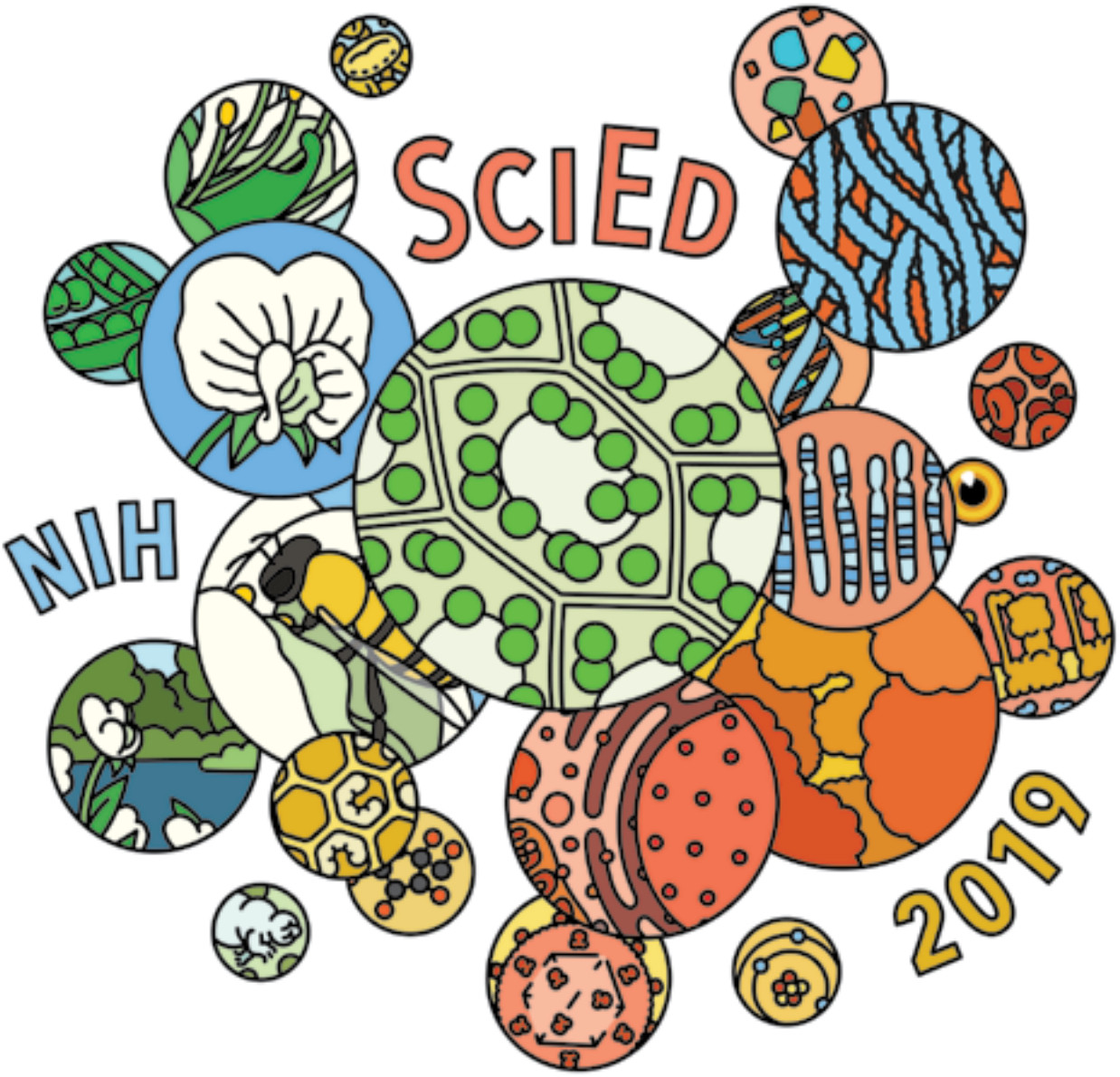
SCIED
NIH
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NIH SciEd 2019

Held April 22-25 in Washington, DC, NIH SciEd 2019 was the eighth NIH-wide P-12 STEM conference and the 24th SEPA PI conference since the program was established in 1991. The 88 projects represented at the conference were funded by the following programs:

- Science Education Partnership Award (SEPA), National Institute of General Medical Sciences (82 projects)
- Youth Enjoy Science Research Education Program, National Cancer Institute (5 projects)
- Enhancing Neuroscience Diversity through Undergraduate Research Experiences (ENDURE), NIH Blueprint for Neuroscience Research (1 project)

The 246 conference registrants included 78 project PIs, 27 Co-PIs, 22 project managers, 32 project staff members, 7 internal evaluators, 8 external evaluators, 3 graduate students, 2 post-doctoral fellows, 2 teachers, 26 other individuals, 27 NIH staff (NIGMS, NHGRI, NCI) and 12 staff from other federal agencies involved in science, technology, engineering and mathematics (STEM) education at the pre-kindergarten – grade 12 and public levels (National Science Foundation, U.S. Department of Education, and the U.S. Army Medical Research and Materiel Command).

The conference began with a keynote address by Jon R. Lorsch, PhD, director of NIH NIGMS, who highlighted the NIH strategic plan for data science and ways this focus is being implemented, including in SEPA projects. He also highlighted new initiatives in the IDeA program and NIGMS science education outreach efforts. In the next keynote address, Eliseo J. Pérez-Stable, MD, director of NIH NIMHD, spoke about health disparities, their effects on children, and promoting health equity for all youth. And in a third keynote, Maryam Zaringhalam, PhD, AAAS Science & Technology Policy Fellow and Senior Producer at the StoryCollider, gave an inspiring presentation about the power of storytelling for engaging people in science. On the second morning of the conference, Leslie Goodyear, PhD, Principal Research Scientist at the Education Development Center, highlighted the elements of high-quality project evaluations. On the final day of the conference, plenary and breakout sessions focused on preparing competitive grant proposals.

Twenty-nine breakout sessions addressed broadening participation, curriculum development, informal science education, research experiences for students and teachers, science teaching and learning, teacher professional development, research and evaluation, and project administration. Eighteen roundtable discussions provided opportunities to learn from other projects in an informal, small-group format. The NCI YES program also held a satellite PI meeting. All projects were invited to present a poster about their work during one of two poster sessions and to give a 1-minute "Flash" talk highlighting their poster. Participants reported that the most valuable things they gained from the conference were learning about and from other projects; learning about evaluation tools and resources; learning about other funding options; and--as always--networking, reconnecting, and finding new collaborators.

NIH SciEd 2018 Conference Organizing Committee

Individuals' names are followed by the strand they co-organized or their role.

Kristin Bass, PhD, Rockman Et Al *(Science Teaching and Learning)*

Karin Chang, PhD, University of Kansas *(Research and Evaluation)*

Dina Drits-Esser, PhD, University of Utah (Assistant Chair)

Melani Duffrin, PhD, Northern Illinois University *(Teacher Professional Development)*

Robin Fuchs-Young, PhD, Texas A&M Health Science Center *(Broadening Participation)*

Barbara Hug, PhD, University of Illinois *(Curriculum Development)*

Michael Kennedy, PhD, Northwestern University *(Science Teaching and Learning)*

Christopher Pierret, PhD, Mayo Clinic - Rochester *(Curriculum Development)*

Alana Newell, PhD, Baylor College of Medicine *(Research and Evaluation)*

Carla Romney, DSc, MBA, Boston University School of Medicine *(Science Teaching and Learning)*

Robert L. Russell, PhD, National Science Foundation *(Science Teaching and Learning)*

Louisa A. Stark, PhD, University of Utah (Chair)

Gwendolyn M. Stovall, PhD, University of Texas at Austin *(Teacher Professional Development)*

Jennifer A. Ufnar, PhD, Vanderbilt University *(Research Experiences)*

Michelle Venture-Ezeoke, PhD, Georgia State University *(Informal Science Education)*

Laurie Jo Wallace, MA, Health Resources in Action, Inc. *(Informal Science Education)*

Kelley Withy, MD, PhD, University of Hawaii *(Broadening Participation)*

J. Michael Wyss, PhD, University of Alabama at Birmingham *(Project Administration)*

Debra L. Yourick, PhD, Walter Reed Army Institute of Research *(Research Experiences)*

Cooperative Agreement Program Management

Tony Beck, PhD, Program Director Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences, NIH

Conference Support

Funding for this conference was made possible by the Cooperative Agreement U13GM129167 from the National Institute of General Medical Sciences, the National Institutes of Health. The views expressed in written conference materials or publications and by speakers and moderators do not necessarily reflect the official policies of the Department of Health and Human Services; nor does mention of trade names, commercial practices, or organizations imply endorsement by the U.S. Government.

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Report prepared by

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Genetic Science Learning Center, University of Utah

Conference Schedule

Monday, April 22

4:00-6:00	Conference Check-in Grand Foyer (Declaration Level, 1B)
5:00-7:00	Networking Session Grand Foyer (Declaration Level, 1B)

Tuesday, April 23

All sessions meet in Independence Ballroom, East unless otherwise noted.

7:15-8:30	Breakfast and Poster Set-up
7:30-8:30	Conference Check-in
8:30-8:45	***Welcome*** Louisa A. Stark, PhD, Chair, NIH SciEd 2019 Conference Organizing Committee, Professor of Human Genetics, and Director, Genetic Science Learning Center, University of Utah Judith Vaitukaitis, MD, Memorial and Scholarships Carla Romney, DSc, MBA, PI, CityLab and Urban Squash: A New Pathway to Achieve STEM Success project, Boston University School of Medicine
8:45-8:55	***Welcome & Introduction of Dr. Jon R. Lorsch*** Ming Lei, PhD, Director, Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH
8:55-9:40	***Keynote Address: NIGMS Update*** Jon R. Lorsch, PhD, Director, National Institute of General Medical Sciences (NIGMS), NIH
9:40-9:45	***Introduction of Dr. Eliseo J. Pérez-Stable*** Ming Lei, PhD, Director, Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH
9:45-10:30	***Keynote Address: The Future is Now: Promoting Health Equity in America's Youth*** Eliseo J. Pérez-Stable, MD, Director, National Institute on Minority Health and Health Disparities (NIMHD), NIH
10:30-10:45	Break
10:45-11:30	***Keynote Address: Scientists are People Too: Breaking Barriers Through Science Communication*** Maryam Zaringhalam, PhD, AAAS Science & Technology Policy Fellow; Senior Producer, StoryCollider
11:30-11:50	***Update on the SEPA Program***

Tony Beck, PhD, Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH

11:50-12:10 ***Programs to Enhance Diversity in the Biomedical Research Workforce***

Alison Gammie, PhD, Director, Division of Training, Workforce Development and Diversity, National Institute of General Medical Sciences (NIGMS), NIH

12:10-1:45 Lunch

Mentor-Mentee groups meet for newly-funded SEPA projects
Independence Ballroom, West

Informal Discussion with Maryam Zaringhalam (keynote speaker)
Lafayette Park

Table Discussions
Independence Ballroom, East

1:45-2:05 ***Flash Talks for Poster Session 1***

2:05-3:00 ***Poster Session 1 (odd-numbered posters)***

3:00-3:15 Break

3:15-4:30 ***Concurrent Breakout Sessions***

Investigating Inclusive Curricula in the Science Classroom: Scientist Spotlight Homework Assignments
Presenters: Jeff Schinske, Kimberly Tanner
Strands 1 & 7: Broadening Participation; Science Teaching & Learning
Room: Lafayette Park

An Introduction to Curriculum Development Using Backwards Design Principles for Formal and Informal Learning Environments
Presenters: Nancy Moreno, Alana Newell
Strands 2 & 3: Curriculum Development; Informal Science Education
Room: Farragut Square

The Power of Media to Engage Latinx Students and Families in the STEM Ecosystem
Facilitator & Panelists: Robert L. Russell, Alicia Santiago, Leah Clapman
Strands 3 & 1: Informal Science Education; Broadening Participation
Room: Independence Ballroom, West

What Doesn't Work – Learning from Negative Results
Presenters: Michael Carapezza, Aaron Kyle, Marie Barnard, Bret Hassel
Strand 5: Research and Evaluation
Room: Independence B/C

Measuring STEM Mindsets
Presenters: Karin Chang, Julia McQuillan, Rebecca Smith, Amy Spiegel, Linda Morell
Strand 5: Research and Evaluation
Room: Franklin Square

Continuity of Student Research Experiences
Panelists: Jennifer A. Ufnar, Debra L. Yourick, Jane E. Disney, Robin W. Rockhold, Marlys Hearst Witte, Idit Adler
Strand 6: Research Experiences
Room: McPherson Square

Designing Innovative Experiences to Engage Students in Inquiry
Facilitator & Presenters: Kristin Bass, Tim Indahl, Anja Scholze
Strand 7: Science Teaching & Learning
Room: Independence D/E

4:30-4:45 Break

4:45-5:05 ***Flash Talks for Poster Session 2***

5:05-6:00 ***Poster Session 2 (even-numbered posters)***

Networking Session

Dinner on your own

Wednesday, April 24

All sessions meet in Independence Ballroom, East unless otherwise noted.

