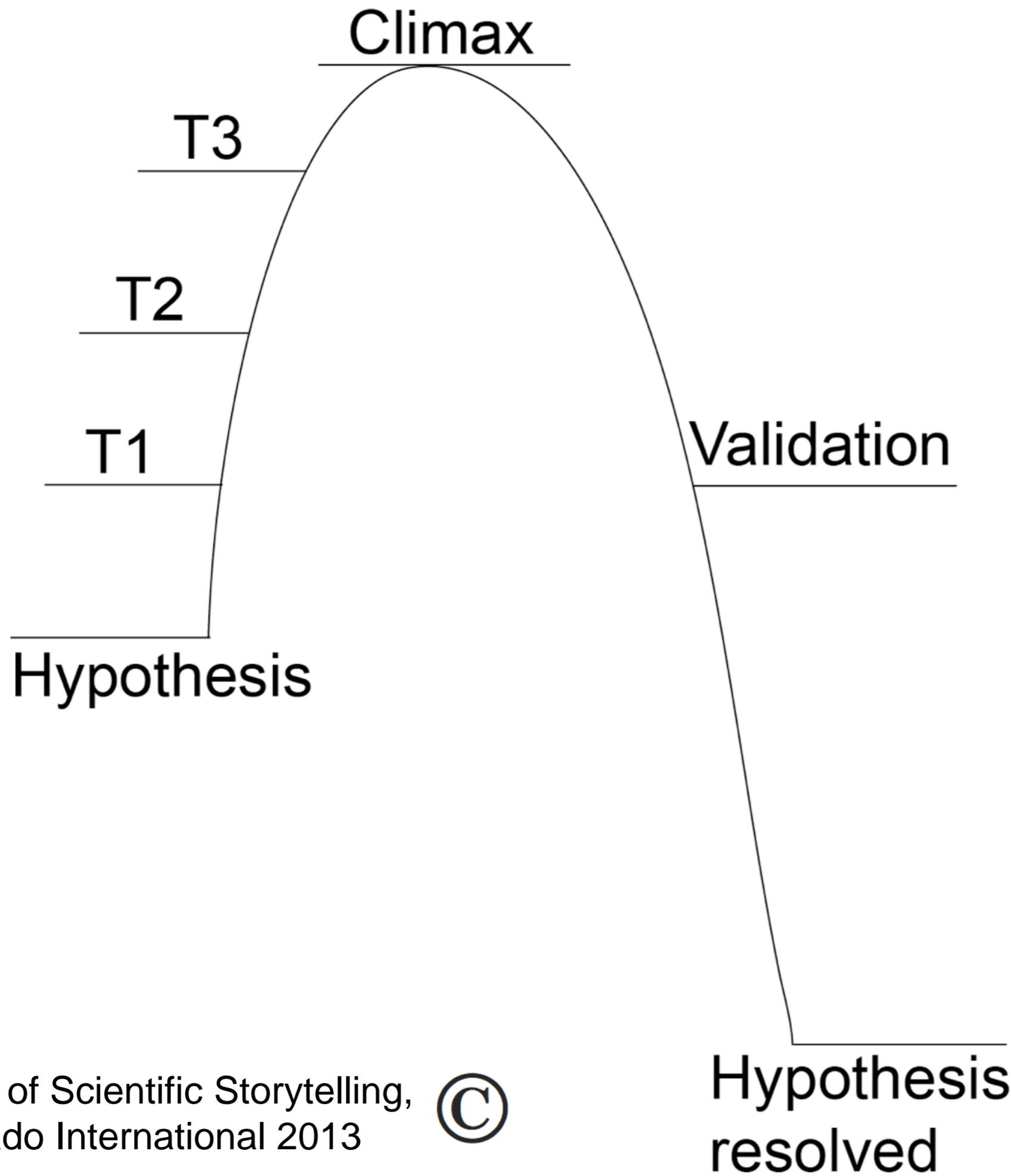
⁹Present address: R&D Division, Bruker BioSpin Corporation, Billerica, MA 01821, USA

¹⁰Present address: Department of Chemical and Biomolecular Engineering, University of California, Berkeley, Berkeley, CA 94720, USA