7:15-8:30 Breakfast

Meeting for New SEPA PIs
Tony Beck, PhD, Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH
Lafayette Park

8:30-9:30 ***Keynote Address: Elements of Evaluation Quality: Questions, Answers and Resources***
Leslie Goodyear, PhD, Principal Research Scientist, Education Development Center; past president, American Evaluation Association

9:30-9:45 Break

9:45-11:00 ***Concurrent Breakout Sessions***

Curriculum Development and Using Lessons Learned: Looking Across Informal and Formal Contexts, What Can We Learn from Each Other?
Presenters: Barbara Hug, Idit Adler, Renee Bayer, Katherine Richardson Bruna, Susan Hershberger, Christopher Pierret, Mary Jo Koroly, Sara Erickson
Strands 2 & 3: Curriculum Development; Informal Science Education
Room: Farragut Square

WHAM! BANG! SLAM! Reading and Making Comics: Innovative Pathways to STEM Content
Presenters: Martin Weiss, Wren Thompson, Laycca Umer
Strands 3 & 7: Informal Science Education; Science Teaching & Learning
Room: McPherson Square

Patents, Copyright and Trademarks: Commercial Protection for Your New Product
Presenter: Mark Rohrbaugh
Strand 4: Project Administration
Room: Franklin Square

Developing Indicators of a High-Quality SEPA Evaluation
Facilitator & Panelist: Louisa A. Stark, Leslie Goodyear
Strand 5: Research and Evaluation
Room: Independence B/C

Designing Effective STEM Experiences for Elementary-Aged Students: A Developmental Perspective
Facilitator & Panelists: Robert L. Russell, Nancy Moreno, Michelle Ventura Ezeoke
Strand 7: Science Teaching & Learning
Room: Independence A, West

Town Hall to Talk about Big Data and Develop a Plan for a 2020 and Longer Approach to Incorporating it into SEPAs.
Facilitator & Panelists: Mike Wyss, Carla Romney, Ralph Imondi, Charles Wray
Strand 7a: Science Teaching & Learning: Big Data
Room: Independence D/E

National Cancer Institute Youth Enjoy Science (YES) Program Meeting
Note: This session meets 9:45-12:30. The first half of the meeting (9:45-11:00) is open to everyone. The second half of the meeting (11:15-12:30) is only for current YES grant recipients.
Facilitator: Alison Lin
Room: Lafayette Park

11:00-11:15 Break

11:15-12:30 ***Concurrent Breakout Sessions***

Engaging Native Students in STEM Experiences
Presenters: Kelley Withy, Bonnie Sachatello-Sawyer, Tana Chandler, Mary Larson, Victoria Coats, George Shipley
Strand 1: Broadening Participation
Room: McPherson Square

Exploring Common Themes in Diabetes and Obesity Education
Presenters: Joan Griswold, Atom Lesiak
Strand 2: Curriculum Development
Room: Independence D/E

Short- and Long-Term Evaluation for SEPA/INBRE and COBRE Partnerships
Facilitators: Rashada Alexander, Krishan Arora
Strand 5: Research and Evaluation
Room: Independence East

Preparing Students for Research Experiences
Panelists: Debra L. Yourick, Jennifer A. Ufnar, Gwendolyn M. Stovall, Rebecca Smith, Farrah Jacquez, Lisa Vaughn

Strand 6: Research Experiences
Room: Franklin Square

DEMO of How Big Data Programs Can Advance Learning
Facilitator & Presenters: Kristin Bass, Stephen Koury, Andrea Panagakis, Bruce Nash
Strand 7a: Science Teaching & Learning: Big Data
Room: Independence B/C

Teacher Professional Development Curricular Quality
Presenters: Melani Duffrin, Virginia Stage
Strand 8: Teacher Professional Development
Room: Farragut Square

National Cancer Institute Youth Enjoy Science (YES) Program Meeting
(YES PI Meeting, continued). Note: The second half of the meeting (11:15-12:30) will be a closed meeting for current YES grant recipients.
Facilitator: Alison Lin
Room: Lafayette Park

12:30-1:50 Lunch

1:50-2:10 ***Round Table Flash Talks***

2:15-3:45 ***Round Table Discussions/Presentations (3, 30-minute discussions/table)***

Table #	Title	Presenters	Strand
1	Addressing Structural Barriers to STEM Participation through Games	Mason W Arrington	1. Broadening Participation
2	Science as Diversity Pedagogy: The TriSC3i (Cognition, Culture, & Communication) Learning Framework	Katherine Richardson Bruna Sara Erickson	1. Broadening Participation
3	Bioscann: A Web-based Interactive Curriculum to Promote Career Awareness in High School Students	Berri Jacque	2. Curriculum Development
4	Collaborative Curriculum Development with Teachers in the Era of NGSS	Jeanne Chowning Regina Wu	2. Curriculum Development
5	Utilizing Public Libraries to Reach Underserved and Underrepresented Audiences	Anne Holland	3. Informal Science Education
6	Engaging High School and College Students as Peer Leaders and STEM Educators	Laurie Jo Wallace Michelle Ventura Ezeoke Brandon Morgan	3. Informal Science Education
7	Creating and Managing Participant Web Resources: Institutional Firewalls and IT Security	Charles Wray	4. Project Administration
8	How to Increase Parent Involvement in Programming: A Discussion and Sharing of Ideas	Melinda Gibbons Erin Hardin	4. Project Administration
9	How to Navigate the World of a SEPA Application	Jan Straley	4. Project Administration

10	Possible Use of the Multi-dimensional Health Locus of Control for Evaluation of the Effect of a Project on Changes in a Community's Health and Understanding of Health	Susan Hershberger	5. Research & Evaluation
11	Using Structured Problem-solving Assignments to Enhance Knowledge: From Description to Reasoning	Ang Chen	5. Research & Evaluation
12	Commonly Used Evaluation Tools Utilized in SEPA Projects	Tony Ward Kevin Phelan	5. Research & Evaluation
13	Practicalities of Publishing	Michael Kennedy Jennifer Ufnar Kristen Bass	5. Research & Evaluation
14	Don't Have Enough Research Options for Your Students? Try Distance Research!	Kelley Withy	6. Research Experiences
15	Portable and Wearable Technologies in Science Learning	Ido Davidesco Wendy Suzuki	7. Science Teaching & Learning
16	Virtual Teacher PD: How, What, and When?	Joan Griswold Atom Lesiak	8. Teacher Professional Development
17	High School Teacher PD Models: Workshops, Extended Summer Training, and/or On-going Trainings	Gwendolyn M. Stovall Michael Carapezza Dina Drits-Esser	8. Teacher Professional Development
18	Genuine Research Experiences for Teachers: Fostering Mentors of Student Research. Reflections on Multi-year, Intensive PD by SEPA Project Leaders and a Participating Teacher	Marisa Pedulla Rayelynn BrandL Linda Rost	8. Teacher Professional Development

3:45-4:00 Break

4:00-5:15 ***Concurrent Breakout Sessions***

Engaging Middle School Students in Hands-On, After-School Science Activities while Enhancing the Workforce Preparation for Undergraduates Via the NE STEM 4U Intervention

Presenters: Christine Cutucache, Julia McQuillan, Michelle Phillips, Amy Spiegel, Grace Stallworth, Trish Wonch-Hill

Strand 3: Informal Science Education

Room: Lafayette Park

SEPA Synergies Across Federal Programs

Introductions & Presenters: Mike Wyss, Robert Russell (NSF), Patrick Brown (NIH), Kathleen B. Bergin (NSF)

Strand 4: Project Administration

Room: Franklin Square

Spreading the SEPA: Exploring Fidelity and Outcomes Across Sites Nationwide
Presenters: Loran Carleton Parker, Lindley McDavid, Weiling Li, Sandra F. San Miguel, Adrianne Fisch, Grace Craig
Strand 5: Research and Evaluation
Room: Independence East

Inclusive Measurement of STEM Development Among Students: Supporting Equity and Early Identification of STEM Disparities
Presenters: Lisa Marriott, Kristin Bass, Alana Newell
Strands 5 & 1: Research and Evaluation; Broadening Participation
Room: Independence B/C

Authentic Research Experiences for K-12 Teachers and Students: Programs Aimed at Increasing STEM Workforce Diversity
Panelists: Robin Fuchs-Young, Taylir Schrock, Laurie Jo Wallace, Kelley Withy
Strands 6 & 1: Research Experiences; Broadening Participation
Room: Wilson/Roosevelt (Constitution Level, 3B)

Sharing Resources and Strategies for Teaching Data Analysis
Presenters: Carla Romney, Donald DeRosa, Carl Franzblau, Obi Onochie
Strand 7: Science Teaching & Learning
Room: Independence D/E

Best Practices and Logistics for Teacher Professional Development: On-site, Extended, and/or Online – Your Pick!
Panelists: Gwendolyn Stovall, Louisa Stark, Nancy Moreno, Mary Jo Koroly
Strand 8: Teacher Professional Development
Room: Farragut Square

Take down all posters

Dinner on your own

Thursday, April 25

All sessions meet in Independence F-I unless otherwise noted.

7:15-8:30 Breakfast

Meeting for Potential SEPA Applicants
Tony Beck, PhD, Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH
Lafayette Park

8:30-10:00 ***Preparing Competitive Grant Proposals: A Multi-Agency Perspective***
Tony Beck, PhD, Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH

Christina S. Chhin, PhD, Education Research Analyst, Program Officer – STEM Education Research, Institute of Education Sciences, National Center for Education Research, U.S.

Department of Education

Alison Lin, PhD, Program Director, Diversity Training Branch, NIH/NCI Center to Reduce Cancer Health Disparities, National Cancer Institute, NIH

Rajesh Mehta, PhD, Program Director for Educational Technologies and Applications, SBIR Program, National Science Foundation

Edward Metz, PhD, Research Scientist and Program Manager, SBIR Program, Institute of Education Sciences, National Center for Education Research, U.S. Department of Education

Robert L. Russell, PhD, Program Director, Division on Research and Learning, Directorate for Education and Human Resources, National Science Foundation

10:00-10:30 ***Leveraging Your SEPA Grant for Additional Funding***

Melinda Gibbons, PhD, Professor of Educational Psychology & Counseling, University of Tennessee Knoxville

Berri Jacque, PhD, Assistant Professor of Medical Education, Tufts Medical School

Lisa K. Marriott, PhD, Assistant Professor of Health Promotion & Environmental Systems and Human Health, Oregon Health & Science University

Kim Soper, MS, Munroe Meyer Institute, University of Nebraska Medical Center

J. Michael Wyss, PhD, Professor and Director, University of Alabama at Birmingham

10:30-10:45 Break

10:45-11:45 ***Concurrent Breakout Sessions***

Connecting the Dots: An Introduction to Logic Models for Project Planning, Management and Evaluation
Presenters: Nancy P. Moreno, Ann Chester, Robin W. Rockhold
Room: Lafayette Park

Writing a Rigorous Evaluation Plan for Your Next Proposal: Practical Considerations
Presenters: Kristin Bass, Louisa A. Stark, Dina Drits-Esser
Room: Wilson/Roosevelt (Constitution Level, 3B)

How Do Small Businesses Get Started with SBIR and STTR Programs?
Presenters: Melani Duffrin, Dina G. Markowitz, Tim Herman
Room: Farragut Square

Curricular Tools Flea Market
Organizers: Christopher Pierret, Tim Indahl, Seth Thompson
Room: Independence F-I

Table Numbers, Projects, Institutions, and Presenters:

1. A New Genomic Framework for Schools and Communities, Michigan State University, Renee Bayer
2. ARC: Building Awareness, Respect, and Confidence through Genetics, Harvard Medical School, Marnie Gelbart

3. Barcode Long Island: Exploring Biodiversity in a Unique Urban Landscape, Cold Spring Harbor Laboratory, Bruce Nash
4. Genes and Microbes: Engaging Students and Teachers in NGSS-Aligned Curricula and Professional Development, University of Utah, Ryan Perkins
5. HSTA Citizen Science: Adolescents Addressing Childhood Obesity through Early Childcare Facilities, West Virginia University, Anne Chester
6. Sharing ASSETs: Expanding Science Opportunities in K-12 Classrooms, Cornell University, Donna Cassidy
7. STEM Escape: Immersing Urban and Rural Families in a Biomedical Mystery, University of California Museum of Paleontology, Anastasia Thanukos
8. Turning K-12 Environmental STEM Education InSciEd Out, Mayo Clinic, Christopher Pierret

11:45-12:00 Break

12:00-12:30 ***Town Hall Discussion***
Tony Beck, PhD, Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH

Lunch on your own

Keynote Address
Tuesday, April 23, 2019 – 8:55 AM – 9:40 AM

NIGMS Update

Presenter: **Jon R. Lorsch, Ph.D.,** *Director, National Institute of General Medical Sciences (NIGMS), NIH*

Reporter: **Michael Kennedy,** *Northwestern University*

Dr. Lorsch Announced SEPA's new administrative home in the Division for Research Capacity Building, alongside three other NIGMS programs: Institutional Development Award (IDeA); Native American Research Centers for Health (NARCH); and Support of Competitive Research (SCORE). This alignment positions SEPA as a synergistic partner in the Division's broader goal of supporting educational institutions and communities that historically have not received significant levels of research funding from NIH and/or supported students from underrepresented groups (website: *https://www.nigms.nih.gov/research-areas/areas-of-research/research-capacity-building*)

Last year NIH released its new 5-year Strategic Plan for data science, Dr. Lorsch co-chairs this e-committee. The new plan contains a significant focus on training and national workforce development in the areas of bioinformatics and data science. This includes enhancing quantitative and computational training for post-secondary students and postdocs, as well as engaging the broader community through code-a-thons and other informal education initiatives.

Furthermore, recent educational research suggests a deeper focus on developing K-12 students' quantitative skills may mitigate wide socioeconomic disparities in college graduation rates. Currently, there are nine SEPA projects with a focus related to quantitative and computational skill development. Dr. Lorsch would like to see a stronger emphasis in this area for all projects, especially for new grant proposals. However, PIs need not focus exclusively on computational areas, but they should consider specifically tailoring programs to develop/measure changes in quantitative skills.

The new data science emphasis also includes NIGMS's broader training portfolio. T32 and T34 program objectives have been revised to include, "A strong foundation in scientific reasoning, rigorous research design, experimental methods, quantitative and computational approaches, and data analysis and interpretations." The undergraduate research-focused AREA program (Academic Research Enhancement Award; R15), which awards small-scale research grants to primarily undergraduate institutions, has been updated to reflect a priority focus on developing students' computational skills through interdisciplinary collaborations. For example, the Northeast IDeA region consortium shares its bioinformatics resources. Six different projects have combined to develop a new initiative to sequence the skate (fish) genome. The partnership includes components designed to bring students into the authentic research enterprise to create synergies and efficiencies in research and education (web link: *http://skatebase.org*).

Dr. Lorsch also discussed a new cloud computing and storage initiative called STRIDES (*https://datascience.nih.gov/strides*). This is a partnership with cloud computing companies (storage and computational services, artificial intelligence, etc.) aimed at decreasing cost and increasing efficiency. He suggested SEPA PIs should consider how their projects might leverage the new STRIDES partnership.

One last key issue related to data science—rigorous and reproducible research—was considered. For obvious reasons, reproducible research is a critical part of the scientific enterprise. We are in an era when large amounts of data can be collected, stored, and shared. This brings new questions related to the ethical uses of large data sets, data security, and ensuring the rigor of conclusions reached from examining large data sets. It is very important to start training students in these areas so they are prepared to effectively deal with the social, legal, and ethical issues of large data analyses.

Additional items:

- NIGMS recently formed a partnership with academic publisher Scholastic to provide content related to NIGMS-funded research for middle and high school students. The result is Pathways - a biomedical research magazine specifically designed for 6th- to 12th-graders. It features curriculum and teaching guides, videos, online activities, and even quizzes. The first issue, which has been published, will reach 20,000 schools across the country (Scholastic.com/pathways). If PIs have ideas for engaging students via Pathways, please let Dr. Lorsch know.
- Update on the National Science and Engineering Festival: NIGMS has taken a lead role in representing NIH. Last year's expo drew more than 365,000 people. NIGMS featured several engaging activities for the public, including a virtual reality protein structure activity and a protein structure alphabet printer. Additionally, the festival served as a site for SEPA-led health experiments. SEPA PI Ann Chester coordinated a group of high school students from West Virginia University's Health Sciences and Technology Academy (HSTA) program, who collected health-related data from attendees, analyzed it, and published it online. For the coming year (2020), Dr. Lorsch is IC co-chair for NIH's involvement. He invited SEPA PIs to help him "raise NIH's game" to the level of NASA. He indicated Diabetes or infectious diseases might be potential focuses. Dr. Lorsch is happy to connect interested PIs with the relevant NIH institute for further discussion.
- NIGMS recently launched a new "STTR Regional Accelerator Hub" initiative to promote the development of new small businesses through its Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) grant programs. The regional hubs, consisting of a major academic institution and a business partner, are designed to assist researchers with developing their ideas into small businesses. SEPA PIs in IDeA states should consider utilizing hub resources in the development of SBIR/STTR proposals.

Keynote Address
Tuesday, April 23, 2019 – 9:40 AM – 10:30 AM

The Future is Now: Promoting Health Equity in America's Youth

Presenter: **Eliseo J. Pérez-Stable, MD,** *Director, National Institute on Minority Health and Health Disparities (NIMHD), NIH*

Reporter: **Debra Yourick,** *Walter Reed Army Institute of Research*

Dr. Eliseo Perez-Stable began by defining minority health research as "research that focuses on health determinants that lead to specific outcomes within a minority group and, in comparison to others." He went on to list the Office of Management and Budget (OMB) census categories: African American or Black; Asian,; American Indian or Alaska Native,; Native Hawaiian or other Pacific Islander,; White (Europe, Middle East, N. Africa); more than one race and Latino or Hispanic. Populations experiencing health disparities include these minorities defined by OMB, along with those of less privileged socio-economic status, underserved rural residents, and sexual gender minorities. When health outcomes are worse for these populations as compared to a reference group, a health disparity exists. Hence, social disadvantage leads to health care disadvantage.

Dr. Perez-Stable continued by delineating the mechanisms by which health disparities occur. Examples are many but fall into four categories: 1) individual lifestyles, beliefs and attitudes; 2) biological processes and genetics; 3) physical and cultural environment; and 4) clinical events and health care. He said that research interest in this area has exploded and is focused not on a single disease but rather all diseases and is seen in a social context. For instance, higher incomes, over $115,000 per year, are associated with longer life and are as good an indicator as BMI. Many minority groups have shown recent lifespan gains as indicated by the data, but increased poverty for children concerns many and evidence suggests it leads to poor outcomes in brain development for affected adolescents. Causes of childhood mortality are quite mixed, but infant mortality has improved since 2005, although the reasons are not clear. The playing field has been leveled in terms of vaccination for childhood infections but smoking remains a problem and obesity is the next biggest concern on the horizon, especially for Hispanics. Indoor smoking bans have led to better outcomes related to heart attacks and other outcomes, however, vaping percentages (primarily among white youth whereas American Indian and Pacific Islanders smoke tobacco) have exploded and are an enormous unknown in terms of health because of the many additives in vaping with unclear toxicity profiles.

Next, Dr. Perez-Stable explained the developmental origins of health disparities for children and emphasized that adverse early childhood events and unprotected immigrant mothers and their children will have poor health outcomes because of trauma, violence, discrimination, food and housing insecurity and family dysfunction.

He went on to say that good policy, based on the data, can promote youth health equity. Policy strategies to promote health equity for youth include:

- Preventive health care to address vaccines, social environment, and behavior
- Adolescents: focus on sex, substances and mental health
- Primary care as the central pillar

- Nutrition: real food and not too much, with family/group meal times
- Physical activity and sleep

Proper navigation of the digital world was also emphasized by Dr. Perez-Stable as a means to alter health trajectory. For instance, he said screen time such as the presence of phones on the dinner table should not replace human interactions, rather, consumers should leverage learning and information access to benefit health.

Dr. Perez-Stable concluded his talk by suggesting future directions for research that include multi-level interactions to address disparities. Specifically, researchers must identify mechanisms leading to disparities, whether biological pathways, social determinants, behavior or systems. By the same token, Health care entities should assess communication strategies to maximize trust within communities with structural change being the most potent means to modifying health behavior. In addition, it's important to recognize that physicians who come from underrepresented groups tend to take the best care of patients in those groups.

Questions from the audience were taken: the first question addressed how providers should ask about race and ethnicity. Dr. Perez-Stable endorsed asking nonthreatening questions that would help providers with categorization to improve health outcomes. A second question focused on high school students' interest in health equity and Dr. Perez-Stable suggested that the lens for any discussion should be carefully considered and that health equity research works well with basic science for underserved youth. A third question dealt with how to teach students about gender categories and Dr. Perez-Stable made it clear that using the standard ways to communicate sexual orientation should be incorporated. A second part of the third question asked how learning about health disparities could worry the affected groups. At this point, Dr. Perez-Stable said that feeling well should be the guide and that there should be a high bar for any medical treatment for these populations. For general good health he emphasized good sleep, appropriate physical activity and eating healthy food rather than consuming vitamin supplements, for the best nutrition.

Keynote Address
Tuesday, April 23, 2019 – 10:45 AM – 11:30 AM

Scientists are People Too: Breaking Barriers Through Science Communication

Presenter: **Maryam Zaringhalam, Ph.D.,** *AAAS Science & Technology Policy Fellow; Senior Producer, StoryCollider*

Reporter: **Barbara Hug,** *University of Illinois Urbana-Champaign*

Dr. Zaringhalam mused that she is often asked by high school students about the importance of getting good grades in science courses if they are interested in a scientific career. Her opinion is that grades are not as important as conventional wisdom would suggest, but are often used as "gate keepers" of further success. She suggested we need to rethink this philosophy. Furthermore, in her experience as a student, she was asked only to answer the questions asked of her in class, but after joining a lab as an undergraduate, she began to ask new and novel questions of herself.

This suggests that science is more than what is contained in a textbook, which is primarily a record of the history of science. Rather, science is a process or practice that happens in labs around the world. The findings are what end up in textbooks. Therefore, she views science as a discipline requiring creativity and resilience so that test scores are not the best metric for determining success.

Because of this, Dr. Zaringhalam says that narrative stories are useful in teaching science. Their structure, which includes ups and downs that humanize scientists allow students entry points into science that might not otherwise be there. However, she cautions, the word "story" must be defined as having a beginning, middle and end with a change in the middle that prompts a discovery. In this way, stories are a good tool in understanding the process of science because science is fundamentally about understanding the world and how it changes around us. Dr. Zaringhalam regards this as anchoring us to the natural world or phenomena.

Based on these ideas, the goal of the Story Collider project is to bring personal stories inspired by scientists to the public using multiple forms of media including a weekly podcast. (https://www.storycollider.org). The project also provides workshops for scientists to train them in storytelling with the aim of better connecting them with the public. During the workshop, scientists are instructed to bring their hopes, fears and dreams into their storytelling. This humanistic approach is what Dr. Zaringhalam says connects students with science as they are able to see themselves reflected in the story.

Dr. Zaringhalam further emphasized the role of stories in teaching science by listing some advantages of using a storytelling method:

- Stories inspire curiosity
    - This curiosity can be used to initiate learning by students
- Stories can be used to show scientists are actual people (similar to everyone else)
    - Science is hard, scientists often fail; learning through failure

- Stories humanize scientists
    - Science can be used to connect to people, experiences similar to everyone
    - Science might be hard and frustrating, but there are amazing discoveries
- Stories show why scientists are interested in the questions/areas of research
    - Individual unique experiences inform the research that scientists are interested in.
        - Lived experiences inform what people are interested in.
        - Scientists are informed/formed by their experiences
- Stories are all different; all provide context, background for how/why become a scientist
    - Provide audience with characters that they can relate/connect to
- Stories are effective tools for communication
- Stories are how we relate to each other every day; stories can vary across the day
    - "Hardwired" to interact through stories
- Stories can be used to showcase the how and why of science
    - Returning to the idea of science as a process/practice

Furthermore, Dr. Zaringhalam contends that in understanding/emphasizing the nature of science (NOS) in instruction, teachers can help challenge stereotypes of who can do science or who is a scientist through stories that show science is not linear and is not a set of truths, but a process requiring one to think outside the box and that develops over time through collaboration. In fact, case examples from the research literature demonstrate the effectiveness of emphasizing the nature of science. The case studies include:

Even Einstein Struggled: effects of learning about great scientists' struggles on high school students' motivation to learn science (Siegler et al)

This study examines Einstein's early struggles in school as well as the challenges and intellectual struggles of Faraday and Curie. After students read the stories, their grades were tracked over time and they completed a survey about what they had read. In the findings, students who read the narratives showed an improvement in their learning over a six-week period and expressed a connection to the scientists regardless of whether they had experienced the same types of struggles.