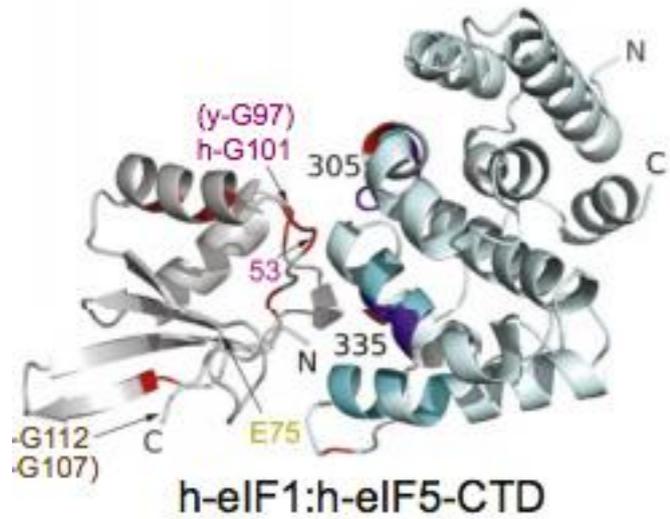
¹¹Present address: Merck & Co. Inc., Rahway, NJ 07065, USA

*Correspondence: gerhard_wagner@hms.harvard.edu

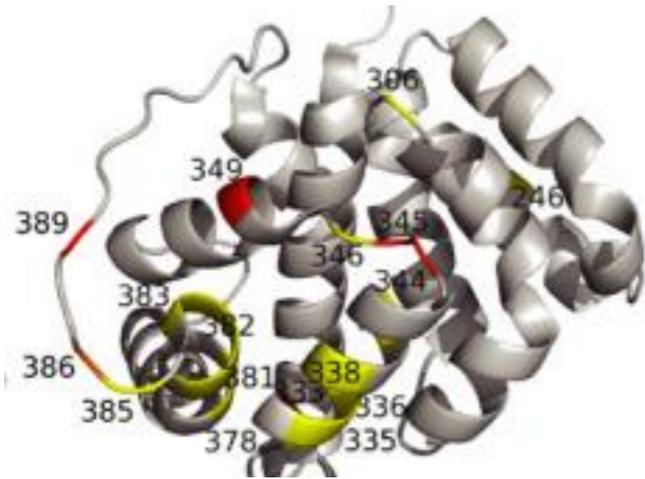
DOI 10.1016/j.celrep.2012.04.007



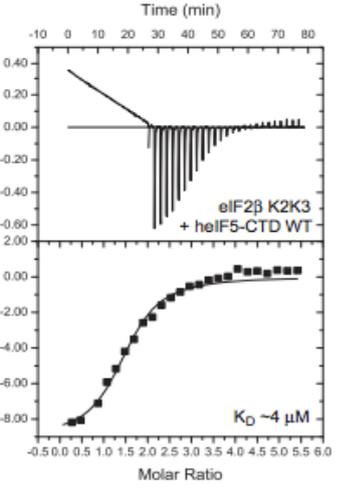
1.)