Other studies discussed were a Draw a scientist study which demonstrated how small interventions can help create an environment of more diversity and Scientist Spotlight: Homework Assignment to Shift Students' Stereotypes of Scientists and Enhance Science Identity in a Diverse Introductory Science Class (Schinske et al).

According to Dr. Zaringhalam the following points are important to remember:

- Whose stories we tell is just as important as the stories themselves
- We need to be intentional in the stories that we tell: this is not a trivial decision
- Stories need to be relevant to the lesson that is being learned
- Stories must highlight the question that the scientist is asking
- Stories need to address what is/was not yet known

- Stories should emphasize the struggles and hurdles along the way (emphasize the idea that science is not a linear process)
- Stories need to highlight the humanity of scientists/people doing the science
- And stories must acknowledge collaborators, past and present

Finally, she finished with a quote:

"We must show people how they belong to science- and how science belongs to them."
– Mónica Feliú-Mójer

Tuesday, April 23, 2019 – 11:30 AM – 11:50 AM

Update on the SEPA Program

Presenter: **Tony Beck, Ph.D.,** *Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH*

Reporter: **Barbara Hug,** *University of Illinois Urbana Champaign*

Dr. Beck opened by saying he is looking forward to next year's conference and asked that those who are interested in helping organize it should contact Louisa Stark or respond to her e-mail request. He described the organizing committee structure where each organizing committee member is co-leader of a conference strand and each conference strand has two leaders. Conference strand leaders' responsibilities include identifying types of sessions; seeking people to lead the sessions and helping to identify the focus of plenary sessions. Among the reasons to join the committee, he cited the opportunity to help determine the direction of next year's conference as well as becoming an active member of the Science Education Partnership Award (SEPA) community. The conference remains an event primarily focused on serving the community, but the impact on other participants is significant as well. Thus, over time the responsibilities of the planning committee have evolved to reflect a broader mission.

Furthermore, conference evaluations play a key role in the planning process as well. The unique viewpoints of new PIs and future PIs are especially helpful, however comments representing all voices/views are valuable. Dr. Beck said he is specifically seeking input in the comments about whether or not to continue a yearly conference and about the value of the meeting for networking across the SEPA community. This feedback can significantly impact the 5-year conference grant application process by demonstrating its value to participants.

The final product of the annual conference planning effort is a report that includes session notes and pictures of the conference. Past reports have become part of an archive of the SEPA program and are useful in informing those outside the SEPA community about the program. In addition, program officers use the annual report as an evaluation tool.

Dr. Beck also requested participants upload posters to the NIH SEPA website and that each SEPA PI or PI team check their SEPA website landing page to ensure accuracy and up-to-date information about their programs. Press releases and other media are of particular interest to NIGMS communications office. Those who would like to use social media can tag the twitter handles @NIHSEPA and @NIGMStrain.

Regarding the latest SEPA funding announcement, the template has specific text requirements, but does allow for additional information to be added. If you have any questions or need clarification, you may ask Dr. Beck, but please be sure to specify what you find confusing.

Next, strategies to extend the reach of SEPA were discussed. For example, how might SEPA take advantage of the overlap between curricula for high schools and community colleges and potentially shared resources, and how can community colleges be made aware of the availability of SEPA

materials? To highlight the issue, Dr. Beck presented a graph showing the decline over time in science interest and expressed the need to increase support and pull people back in. A suggestion was made to include Community Colleges and Bridges community in the NIH SciEd conference. Other suggestions included inviting YES awardees to SciEd and possibly other groups as well. Dr. Beck encouraged PIs and project members to continue to think about ways to maximize the reach of SEPA programs. He said it's great to have SEPA especially as part of the NIGMS pipeline so that we should continue to look for partnerships that can be established to support connections across the trajectory/ pipeline.

Finally, Anne Chester announced the Journal of STEM Outreach is looking to highlight programs with a special journal issue. There is a $250 fee to publish if your abstract is selected. Virginia Shepard will be sending out the details of the call for abstracts.

Tuesday, April 23, 2019 – 11:50 AM – 12:10 PM

Programs to Enhance Diversity in the Biomedical Research Workforce

Speaker: **Alison Gammie, Ph.D.,** *Director Division of Training, Workforce Development and Diversity, NIGMS, NIH*

Reporter: **Robin Fuchs-Young, Ph.D.,** *Texas A&M University*

The NGMS portfolio includes an array of programs to enhance the diversity of the biomedical workforce. NIGMS administers 1,144 Research Training and Diversity Enhancing Awards at 288 Institutions.

Dr. Gammie described the breadth of training programs, with a focus on those for undergraduate students:

Undergraduate Programs (BUILD, U-RISE, BRIDGES to BAC, MARC, IMSD) emphasize the development of a diverse pool of undergraduates that complete their baccalaureate degree and transition into and complete a research-focused, biomedical higher degree program (e.g., Ph.D. or M.D./Ph.D.).

Bridges to the Baccalaureate

- Contacts: Mercedes Rubio, Patrick Brown
- FY2018: NIGMS supported 39 institutions with 627 slots.
- Encourages a strong partnership that offers a well-integrated set of activities both pre-and post-bridging (e.g., trainees conduct research both prior to and after bridging)
- Encourages articulation agreements to reduce the time-to-degree.

Maximizing Access to Research Careers MARC (T34)

- Contacts: Sailaja Koduri, Luis Cubano
- FY2018: NIGMS supported 54 institutions and 572 trainees.
- At research intensive institutions
- Support for 1-3 years.

Undergraduate Research-Training Initiative for Student Enhancement (U-RISE)

- Contacts: Luis Cubano, Anissa Brown
- FY18 NIGMS supported 671 undergraduates
- At research intensive institutions (< $7.5 M NIH Research Project Grant funding per year average),
- Support for 1-3 years.

Post-baccalaureate programs (PREP) emphasize the development of a diverse pool of scientists with a baccalaureate degree who transition into and complete a research-focused, biomedical higher degree program (e.g., Ph.D. or M.D./Ph.D.).

Graduate programs (RISE, BRIDGES to DOC (for MS), IPERT, IMSD) emphasize the development of a diverse pool of scientists earning a biomedical Ph.D. who have the skills to successfully transition into careers in the biomedical research workforce.

Post-doctoral programs (IRACDA, K awards) emphasize the development of a diverse pool of scientists who have the skills to successfully transition into biomedical research careers.

In addition, several programs span across levels, including the National Research Mentoring Network (undergrad through graduate); NIGMS Diversity Supplement Program (undergrad through graduate); NRSA fellowships; including T32 (graduate through post-doctoral).

- All NIGMS training programs should:
- Have strong institutional support.
- Focus on technical, operational and professional skills development.
- Promote rigor and reproducibility in research.
- Teach the responsible and safe conduct of research.
- Encourage inclusive, safe, and supportive research environments.
- Develop Program Director/Principal Investigator teams to broaden program leadership and provide complementary expertise.
- Display coordinated interactions and synergies with other NIGMS-funded training programs at the institution.
- Employ long-term tracking of trainee outcomes.

For SEPA programs focused on high school students, consider providing information on NIGMS programs at the undergraduate stage (2-year and 4-year).

Opportunities for synergy with SEPA:

- Engage SEPA PIs in ongoing TWD (Training Workforce development and Diversity) programs,
  - TWD and SEPA programs are colocalized at 45 institutions.
- Focus on "giving back" to the community and altruistic activities, which demonstrably enhance persistence in STEM fields.

Breakout Sessions
Tuesday, April 23, 2019 – 3:15 PM – 4:30 PM

Investigating Inclusive Curricula in the Science Classroom: Scientist Spotlight Homework Assignments

Presenters: **Jeff Schinske, MS,** *Biology Instructor, Foothill College*
Kimberly Tanner, Ph.D., *Professor, San Francisco State University*
Reporter: **Teresa Evans**

The session was led by Kimberly Tanner, Director of the Science Education Partnership and Assessment Lab (*http://biology.sfsu.edu./people/kimberly-tanner*) and Jeff Schinske, Biology Instructor at Foothill College (*https://foothillcollege.instructure.com/courses/3682/pages/welcome-to-jeff-schinskes-website*)

Kimberly Tanner discussed the ideas that drive the SEPAL Research.

- Twice as many undergrads leave the sciences as the humanities in the US
- Women and scientists of color continue to be underrepresented in the sciences
  - In Nature, 2018: *https://www.nature.com/articles/d41586-018-03178-5*
  - In Science, 2018: *https://www.sciencemag.org/careers/2018/03/stem-losing-male-lgbq-undergrads*
- Few scientists have formal training in teaching
  - Goal is to translate information from K-12 education colleagues into what higher education colleagues will use.

It is important to note that research in biology education lags behind other science disciplines, but the research that does exist suggests many students are not feeling included in the classroom and in STEM, resulting in hindered levels of learning. "Inclusion is a prerequisite for learning and not separate", stated Dr. Tanner.

As a part of the session, the attendees were asked to participate in a common experience focused on the discussion of the Rock Stars of Science campaign (*https://geoffreybeenefoundation.com/rockstars/?page_id=40*)

Drs. Tanner and Schinske did the following:

1. Gave everyone a moment to write down ideas so that there would be time for individuals to think before speaking. (It was mentioned that many need a few moments to think before talking so taking this step ensures everyone has equal ability to engage).
2. Asked audience members to discuss their ideas with a partner
3. Asked partners to share out with the group

Observations of the group:

1. One person who appears to be female
2. Scientists tend to wear white

3. Most people on images appear to be white
4. Participants seem to be of an age to have some experience
5. A lot wearing button down shirts; lots of neck ties

Past Student Conclusions:

1. All appear to be men
2. All appear to be white

A key student quote was shared:

"It kind of says that women and people of color are more likely to be rock stars than scientists, huh?" _ (undergraduate student woman of color)

Jeff Schinske led the discussion on the following:

When students are given messages that people like them don't belong in a field, they can no longer perform at their best ability. Further, research in numerous areas including "social science threat," "science identity," and "possible science selves" suggest this messaging has a broad impact on students

- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. American psychologist, 52(6), 613.
- Brickhouse, N. W., Lowery, P., & Schultz, K. (2000). What kind of a girl does science? The construction of school science identities. Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 37(5), 441-458.
- Steinke, J., Lapinski, M., Long, M., Van Der Maas, C., Ryan, L., & Applegate, B. (2009). SEEING ONESELF AS A SCIENTIST: MEDIA INFLUENCES AND ADOLESCENT GIRLS' SCIENCE CAREER-POSSIBLE SELVES. Journal of Women and Minorities in Science and Engineering, 15(4).

Key questions to ask ourselves as STEM educators are:

- How are we messaging and branding biology in our courses?
- What examples of scientists do students encounter in your course?
- What messages might those examples send?

Dr. Schinske said that he would answer these questions by saying:

"I have no examples except maybe that of myself, the teacher. This might not be the most helpful example. As a result, I wondered how I could structure into my course other examples of scientists."

Scientist Spotlight Assignment examples were passed out and questions were asked.

Sample Scientist Spotlight Homework Assignment #4

Mercedes Lopez is a Principal Investigator at the National Polytechnic Institute in Guanajuato, Mexico. Her research focuses on how naturally occurring chemicals from agave plants impact human health. In 2014, Dr. Lopez coauthored a study titled *Agave Fructans: Their Effect on Mineral Absorption and Bone Mineral Content*. In the summer of 2017, this article was covered by a science news website and the story was subsequently picked up by numerous newspapers and television stations across the country, often saying that tequila can prevent osteoporosis!

1) Please click here to read a summary of Dr. Lopez's fascinating path to her current position, which begins... **"Mercedes, you cannot learn English and Science at the same time."** "Guess what? My family had very little, I was the first in my family to ever study outside of Mexico, I am dyslexic, and ***I DID IT.***" says Dr. Lopez emphatically
2) Then, click here to read the science news article that set off a storm of publicity around Dr. Lopez's work.
3) Finally, please briefly review the abstract of the research article.

Compose your 350 word or more response on:
1) What was most interesting or most confusing about the these resources?
2) What can you learn from these resources about bone homeostasis and bone chemistry?
3) What do these resources tell you about the types of people that do science?
4) What new questions do you have after reviewing these resources?

It has been shown that Scientist Spotlights are more impactful to students if they include a near-peer. They are currently looking at data focused on identity characteristics like gender and/or ethnicity pairing.

It is key to remember that the Adult/Grown-up reactions to scientist spotlight is not the same as a student or child's reactions to scientist spotlight. Therefore, the team has engaged students to help build and analyze the next set of spotlights. When doing this type of project, it is imeprative to remember that students are the audience not adults. This could be a concern with the Rock Star Scientists activity as well.

Student quotes were showcased to address the question of, "What do you think students would learn about as a result of this assignment?",.