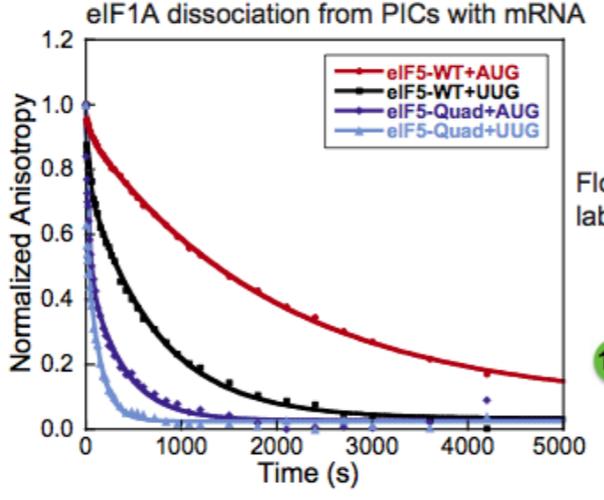
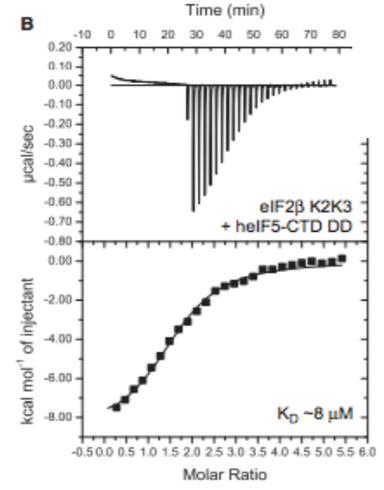
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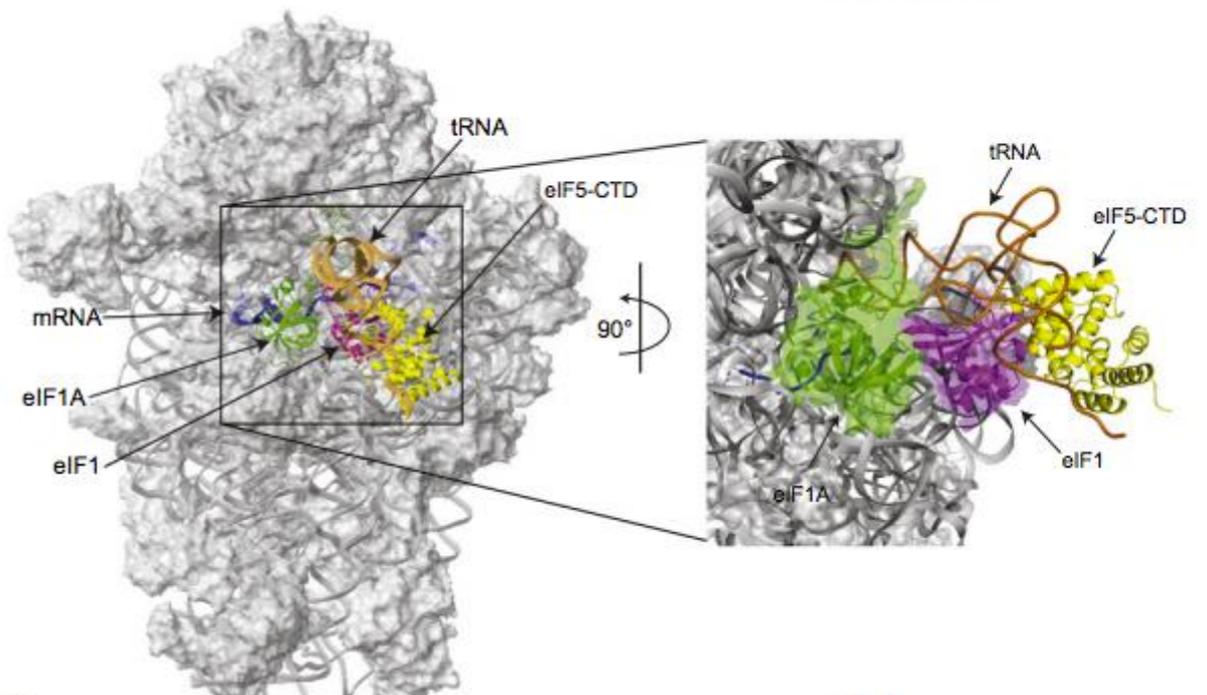
3.)



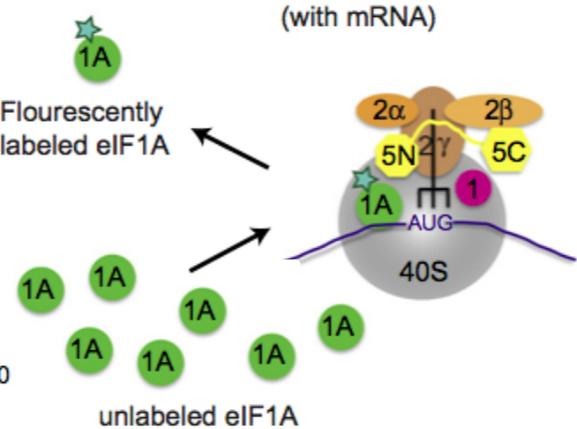
4.)



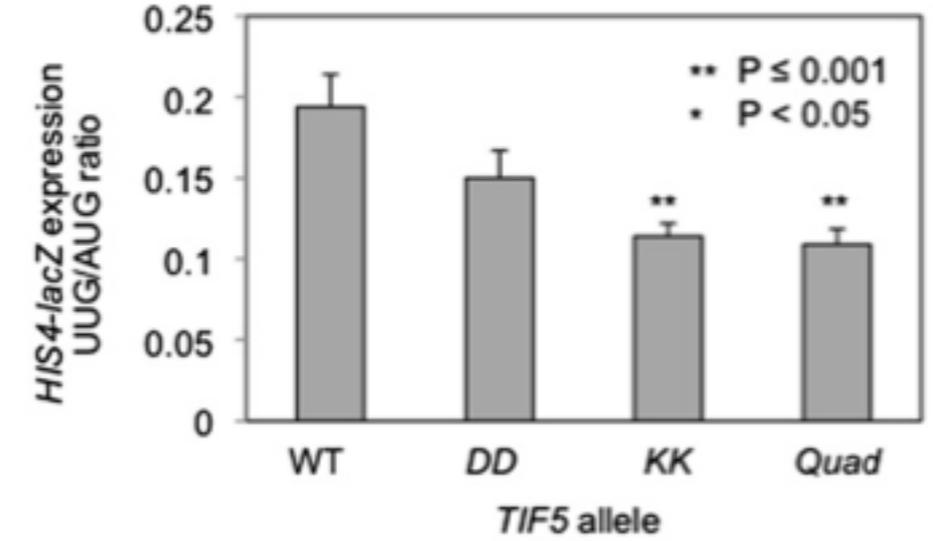
7.)