"For me science has always been intimidating and unapproachable. Listening to Megan describe her personal and professional struggles, frustrations, set backs, self-doubt, and success in relation to science made it feel very relatable and relevant. Her story humanized scientists to me. I have always thought of scientists as these brilliant successful people who have vast knowledge, have it all together, and change the world. What Megan showed me is that scientists are absolutely brilliant success people who have vast knowledge and change the world, but they do not have it all together. They stumble, they fail, they struggle. They also do not give up. Megan's story points to the perseverance, resilience, and persistence of scientists. That is beyond admirable."

"What I have learned...is that it is possible to be a scientist under any circumstances, from poverty to being from a different country to [overcoming] stereotypical assumptions about a person...Anyone can be a scientist if they want to. One thing all scientists we learned about had in common was that they weren't interested in science until something sparked their interest."

"Anyone can be a scientist if they want to."

Data from essays written before exposure to scientist spotlight and after exposure were shown via word clouds.

The essay focused on the following instructions:

"Based on what you know now, describe the types of people that do science. If possible, refer to specific scientists and what they tell you about the types of people who do science."

Trends seen before the assignment: Students often list types of science because they do not know what types of people do science before exposure to spotlights.

After they see the spotlights: Students are able to discuss all types of scientists.

Key outcomes of the course include increased grades in classes with students who were assigned the scientist spotlights. This indicates that they are not only learning more about science but are more aligned with the content goals.

How might this relate to SEPA objectives?

- Engage undergraduates in service learning to create new Scientist Spotlight assignments matching diverse course content, K-16+. "Students are asking what about people like us."
- Develop searchable web repository of scientist spotlight assignments aligned with NGSS
- Evaluate impacts of scientists' spotlights in diverse middle school, high school, and higher education centers.

Other take-aways for presenting with inclusion in mind: Use a name tag! Do pair discussions! Honor who people are!

Participants:

Margaret E. Stieben, American Physiological Society

Michael McKernan, The Jackson Laboratory

Gwendolyn Stovall, University of Texas at Austin

Gretchen Gose, Unidos Dual Language School

Michele Shuster, New Mexico State University

Madison Spier, Texas A&M Health Science Center

Berri Jacque, Tufts Medical School

Teresa Evans, University of Texas Health Science Center at San Antonio

Ido Davidesco, New York University

Louisa Stark, University of Utah

Chris Prichard, University of Kentucky

Seth Thompson, University of Minnesota

An Introduction to Curriculum Development Using Backwards Design Principles for Formal and Informal Learning Environments

Presenters: **Nancy Moreno, Ph.D.,** *Associate Provost of Faculty Development and Institutional Research, Baylor College of Medicine*
Alana Newell, Ph.D., *Assistant Professor, Baylor College of Medicine*
Reporter: **Mason Arrington** *from the Center for Interdisciplinary Inquiry and Innovation in Sexual and Reproductive Health at the University of Chicago.*

The session was focused on having attendees rethink how they develop curriculum and curricular materials. The presenters wanted participants to flip the basis of their thinking on its head starting with HOW a curriculum teaches rather than simply WHAT it teaches. Essentially, the presenters were detailing a process of curricular development that produces a specifically student-centered form of instruction. They were given the following quote early in the presentation: "Tell me and I forget. Teach me and I remember. Involve me and I learn." The quote, attributed to Benjamin Franklin very effectively summed up the concept being presented.

Participants started by asking: "What is worth understanding? Can you use/understand/teach that?" It's not as though these questions can simply lead to a straightforward 'no' however, by asking these questions a person can begin to reveal some of the shortcomings of the curriculum at a fundamental level. In this way small issues in curriculum development can be corrected in order to head off larger problems down the line. It was observed that often curriculum development focuses on everything EXCEPT what is actually being taught.

One way of framing this approach is with the five Es:

- Engagement
- Exploration
- Explanation
- Elaboration
- Evaluation

Since this process begins with Engagement it guarantees that the target audience is part of the development process. By making the audience a key aspect of development throughout the E's, it will be evident what kinds of things aren't working for the people who will ultimately be the users. In the typical process, this information isn't available until after the curriculum has been implemented, which is often too late.

Participants:

Roger Sloboda, Dartmouth College
Holly Brown, US Army Medical Research and Materiel Command
Sheila Thomas, Harvard University
Kelly Furr, Northern Illinois University
Melani Duffrin, Northern Illinois University
Geza Varhegyi, Cuyahoga Community College
Dirk Swart, Wicked Device LLC
Edward Zovinka, Saint Francis University
Robert Young, Saint Francis University
Irene Wolf, Saint Francis University
Bethany Hornbeck, West Virginia University
Roy Womack, Georgia State University
Sara Erickson, Iowa State University

Stephanie Alphee, University of Maryland, Baltimore
David Clayton, University City Science Center
Mason Arrington, University of Chicago
J. Michael Wyss, University of Alabama at Birmingham
Abbey Thompson, Stanford University
Laura Courtney, Washington University
Brinley Kantorski, The Partnership in Education
Alexander Chang, Seattle Children's Research Institute
Amanda Jones, Seattle Children's Research Institute
Rebecca Carter, Seattle Children's Research Institute
Virginia Stage, East Carolina University
Brett Taylor, University of Montana
Tony Beck, NIH/NIGMS
Ang Chen, University of North Carolina at Greensboro
Renee Bayer, Michigan State University
Larry Johnson, Texas A&M University
James Cotner, University of Minnesota Twin Cities
Ming Lei, NIH/NIGMS

The Power of Media to Engage Latinx Students and Families in the STEM Ecosystem

Panelists: **Robert I. Russell, Ph.D.,** *Program Director, National Science Foundation*
Alicia Santiago, Ph.D., *Co-Investigator, Twin Cities Public Television*
Leah Clapman, *Managing Editor, Education, PBS NewsHour*
Reporter: **Elizabeth Grace,** *Washington State University*

The goal of this breakout session was to discuss ways in which Latinx students and families engage with media; to consider how partnerships with media can promote a positive message about Latinx engagement in STEM; and to consider how social media can engage a Latinx audience. Bob Russell kicked off the session by discussing the need to engage the Latinx population in STEM. Following this, Rita Karl, Kristin Pederson, and Leah Clapman presented projects that successfully engage Latinx students through media.

Bob Russell – NSF Program Director

Bob gave a general overview of Latinx culture and the media. According to Bob, you need to know about your audience to engage your audience. He presented examples of ways that media has been used effectively in health education projects, explaining that advertising can be used to "sell" a health benefit (e.g., a specific screening, lifestyle, etc.). Therefore, we should be using media as a way to engage Latinx populations in STEM.

The Latinx population continues to grow in the United States and many identify with their country of origin first, with two-thirds of them being Mexican in origin. In fact, it is projected that by 2050, there will be 155 million Latinxs in the U.S. (approx. 20-25% of the total population). Approximately two-thirds of the Latinx population use both the Spanish and English language with Spanish primarily spoken at home. This usage breaks down as 38% Spanish, 38% bilingual and 24% English dominant, but most believe it is important to learn to speak English. Therefore, not surprisingly, a majority of the Latinx population attends to both English and Spanish media, an important consideration when designing media to engage Latinx audiences.

However, education gaps in reading and math between Latinx students and white students persist. Based on this, it is important to consider where students learn STEM. They do not get much science time in school. Much of what children and families learn about STEM is outside of school in the STEM ecosystem. Media is a big component of that ecosystem. Some of the challenges to parent involvement with school and STEM include lack of familiarity with the school system; language barriers; not feeling welcome; an expectation that parents will help with homework even though Latinx cultures often put that expectation on teachers and deficit stereotypes of students.

It is noteworthy that Latinxs are typically heavy users of media and frequent adopters of digital devices, and as stated before, many consume media in both English and Spanish. Consequently, multi-platform strategies may be the most effective way to communicate through the media. It is important to know what kind of media an audience prefers, to best reach them, and thus it may be a good idea to use members of a target audience as co-creators. Another consideration is where do target audience members consume news; what are their interests; what type of news do they look at; where and on what devices? For Latinxs Internet and TV rival for news (with adult Latinx preferring television), but

radio can be effective for reaching this population as well. This suggests that we should be bringing STEM to the community where they are, rather than trying to bring the communities to STEM. Besides, lower income Latinxs have less attendance at informal science centers, so the use of media could help reach this group.

Bob summarized by saying that Latinxs are vital to our STEM workforce and should be a key focus audience in STEM-related media efforts.

Rita Karl – Twin Cities PBS: Media to engage Latinx students and families in STEM

Rita Echoed Bob that Latinx and STEM are underrepresented in the STEM workforce. She said PBS has been running science programming for youth for a long time (ex. DragonFly, SciGirls). In fact, Latina SciGirls was created out of the need to reach the Latinx audience by using both English and Spanish as well as having actors that look like the audience they are trying to reach. It is produced in Latinx communities nationwide and features youth and mentors for Latinx communities.

Rita highlighted some important practices in using media to engage Latinx audiences such as building relationships and establishing trust; offering programming that engages the entire family; providing experiences that are culturally relevant and personally meaningful; emphasizing educational merit and focusing on careers.

As an example, Rita showed an episode of Latina SciGirls, noting how codeswitching and reverse subtitles were used. Latina SciGirls can be accessed through https://pbskids.org/scigirls/home. Rita also highlighted the STEM Media Role Model videos series. These videos show the stories of young female professionals that look and sound like the Latina audiences they are trying to reach. Producers of the videos worked to make these role models more relatable, with the content showcasing not only the profession, but also personal life, family, friends and hobbies of the characters.

Rita concluded by saying that if you are transparent in the media about perseverance, challenges and success, youth will be more engaged.

Kristin Pederson – CEREBROedu (BRAINedu)

Kristin described CEREBROedu as a Spanish/English informal education project providing culturally competent programming and media resources about the brain's structure and function to Latinx middle school students and their families. She emphasized that media is produced in partnership with these communities and empowers families, kids, and informal educators to think about cerebral function.

CEREBROedu media and education resources include: role model videos of Latinx neuroscience professionals; professional development for educators; hands-on programming at 18 partner organizations and an educator activity guide, which along with training focuses on mental health topics that are often stigmatized.

Most important, Kristin emphasized, is parent and family engagement in the process.

Leah Clapman – PBS NewsHour Student Reporting Labs (SRL) (studentreportinglabs.org)

The impetus for creating Student Reporting Labs came from a recognition that students were not connecting personally to news content and it became a way for students to tell their stories.

In general, students feel that media should show more people their age; they don't see themselves represented. The theory behind SRL is that news happens to young people too, so if we empower them to tell their stories they may get involved in a new way.

SRL is now in 46 states and 170 schools. Typically broadcast, journalism and media arts teachers apply to use the resources, but often STEM teachers also find it worthwhile to engage students in this type of real-world curriculum.

As a result of the interest from STEM teachers, STEM Reporting Labs was created. STEM Reporting Labs includes the following resources: video journalism curriculum; video tutorials; health and STEM communication lesson plans; professional development; event and screening templates; customized social media toolkits; a local mentor handbook; and support for these resources. To illustrate the types of materials available, Leah showed an example video about suicide prevention. In the video, students identified a problem they wanted to research and went out to collect data to reach a young audience about suicide.

SRL also has partnerships with Snapchat, Instagram, Teen Vogue, PBS learning media, YouTube, and more.

In closing, Leah highlighted that journalism can be an effective transdisciplinary approach to learning and that research has shown students feel more confident as they see their health and STEM efficacy increase.

Participants:

Elizabeth Frace, Washington State University
Michelle Ezeoke, Georgia State University
Christine Cutuchache, University of Nebraska Omaha
Grace McClure, University of Texas at Dallas
Jenica Finnegan, University of Nevada, Reno
Joan Griswold, University of Washington
Rebecca Norlander, New Knowledge Organization
Stephanie Tammen, Tufts Medical School
Jennifer Wiles, NIH/NCI
Victoria Coats, Oregon Museum of Science & Industry
Tana Chandler, Hopa Mountain
Robin Fuchs-Young, Texas A&M University

What Doesn't Work – Learning from Negative Results

Presenters: **Michael Carapezza, BS,** *Program Coordinator, Columbia University*
Aaron Kyle, Ph.D., *Director, Columbia University*
Marie Barnard, Ph.D., *Assistant Professor of Pharmacy Administration and Research Professor, University of Mississippi*
Bret Hassel, Ph.D., *Professor of Microbiology and Immunology, University of Maryland*
Reporter: **George Shipley Jr.**

Problem

Retaining students as they transition from the Middle School Cure Connection Program to the High School Cure Connection Program. The first class to transition lost eight of 29 students (28%) due to an issue of transportation to and from the program at the University of Maryland Medical School. Transportation is provided for middle school students, but not for high school students

Solutions currently being utilized

High school students are allowed to ride the middle school bus when schedules of the middle school and high school programs overlap. There also are monthly dinner meetings with parents to discuss all issues around the program

Solutions recommended from the audience (and responses)

- Convert the program to a summer residential program
  - Undoable due to a lack of dormitories
- Outsource the transportation to a private transportation organization
  - Too costly
- Change the schedule from weekly to bi-weekly
  - Will be considered
- Provide a weekly bus pass to students (students will have to attend the current weekly session in order to receive the bus pass for the next week)
  - Will be considered

Marie Barnard: STEMI, University of Mississippi Medical Center, Jackson, MS

Problem

The STEMI program provides teacher development and helps with science content. The program has a Memorandum of Understanding (MOU) with the Jackson Mississippi School District, which gives STEMI access to teachers and students. Due to turnover in the school district, the current superintendent and school administrators are not honoring the MOU, and as a result, STEMI does not have access to the students and teachers.

Solutions recommended by the audience

- Present the signed MOU to the school board and request it be honored

- Present the signed MOU to the new superintendent and request it be honored
- Re-pitch the STEMI program to the new administration and emphasize:
- The small amount of classroom time required to complete the program's assessment (pre-test and post-test)
- Benefits of the teacher development
- Benefits to the teacher in terms of lesson plans and content materials
- Provide a district/school incentive to participate in the STEMI program

Participants:

Marisa Pedulla, Montana Tech
Melinda Gibbons, University of Tennessee
Donna Cassidy-Hanley, Cornell University
Barbara Hug, University of Illinois
Mary Larson, Salish Kootenai College
Chuck Wood, Wheeling Jesuit University
Susan Hershberger, Miami University
Sarah Wojiski, The Jackson Laboratory
Orestes Quesada, University of Puerto Rico
Adel Karara, University of Maryland, Eastern Shore
Emily McMains, Dana-Farber/Harvard Cancer Center
Nathan Vanderford, University of Kentucky
Jacque Ewing-Taylor, University of Nevada, Reno
Bill Thornton, University of Nevada
Mary Jo Koroly, University of Florida
Lynne Holden, Mentoring in Medicine, Inc
Marnie Gelbart, Harvard Medical School
George Shipley, White River Middle School

Measuring STEM Mindsets

Presenters: **Karin Chang, Ph.D.,** *Executive Director, Kansas City Area Education Research Consortium, University of Kansas*
Julia McQuillan, Ph.D., *Professor of Sociology, University of Nebraska-Lincoln*
Rebecca Smith, Ph.D., *Co-Director, Science & Health Education Partnership, University of California, San Francisco*
Amy Spiegel, Ph.D., *Research Associate Professor, University of Nebraska - Lincoln*
Linda Morell, Ph.D., *Researcher, University of California – Berkeley*
Reporter: **Anjelica Miranda,** *Denver Museum of Nature & Science*

Introduction

STEM mindsets are the attitudes or beliefs individuals have about themselves in relation to their ability to do science and work in the science field. The panelists for this breakout session talked about the different ways in which they measure STEM mindsets within their respective projects.

Dr. McQuillan and Dr. Speigel presented their work in the Discovery Orientation and Science Identity measures created from two projects, World of Viruses and Biology of Humans. One of the aims of their work is to improve the understanding of how informal STEM experiences within health research can increase STEM identities, STEM possible selves, and STEM career aspirations among 6th to 8th grade students from groups historically underrepresented in STEM disciplines.

Their work has shown that there are different types of mindsets about science.

- Growth Mindsets vs Fixed mindsets:
  - People with a growth mindset believe that abilities can be developed.
  - People with fixed mindsets believe that intelligence or talent are fixed traits they are either born with or not.
- Essentialism Mindsets
  - Psychological essentialism: the belief that people naturally possess certain traits based on group characteristics
  - Gender essentialism: the belief that differences between boys and girls are natural or innate (based on biology) and that they cannot be changed
    - Why might mindsets matter for favoring boys in science? If boys are seen as naturally or effortlessly brilliant and science requires brilliance, then fixed mindsets about intelligence and essentialist mindsets about gender lead to the belief that boy = science

To measure mindsets in a middle school setting, a science identity study was conducted in a midsized Midwestern city with 6th to 8th graders from a title I middle school science classroom where 63% of the students were from of a minority group and 80% qualified for free/reduced lunch.

- Mindset Measures:
  - To assess the extent to which students have a fixed mindset, students were asked: to respond the statement "You can learn new things, but you can't really change how smart you are." 1 = strongly disagree to 5 = strongly agree
    - Those who strongly disagree do not have a fixed mindset, those who strongly agree have a fixed mindset.
  - To assess the extent to which students have an essentialist mindset, students were asked to respond to the statement: "Some people are just naturally good at things (like sports, science, or music) and will never have to work hard at them." 1 = strongly disagree to 5 = strongly agree

With this work, the researchers started to measure discovery orientation within the middle school students. Discovery Orientation is the measure of propensity, it allows the researchers to ask the students about their interest in science, without actually using the word "science". For example, questions like:

- How much do you like learning about new discoveries?
- How curious are you about the world?
- How much do you like exploring nature?
  - Key components to science identity:
    - "I like it" – affect/enjoyment
    - "I'm good at it" – achievement/competence
    - "It's important" – salience/relevance (I use it to make decisions that affect me).

Their work with middle school students also allowed them to assess the roles race and gender play in a student's science identity. Their findings using discovery orientation were that white boys and girls, and

minority boys and girls, all scored fairly equally about having a science identity. However, when asked about science identity, white boys had a higher score vs white girls and minorities, while white boys and girls were more likely to have a higher rating when asked about their science competence

Dr. Smith presented work on the development of a "Researcher Identity" from their San Francisco Health Investigators (SFHI) program. This program seeks to empower students as agents of change in their communities and find opportunities to help develop students' identities as researchers.

- Program Overview:
  - 20 students from San Francisco public schools
  - Year-long program with a summer-intensive and monthly follow-ups
  - Students pick different health topics to research
- The summer intensive includes training with hands-on science experiences, field trips, teamwork and community building. Also includes formative surveys for the data collection around San Francisco, development of a health message campaign and campaign pitches
  - Phases of student research:
    1. Formative
    2. Data analysis
    3. Campaign development (designed to reach underrepresented communities and inform change)
    4. Implementation of health messages (through social media; survey for changes in knowledge and awareness)
    5. Summative (testing effectiveness of students' messages using the Health Belief Model)
- The monthly follow-ups help students refine their health message campaign and prepare to launch the campaign.

Within the SFHI, Dr. Morell has worked on developing instruments that programs with similar goals to the San Francisco Health Investigators program can use. Within their program, they developed the construct map.

- Construct map: Researcher Identity
  - Title of level = description
    - Secure identity or integration of identity = student identifies as researcher and integrates this into their larger self
    - Comfortable with identity = student begins to feel comfortable with their identity as a researcher
    - Role exploration = student explores the different aspects of research
    - Curious identity = student is a newcomer to the concept of research
    - Absent = student is unaware of what research entails and has not considered their role in research
  - Construct map consists of four strands:

- Fit & aspiration – interest in research as a career path and belief in research as a great fit to their personal interests (future self)
- Self – current idea of self-identity as a researcher. The focus here is on how the student feels about their self at the present moment
- Community - Sense of belonging to a research community
- Agency - The degree to which a student feels empowered to impact change through research.

Participants:

Anjelica Miranda, Denver Museum of Nature & Science

Kelli Qua, Case Western Reserve University

Luke Bradley, University of Kentucky

Katherine Bruna, Iowa State University

Elizabeth Parker, University of Maryland, Baltimore

Kevin Morris, Walter Reed Army Institute of Institute

Charles Wray, The Jackson Laboratory

Lisa Vaughn, Cincinnati Children's Hospital/ University of Cincinnati

Farrah Jacquez, University of Cincinnati

Neil Lamb, HudsonAlpha Institute for Biotechnology

Diane Munzenmaier, Milwaukee School of Engineering

Melissa Kurman, University City Science Center

Erin Hardin, University of Tennessee, Knoxville

Crystal Lumpkins, University of Kansas

Georgia Hodges, University of Georgia

Melissa Gilliam, University of Chicago

Karen Yanowitz, Arkansas State University

Martin Weiss, New York Hall of Science

Kate Ayers, St. Jude Children's Research Hospital

Melinda Butsch-Kovacic, University of Cincinnati

Michael Kennedy, Northwestern University

Donald DeRosa, Boston University

Obi Onochie, Boston University

Bill Thornton, University of Nevada

Dina Drits-Esser, University of Utah

Continuity of Student Research Experiences

Panelists: **Jennifer A. Ufnar, Ph.D.,** *Executive Director, Center for Science Outreach; Research Assistant Professor of Teaching and Learning, Vanderbilt University*
Debra L. Yourick, Ph.D., *Director, Walter Reed Army Institute of Research*
Jane E. Disney, Ph.D., *Director of Education, MDI Biological Laboratory*
Robin W. Rockhold, Ph.D., *Professor of Health Sciences; Deputy Chief Academic Officer, University of Mississippi Medical Center*
Marlys Hearst Witte, MD, *Professor of Surgery; Director, Medical Student Research Program; Director, Lymphology Laboratories, University of Arizona College of Medicine*
Idit Adler, Ph.D., *Research Associate, CREATE for STEM Institute, Michigan State University*

Reporter: **Brandon Morgan** *(Health Resources in Action)*

Summary

In this session, participants were briefed on various SEPA projects that have a sustainability plan for youth to continue research projects in different environments. The PIs presenting these projects spoke about their successes and challenges concerning youth research projects and sustainability in the STEM field.

Format

The format of the workshop included the five PIs giving a summary of their projects as well as the perceived challenges in continuing student research from an initial institution to a second one. Afterward, there was a brief question and answer session to brainstorm possible solutions for the stated challenges.

Best Practices

Of the projects discussed, best practices arose in the discussion for continuing research experiences.

- Online Platform - In Dr. Disney's program, an environmental science training program for teachers and students, she developed free online resources for her participants to access whenever they need to. This allows teachers to not have to wholly rely on the PI or project staff to learn a specific concept. It's something that helps teachers maintain autonomy and feel confident in their teaching.
- Embedded in Schools - Several projects are embedded in schools and complement the curriculum the school system is using. This is significant because it allows the project to be a part of the culture of the school system.
- Compensation - Being able to compensate individuals at every level of the intervention is helpful. Whether individuals are at the high school, college, post-baccalaureate level, or beyond; compensation is a way to keep participants committed to a program.
- Compelling Curriculum - A curriculum needs to be not only academically competent, but culturally competent as well, in other words, something that will help keep participants in the program.

Challenges

Of the projects discussed, these challenges arose in the discussion for continuing research experiences

- Teacher and Administration Turnover - For several projects, they mentioned severe turnover in administration, specifically with superintendents. If administration continues to change, it's difficult to generate momentum for continuing research experience in programs.
- Transportation - Some places don't have enough transportation for participants to be a part of the program. The lack of busing proves to be a challenge in school systems where public transportation is not expansive.
- Garnering Commitment from Participants -There are times when participants have other commitments. This is especially the case when Ph.D. and postdoctoral students are the participants involved in the project. Because they have other obligations, it is difficult to instill commitment in participants.
- Teacher Confidence - Specifically with some teachers, there's a reasonable chance that science may not be their background so there's an understandable trepidation in teaching a new curriculum and sometimes it is difficult to build that self-efficacy within teachers.
- Tracking - For youth who are participants in a program, it can be difficult to track them to evaluate their progress once they leave an institution, like high school. Oftentimes, staff must rely on informal means to track their progress.