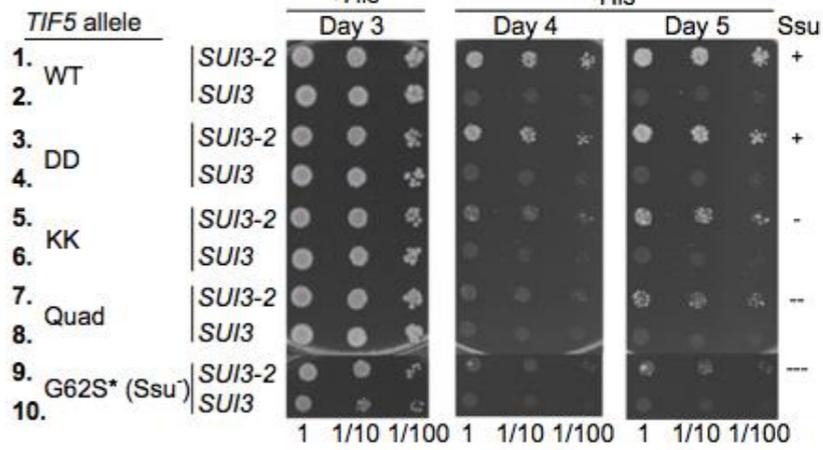
5.)



6.)

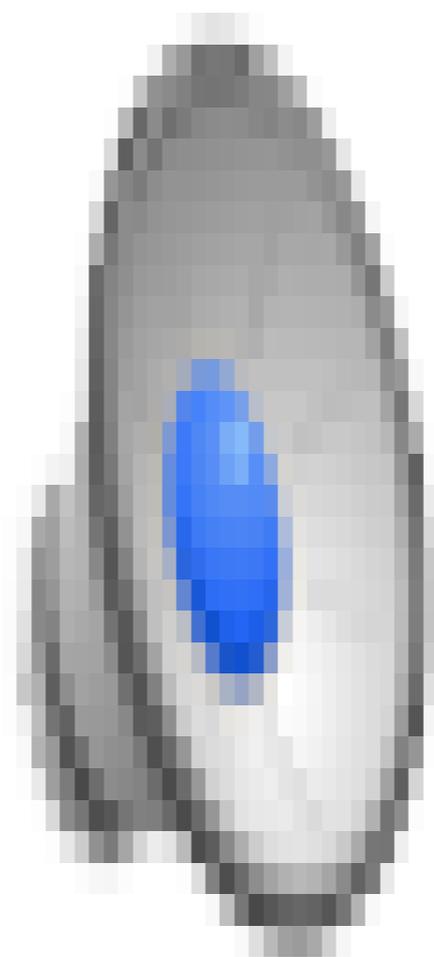


Ssu⁻ assay



Cancer therapeutic
target....

4EGI-1 (space-filled) eIF4E (grey helices, sheets)



(II) Titles that pack a punch

Structure of the eukaryotic translation initiation factor eIF4E in complex with 4EGI-1 reveals an allosteric mechanism for dissociating eIF4G

Evangelos Papadopoulos^a, Simon Jenni^a, Eihab Kabha^{a,b}, Khuloud J. Takroui^{b,c}, Tingfang Yi^a, Nicola Salvi^a, Rafael E. Luna^a, Evripidis Gavathiotis^{d,e}, Poornachandran Mahalingam^{b,f}, Haribabu Arthanari^a, Ricard Rodriguez-Mias^a, Revital Yefidoff-Freedman^{b,c}, Bertal H. Aktas^b, Michael Chorev^b, Jose A. Halperin^b, and Gerhard Wagner^{a,1}