Participants:

Stephen Koury, University at Buffalo
Anne Van De Ven, Northeastern University
Lisa Marriott, Oregon Health & Science University
Kelley Withy, University of Hawaii
Brandon Morgan, Health Resources in Action
Laurie Jo Wallace, Health Resources in Action
Summer Kuhn, HSTA
Consuelo Morales, Michigan State University
Renee Bayer, Michigan State University
Dave Vannier, Fred Hutchinson Cancer Research Center
Kim Soper, University of Nebraska Medical Center
Luke Bradley, University of Kentucky
Michele Morris, HudsonAlpha Institute for Biotechnology
Jane Disney, MDI Biological Laboratory
David Petering, University of Wisconsin – Milwaukee
Idit Adler, Michigan State University
James Skeath, Washington University
Ann Chester, West Virginia University

Designing Innovative Experiences to Engage Students in Inquiry

Facilitator: **Kristin Bass, Ph.D.,** *Senior Researcher, Rockman Et Al*
Presenters: **Tim Indahl, Ph.D.,** *Internal Evaluator, Education Director, Mayo Clinic*
Anja Scholze, Ph.D., *Program Director, Biology + Design, The Tech Museum of Innovation*
Reporter: **Taylir Schrock, M.S.,** *Research Coordinator, Salish Kootenai College STEM Academy*

The Biotinkering Lab: From theory to implementation By Anya Scholze

- Early Concept: An experimental museum where people can use biology as a medium in which to learn, engage and create.
- Motivation: Biology has become a powerful technology poised to transform and propel innovation.
  - We need motivated problem solvers, new ways to inspire and engage young people.
  - How can we:
    - Enable young people to pursue careers in these fields?
    - Support young people as they learn how to explore the biological world?
    - Make it accessible to all, young and old, from a diverse background, education, and experiences?
- Early Inspiration: Makerspaces
  - Emphasize learning through doing in a social environment.
  - Engage people from diverse backgrounds and perspectives.
  - Design based
- Early Inspiration: DIYbio Community Labs
  - Enable broader access to wet-lab tools and supplies.
  - Allow the public opportunities to personally explore and experiment with biology.
  - Have the most engagement at the young adult or adult level.
  - Inquiry Based
- Their Idea: Making and Biology in a Museum?
  - Integrate design-based learning and inquiry-based learning
  - Create a flexible workshop in the museum.
  - Experiment at the intersection of biology, design, technology and making to empower everyone to use biology as a creative tool.
- Underlying Learning Theories
  - Knowledge is not simply transmitted from teacher to learner, it is actively constructed by the mind of the learner
    - Learning is active. The learner needs to do something.

        - Learning is contextual: mental and social. You have to work with the existing knowledge in the learners' heads.
    - Constructionism
        - Learning happens best when the learner is engaged in a personally meaningful activity outside of their head that makes the learning real and sharable.
        - The teacher takes on more of a facilitator role.
- Three core approaches
    - Making
        - Active creating with tools and materials
    - Tinkering
        - Mindset, a playful way to discover
    - Design Challenge Learning
        - Using the design process to create and iterate
    - Why these approaches?
        - Learner-centered
        - Promote:
            - Collaboration
            - Ownership
            - Agency
            - Creative confidence
            - Problem solving skills
            - Inquiry and experimentation
            - STEM Identity
- Biology as a medium
    - How can we make biology more meaningful to 10-year-olds?
- Activities in development
    - Semi-permanent programs
        - 30-minute sessions
        - Run by museum staff
        - More infrastructure
    - Pop up activities
        - 15-minutes
        - Run by volunteers
    - Inherent challenges
        - Biology systems

        - Alive, slow, complex
    - Museum Setting
        - Limited staff
- Mushroom Bricks
    - Grew bricks and blocks using nature's technology—living mushrooms!! People loved it!
- CRISPR in Yeast
    - Used cutting edge new scientific tool to edit the DNA in living yeast
- Bio Inks
    - Grew natural soil bacteria on agar plates
    - Challenge was how to extract it.
    - It is pH colored, so they are able to make art from it.
- Ancient DNA
    - Use DNA information to uncover the stories of peoples and animals of long ago.

- Making with Microbeds
    - Collaborated with tiny living organisms to design, mix, and grow biomaterial: they used Kombucha mushrooms!

- Lessons Learned so Far:
    - Making with Biology
        - The final product is the best/easiest for personal creation.
    - Tinkering with Biology:
        - Not all biological systems are transferable to a museum setting- select carefully for "tinkerablility" during R&D
        - Have children chose the tools that they want to use to design their projects
    - Design Challenges of Learning with Biology
        - Have to adapt the most with combined challenges inherent to museum + biology.
        - Getting enough information to a visitor in a short time to enable experimentation

Designing Innovative Experiences to Engage Students in Inquiry by Tim Indahl

- Turning environmental stem education in InSciEd Out
    - Founded in 2009
    - SEPA Grant for expansion began in 2016
    - Clinical and educational access for marginalized students and communities through STEM education

- Learning Theory threads
    - Inquiry based learning
        - They use the essential features of inquiry from the National Research Council, Rodger Bybee

        - Teacher led and student led
        - Uses Zebra Fish
    - Students as Producers of Science
    - Prescription Education
- Experience
    - Detailed observation protocol. Looking in depth at a small subset of kids, writing down everything they are doing and seeing how they did using assessments
    - Found with these assessments that the kids needed to talk to each other to learn more.
- What they learned
    - Language production is a key to learning. Vocalizing is important to learning.
    - Curriculum Development Process
    - Professional Development
- Students as Producers of Science
    - Students can ask and answer questions to which science has no answers.
    - Benefits learning for students
    - Different perspective for science
- Video: Students can tell the story. Kids can do some really amazing things.
- Experiences
    - Evolution of Experimental Design
        - Six levels that we articulate. We have found that if kids aren't allowed to go through these levels, they aren't really learning science. They need to see all levels in order to understand the background.
            - Entry level: some sort of change occurs; it's going to kill the fish
            - Monster hypothesis- something morphs
            - The fish gets bigger or smaller
            - Making changes to a specific tissue
            - Looking at changes that require some sort of assay to detect.
        - What we learned:
            - Students often mismatched stages across hypothesis, data collection and conclusion
            - Need to train scientist mentors in the Evolution of Experimental Design to support students in growth.
- Prescription Education
    - Students who ask and answer their own questions through scientific inquiry will be empowered to both elevate their learning and elect healthier behaviors.
- Experiences

    - "Change-opolis" to improve mental health in the communities they are involved with
- What We Learned:
    - Curricular Revision and Wider Delivery
    - Larger Community Reactions. They met students that had unmet mental health needs. They worked with Rochester Pediatric Mental Health to help meet the needs.

Questions and Answers

To Anja: Was there any reason why you chose things you can actually see rather than to use digital things?

They were looking for ways to engage multiple senses in kids, example: smell, feel, see, etc. Biomaterials were very valuable.

To Tim: When training mentors, what was the training about to look for pitfalls?

We do a PLC (professional learning committee) where they talk about where they need to grow. They take the volunteers out to the schools where they see real-life scenarios and what to look for.

Kids can go from classroom to classroom and never speak the language…which is amazingly awful!

To Anja: How are you surveying/observing the participants in the museum?

They continue to do observations. They also do post-visit questionnaires. They work with an internal evaluator that helps them come up with the tools.

To Anja: Are these classrooms coming in?

No, these are entirely drop-ins. People can see what activities are running and get in line to participate. This means that any given session could be one person, a school group, or a family; it is very variable.

To Anja: I am excited about bringing biology back to museums! With your Maker Space, can you implement 3-D bioprinting?

We have thought about it. But we value the idea of getting people to engage and come up with a creative, hands on project. We want them to think of biology as the medium rather than the 3-D printing.

To Anja: I am wondering about your programs (pop up and semi-permanent) how do you turn these over? And how are you training graduate students and people?

For semi-permanent: We tend to turn over every year and a half because we have invested the resources into them. For pop up: we are more flexible. We work with Stanford and we have different ones every day.

As for training, they get communication training and watch others teach before they jump in. For semi-permanent we train our actual museum staff. The challenge there is understanding if they understand the concept well enough. We train them for all the procedures. They shadow a lot and then run some.

To Anja: Is the museum free?

No, it is not free, but if people cannot pay, we will let them in.

To Anja: Do you have any curriculum accessible or sharable?

The website is down right now, but when it is back up, they will have it there. Email Anja and she will send you whatever you need. Their end-goal is to have a final "package" that they can pass out.

Takeaways

Be flexible. Go with the flow. If something goes "wrong" then work through it and continue to engage the students.

Kids get excited when they can do something and no one tells them how to do it. They like the challenge and like figuring things out.

Participants:

Sandra San Miguel, Purdue Veterinary Medicine
Tim Herman, Milwaukee School of Engineering
Regina Wu, Fred Hutchison Cancer Research Center
Danielle Alcena-Stiner, University of Rochester
Atom Lesiak, University of Washington
Krisderlawn Motley, St. Jude Children's Hospital
Christopher Pierret, Mayo Clinic
Adam Hott, HudsonAlpha Institute for Biotechnology
Kristine Wylie, Washington University
Emily Kuehn, US Army Medical Research and Material Command
Samantha White, NIH/NINDS
Mary Kay Hickey, Cornell University
Taylir Schrock, Salish Kootenai College
Charlie Geach, American Physiological Society
TanYa Gwathmey, Wake Forest School of Medicine
Sequoia Wright, University of Maryland, Baltimore
Kristina Yu, Exploratorium
Jackie Shia, Wheeling Jesuit University
William Schneller, Substrate Games
Kevin D. Phelan, University of Arkansas for Medical Sciences
Sara Hargrave, NIH/NCI
Behrous Davani, NIH/NCI

Keynote Address
Wednesday, April 24, 2019 – 8:30 AM – 9:30 AM

Elements of Evaluation Quality: Questions, Answers and Resources

Presenter: **Leslie Goodyear, Ph.D.,** *Principal Research Scientist, Education Development Center; past president, American Evaluation Association*

Reporter: **Michelle Ezeoke,** *Georgia State University*

The Elements of Evaluation Quality session examined the several factors that need to be discussed between an evaluation team and project team in order to obtain "evaluation quality". Dr. Leslie Goodyear, Principal Research Scientist, believes a quality evaluation plan comes from the different ideas that are discussed before beginning a project. Accordingly, the evaluator should recognize the different individuals and their roles within the project.

The American Evaluation Association will be having their annual conference this year in Minneapolis, MN. Dr. Goodyear has been a past president for the Association and encourages attendance if you are working on a project with evaluation requirements.

Questions for the session: What is evaluation? Who should be concerned about it? And what do I need to know?

- What is evaluation?
    - Dr. Goodyear's answer: It depends. This may depend on the program's evaluation standards check, systematic investigation of the quality of the programs/projects and/or their components together or singly.
- For purposes of decision-making, judgements, conclusions, findings, new knowledge, organizational development and capacity building should develop in response to the identified needs of identified stake holders
    - Leads to improvement and/or accountability
    - Ultimately helps contribute to organizational or social value
- What is evaluation quality? When do we look for it? Who determines what constitutes it, who contributes to it?
    - It is everyone's job to determine what constitutes quality.
    - Real quality in evaluation means that everyone is looking for it during every step in the evaluation plan
    - We look for quality in design, data collection, analyses and reporting
- How is the relationship with the evaluator?
    - Look for evaluation quality all along the way
    - High evaluation quality will use the information and apply it in the program

- Elements of Evaluation Quality
  Evaluators/Evaluation
  - AEA Evaluator Competencies-Program evaluation standards
  - Visitor Studies Association Evaluator-AEA Cultural Competencies Statement Competencies
    - AEA Guiding Principles (1994)-Funder Guidance (NIH/SEPA, NSF, etc.)
- Conversation on Big Data: How to pull data off twitter and use it?
- What does it mean be a culturally responsive evaluator?
  - Able to design evaluation plans that use rigorous methods and analysis in a way that is culturally responsive
- When selecting an evaluator, the AEA competencies specify that a competent evaluator should be reflective of the work/project they are working on
- Methodology: Super key to evaluation
  - What is the purpose of this study? Why are we doing this? Do we think we will need information for the next project?
  - A competent evaluator needs to communicate, listen and move in concert with the project .
- All evaluators come into a project with a different experience
  - Should use the AEA Guiding Principles/Ethical Principles (Systematic inquiry, Competence, Integrity, respect for people, common good & equity)
- Program Evaluation Standards
  - Utility
  - Feasibility
  - Propriety
  - Accuracy
  - Accountability
- Dr. Goodyear's tip for ensuring evaluation quality
  - "Communicate early and often"
  - Refer to Evaluation in Informal Science Education (book just published)

Breakout Sessions
Wednesday, April 24, 2019 – 9:45 AM – 11:00 AM

Curriculum Development and Using Lessons Learned: Looking Across Informal and Formal Contexts, What Can We Learn from Each Other?

Presenters: **Barbara Hug, Ph.D.,** *Teaching Associate Professor, University of Illinois*
Idit Adler, Ph.D., *Research Associate, Michigan State University*
Renee Bayer, MS, *Associate Director for Engagement; Project Manager, Health in Our Hands CREATE for STEM Institute, Michigan State University*
Katherine Richardson Bruna, Ph.D., *Professor of Education, Iowa State University*
Susan Hershberger, Ph.D., *Director, Center for Chemistry Education; Adjunct Assistant Professor, Miami University*
Christopher Pierret, Ph.D., *Assistant Professor, Mayo Clinic - Rochester*
Mary Jo Koroly, Ph.D., *Research Associate Professor; Director, Center for Pre-Collegiate Education and Training, University of Florida*
Sara Erickson, *Program Coordinator, Iowa State University*
Reporter: **Christopher Pierret,** *Mayo Clinic*

In this session, we began with three flash talks, then broke into nine discussion tables, each of which contained a context and questions for discussion.