^aDepartment of Biological Chemistry and Molecular Pharmacology, Harvard Medical School, Boston, MA 02115; ^bLaboratory for Translational Research, Harvard Medical School, Cambridge, MA 02139; ^cDepartment of Medicine, Brigham and Women's Hospital, Boston, MA 02115; ^dDepartment of Pediatric Oncology, Dana-Farber Cancer Institute, Boston, MA 02215; ^eJack and Pearl Resnick Campus, Albert Einstein College of Medicine, Bronx, NY 10461; and ^fRowland Institute, Harvard University, Cambridge, MA 02142

Transitioning from Bench Using Scientific Communication

- Publish or Perish in Academia is converted in Scientific Communication in Higher Ed to Shared Governance or Perish
- Challenge to control the message of your work and/or programmatic initiative
- Calibrate career story to impact institutional efforts
- Need evidence of service and committee work

Scientists are Highly Skilled and Accomplished

- Specialized scientific research training acquired over many years
- Required singular, laser-like focus on scientific research
- Focused on being the first to discovery (highly confidential or not sharing information with others)
- Rewarded for being the smartest person in the room (Frequently asked to serve as expert)

Scientific Communication Field Requires Teamwork

Specialized research training acquired over many years needs to be balanced with the following:

- *Communicate and impact a broad audience*
- *Consult team members to get their buy-in*
- *Learn other areas rather quickly and act*
- *Time-scale of execution: Not able to rush the process*

Scientific Communication Requires Completion of Steps

Singular, laser-like focus needs to be balanced with the following:

- *Multi-task and manage competing priorities by completing one step at a time*
- *Eins nach dem Anderen (German for one step after another)*
- *Close the loop on administrative and leadership tasks*

Scientific Communication Requires Relationship Building

Being the first to reach the discovery (highly confidential or not sharing results with others):

- *Focus on being the first to help someone else within your team, across campus and other institutions*
- *Scientific Communication in Higher Education requires transparency in decision making*
- *Share results of initiatives with key stakeholders and give credit where credit is due (praise others in public)*

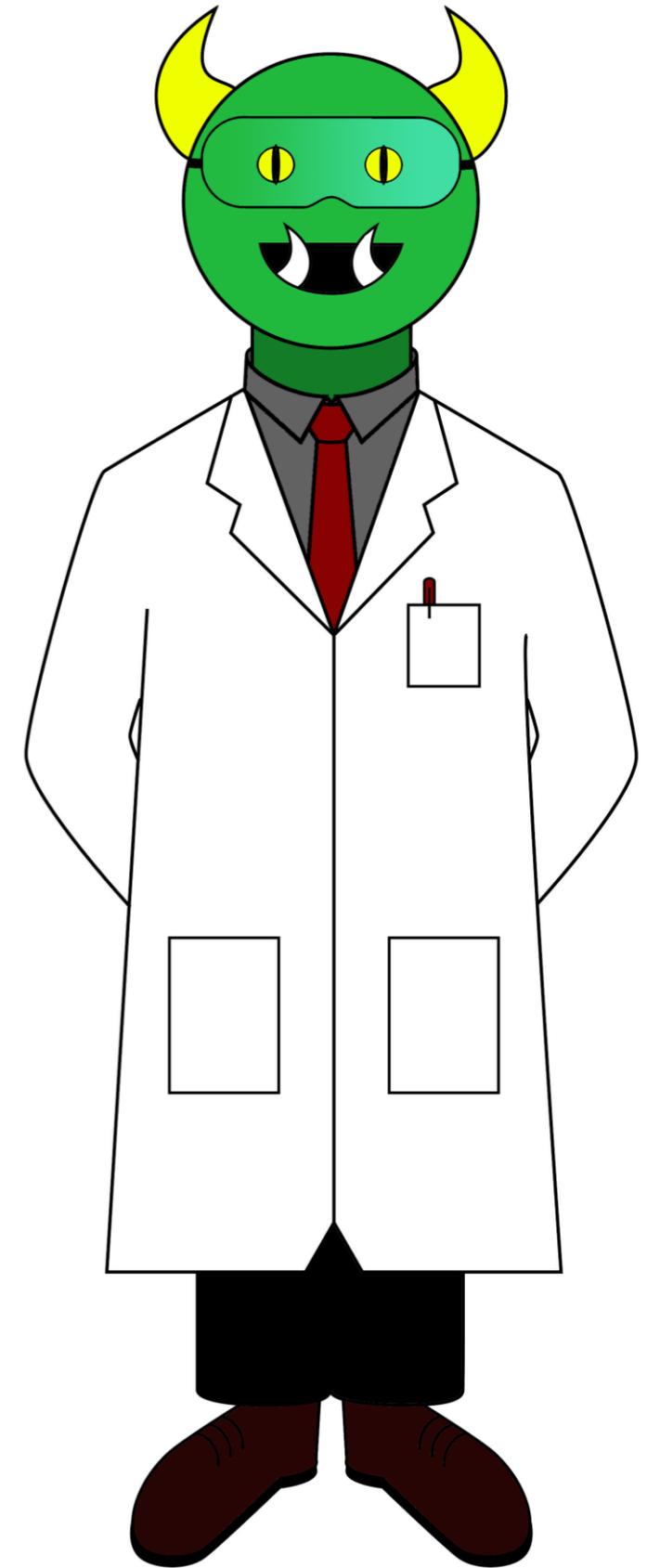
Scientific Communication Requires Relationship Building

Rewarded for being the smartest person in the room
(Frequently asked to serve as expert) needs to be
balanced with the following:

- *No one likes a smarty-pants (German: Schlaumeier)*
- *Reward goes to the person who is the best Team Player*
- *Should focus on being the best listener in the room*
- *Help others shine in meetings and committees*

Thank You!

LUNAR@BC.EDU



Patent Law



Tiphany Dickerson

**Primary Patent Examiner
Operations Research and Analysis Art Unit
United States Patent and Trademark Office**

Poll Question #5 - Patent Law



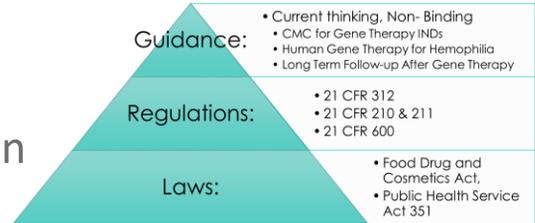
- Do you know anyone who works in Patent Law?
 - A. Yes
 - B. No

Closing Remarks: Summary – Regulatory



- Regulatory work requires:

- Technical expertise
- Written and Oral Communication
- Time management



- Myths about regulatory work include:

- Regulatory positions are boring
- You will not use scientific training in regulatory positions
- It is impossible to get regulatory positions

Closing Remarks: Summary – Science Policy



- Science policy
 - Requires
 - participation by people inside and outside of government
 - scientific expertise
 - understanding policy processes
 - Has both short term and long term capacities
 - Sets goals and funding for running programs
 - Provides informed advice to create policy





Closing Remarks: Summary – Science Communication

- Storytelling is key to success in scientific communication and administrative leadership positions
- Science communication is a narrative process that includes:
 - Protagonist
 - Antagonist
 - Conflict
 - Scene
 - Resolution and Stakes



Closing Remarks: Summary – Patent Law



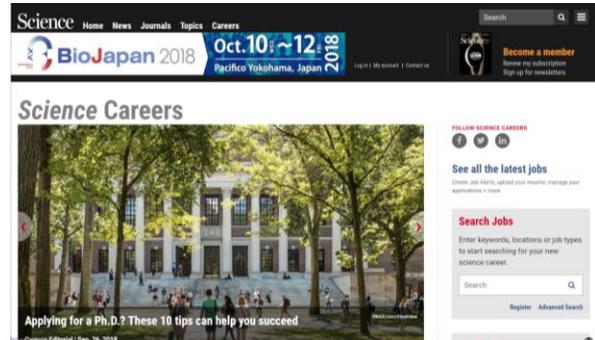
- Patent law requires a combination of scientific and legal expertise including:
 - Communication: written and oral
 - Time management
 - Investigative skills, curiosity
- There are a variety of patent-related careers in the public and private sector
- There are many paths associated with these fields



Closing Remarks – Next Steps



- Follow-up email will contain
 - Post-survey link (please complete so we can get input on future topics...)
 - Webinar recording
 - Webinar slides
 - Resources from panelists
- AAAS Science Careers
<https://www.sciencemag.org/careers>



ERN Program Staff



Yolanda George
Deputy Director
Education & Human Resources
PI: Emerging Researchers
National Conference in STEM



Iris R. Wagstaff
STEM Program Director
Education & Human Resources



Quincy K. Brown
Program Director – STEM
Education Research
Education & Human Resources



THANK YOU



<http://www.emerging-researchers.org/>

AAAS