The three (3-minute) flash talks included:

1. Chris Pierret from Mayo Clinic discussed InSciEd Out, a formal curriculum program that had recently partnered with Boys' & Girls' Clubs of Puerto Rico and were addressing the changes in programming meant to meet the needs of the youth who participated there. Specifically, each age group interacted with the programming in a unique way, presenting challenges for the formal to informal transition.
2. Katherine Bruna and Sara Erickson from Iowa State University told us about the transition of their Urban Ecosystem Project (Mosquito fun) - from informal student programming back to classroom, through more formal ambitious science teaching practices.
3. Rene Bayer described the Michigan State University teams Health in our Hands project and specifically spoke to a balance their team is attempting to strike between the informal summer programming and its return to a classroom environment, while trying to sustain the relationship building of the informal program within a curricular context.

Next, Barbara Hug handed out table questions and each of the attendees was instructed to choose a table to join for a discussion. One individual from each group kept notes on chart paper. After seven minutes, participants were allowed to move to another question/table or stay where they were. We did four such rotations, after which participants were asked to return to their original tables, take in the

additional notes, then summarize briefly the conversations that had occurred at their table.s Brandon Morgan (scholarship awardee) acted as scribe to collect summaries from the tables. These summaries are included below by table number (includes topic of discussion). Images of the detailed chart paper responses can be requested from Barbara @ *bhug@illinois.edu*.

Table 1: Differences across settings of formal and informal:

- Assessment may be easier in formal settings.
- Discussion centered on freedom vs. constraints

Table 2: Merging together formal and informal instruction:

- Building on teacher experience with enriching informal curriculum
- Using failure
- Sending informal curriculum to teachers is a challenge.

Table 3: Parent involvement:

- Groups struggled with what is meant by parent involvement
- How are parents involved at home versus at the education site?
- Communication should occur by the means necessary - could mean mail, but should not become overwhelming.
- Events make an environment for parents
    - Be mindful of their time
    - Requires event and time coordination
    - Food helps (and childcare in same space)

Table 4: Involving the broader community:

- Must lower barriers for participation
- Communication to translate ideas from one to another
- Need stake in project

Table 5: Thinking about empirical base to what we are doing (frameworks)

- Double edged-curricular frameworks (i.e. NGSS) can be the key to teachers valuing experiences in an informal setting.
- Following formal standards in informal spaces may feel duplicative.

Table 6: Differences in methods in formal and informal settings:

- Need established trust
- Team building
- Teaching others to work with youth

Table 7: Issue of equity in the different environments:

- Informal-providing resources
- Inclusivity training, group agreements, trust, science as a pathway, open communication and opportunities

Table 8: Perceptions and advocacy for formal and informal education:

- Respect is necessary for both formal and informal.
- Formal often has clearer goals, and that rigor may be value added for informal education.
- The stakeholders are often the same.

Table 9: Professional learning for teachers and informal educators:

- Time available for content mastery is a challenge for both settings.
- Goals for each may or may not be the same.

Participants:

Laurie Jo Wallace, Health Resources in Action
Renee Bayer, Michigan State University
Melissa Kurman, University City Science Center
Sean Freeland, West Virginia University
Grace Stallworth, University of Nebraska – Lincoln
Brandon Morgan, Health Resources in Action
Michael Carapezza, Columbia University
TanYa Gwathmey, Wake Forest School of Medicine
Alexander Chang, Seattle Children's Research Institute
Rebecca Carter, Seattle Children's Research Institute
Amanda Jones, Seattle Children's Research Institute
Marnie Gelbart, Harvard Medical School
Consuelo Morales, Michigan State University
Karen Yanowitz, Arkansas State University
Andrea Varea, NIH/NINDS
Leah Clapman, PBS NewsHour
Madison Spier, Texas A&M Health Science Center
Katherine Bruna, Iowa State University
Donna Cassidy-Hanley, Cornell University
Regina Wu, Fred Hutchison Cancer Research Center
Idit Adler, Michigan State University
Susan Hershberger, Miami University
Sequoia Wright, University of Maryland, Baltimore
Neil Lamb, HudsonAlpha Institute for Biotechnology
Sara Erickson, Iowa State University
Mary Jo Koroly, University of Florida
Luke Bradley, University of Kentucky
Gwendolyn Stovall, University of Texas at Austin
Laura Courtney, Washington University
Irene Wolf, Saint Francis University
Brett Taylor, University of Montana
Christopher Pierret, Mayo Clinic
Geza Varhegyi, Cuyahoga Community College
Jamie Bell, InformalScience
Waynetta Turner, Birmingham City Schools

WHAM! BANG! SLAM! Reading and Making Comics: Innovative Pathways to STEM Content

Presenters: **Martin Weiss, Ph.D.,** *Senior Scientist, New York Hall of Science*
Wren Thompson, BSc, *Research Assistant, New York Hall of Science*
Laycca Umer, MSc, *Research Assistant, Program Coordinator, New York Hall of Science*
Reporter: **Elizabeth Grace,** *Washington State University*

In this breakout session, presenters from New York Hall of Science (NYSCI) facilitated an interactive exploration of the evolutionary biology digital comic book "Transmission: Gone Viral." Attendees participated in activities associated with the comic book found in the accompanying educator guide, while being introduced to the comic book itself and the instructional resources associated with the project. Project design and the research currently underway were discussed.

As attendees entered the session, facilitators asked them to answer the following questions on sticky notes:

- How do you define observation?
- How do you define inference?

Session began by introducing the project.

- Goal of the project is to support middle school students in understanding zoonotic diseases (West Nile Virus) and to support students in collecting and validating evidence (students continually develop hypotheses and search for evidence to support or reject their hypotheses throughout the comic book).
- Comic book is a narrative story: crows are dying mysteriously in Metro City and three children piece together the evidence throughout the book.
- Comic book is available on a web browser to increase accessibility.
- Curriculum includes supplemental resource guide created in partnership with middle school teachers during a summer program.

Why Comic Books?

- While comics typically include heroes who fight evil, this comic includes three characters who look like students and are investigating a real-world problem.
- Comics can engage young learners in science.
- Can be used in a formal or informal setting.
- Comics can be a familiar medium to students.

About the characters:

- Much attention was given to the character development. Goal was to provide relatable characters that students could identify with.
- The three main characters were Eduardo, Rani, and Maria. Each had a character card that described their special talents and interests.

- Additional characters included Terry, Zip, and Madu, adult scientists who were also designed for relatability.

Session facilitators led attendees through an activity from the resource guide, which supports students in understanding observation and inference.

- Mystery Bags: Facilitators passed around four brown paper bags and instructed attendees to jot down what they noticed. Without looking into the bags, attendees were tasked with making observations about the objects. Example observations included:
  - Squishy, elastic, soft (jelly pom pom)
  - Heavy, loud, small, round, multiple (marbles)
  - Rigid, heavy, smooth on inside, rough on outside (abalone shell)
  - Sappy, bendy, long, prickly (pine cone)
- After attendees finished making their observations, facilitators returned to initial definitions of observation and inference using the mystery bag activity to help differentiate between these two practices.

The Comic Book: *https://nysci.org/school/resources/transmissions-gone-viral/*

- Context – the main characters find a dead bird in the park. They meet a scientist and explore similarities between animals and humans.
- Throughout the narrative, more dead birds are found across Metro City and Eduardo, Rani, and Maria collect maps, newspapers, and photographic evidence to continue investigating the cause of the dead birds.
- Session attendees spent time looking through an interactive map that is included in the comic book. This community map included possibly relevant evidence that students could chart out geographically in different combinations to look for patterns. Students could display three clues at a time and the map showed where those clues were found amongst the dead bird sites. Students could track how different combinations of clues connected at the various dead bird sites and look for overlapping evidence.

Ongoing Research

- Implementation studies: how are students using these in libraries and at home?
- Pre- and post-understanding of zoonotic disease transmission.
- Observation of individual students as they interact with comic.
- Future: Investigate how libraries implement the program (beginning Fall 2019).

Participants:

Diamond Alexander, West Virginia University
Destiny Patterson, West Virginia University
Libby Grace, Washington State University
Roger Sloboda, Dartmouth College
Anne Van De Ven, Northeastern University
William Folk, University of Missouri
Robert Young, Saint Francis University
Anastasia Thanukos, University of California, Berkeley
Rachel Smilow, Children's National Research Institute
Timothy Indahl, Mayo Clinic

Patents, Copyright and Trademarks: Commercial Protection for Your New Product

Presenter: **Mark Rohrbaugh, Ph.D., JD,** *Special Advisor for Technology Transfer, National Institutes of Health*

Reporter: **Mason Arrington** *from the Center for Interdisciplinary Inquiry and Innovation in Sexual and Reproductive Health at the University of Chicago*

This session was informational and may appear, at first blush, to have been a very dry session. The law is often very ponderous (and even intentionally obtuse) but that's not what this session ended up being. It had a matter-of-fact and straightforward nature that made the material easy to understand and apply to our own projects. I should say, as it was clearly stated at the start of the session, this session is not meant to be legal advice.

There are four major categories of commercial protection:

- Patents: These protect ideas and unique designs that are tangible, useful, novel, non-obvious, and not found in nature.
- Copyrights: These are works of authorship fixed in tangible media. This does not account for facts; raw data; functional aspects of software; slogans; titles; and monikers.
- Trademarks: A trademark is a word; phrase; logo; symbol; shape; number; letter; color; sound; or scent used as an identifier.
- Trade Secrets: This is undisclosed information that protects by keeping a secret such as the Coca-Cola recipe.

A copyright is owned by a company or institution if the work is authored during the author's capacity as an employee. This basically means that if a work is authored during work hours or the time you're being paid to work. Important to remember, though: contractors are exempt from this unless specified in the specific contract. Owning a copyright allows you to duplicate, sell, display, and create derivations. Another important note: the US government cannot create/own a copyright but they can create a trademark.

There are some limitations to copyrights. Anyone is able to resell copyrighted material if it is their "first sale" meaning the first instance of that individual purchasing a copy. In other words, you can resell a book you've bought but you can't buy a stack of copies and start reselling them. For software, one can duplicate but not sell authored material. Finally, there is "fair use" which covers criticism, commentary, reporting (journalism), parody, education, and research. Trademarks are also subject to fair use but the protections are narrower than copyrights.

Participants:

Atom Lesiak, University of Washington
Berri Jacque, Tufts Medical School
Stephanie Tammen, Tufts Medical School
Jackie Shia, Wheeling Jesuit University
Donald DeRosa, Boston University
Roy Womack, Georgia State University
Mason Arrington, University of Chicago
Kelly Puzio, SquidBooks
William Schneller, Substrate Games
Melinda Butsch-Kovacic, University of Cincinnati
Jane Disney, MDI Biological Laboratory
Dina Markowitz, University of Rochester
Melani Duffrin, Northern Illinois University
Elizabeth Ozer, University of California, San Francisco
Adam Hott, HudsonAlpha Institute for Biotechnology
Georgia Hodges, University of Georgia
Abbey Thompson, Stanford University
Anja Scholze, The Tech Museum of Innovation

Developing Indicators of a High-Quality SEPA Evaluation

Facilitator: **Louisa A. Stark, Ph.D.,** *Professor of Human Genetics; Director, Genetic Science Learning Center, University of Utah*

Panelist: **Leslie Goodyear, Ph.D.,** *Principal Research Scientist, Education Development Center; past president, American Evaluation Association*

Reporter: **Taylir Schrock, M.S.,** *Research Coordinator, Salish Kootenai College STEM Academy*

This was an informal session where we were tasked with developing a checklist to show what constitutes a quality evaluation for a project. Dr. Stark asked people to start by using a think, pair, share approach, and take a few minutes to write down a few elements they think are essential for a high quality SEPA evaluation. She suggested a good book to read is A Checklist Manifesto by Atul Gawande

Responses from each table:

A. We believe evaluation should be interwoven throughout the grant application, thus holistic. Should have a clear statement of the audience, recruitment, timeline, and logic model. It should also address a needs assessment.

B. Includes opportunities for learning and course correction. Maybe it will say "monthly we will reflect on what's going on and see if there are ways we need to tweak this for the next survey."

C. Develop a relationship and check-in with the person. Be on a first name basis. Budget for meetings!

D. The evaluator should understand the aims and outcomes for the project so that they know what they need to be measuring. It is good to have early meetings with the evaluator and communicate what all of that means and what it can look like. Also be able to evaluate a work plan and interview stake holders about understanding how the project will be evaluated.

E. The evaluation team should plan to observe the program, but not measure yet. Sort of "background observations" just to see how it is going.

F. Advisory board gives input about the evaluation. Have private meetings and reports that become part of the annual report. Consider an evaluator expert as a part of your board to help with the process.

G. Have well defined evaluation questions. Have a matrix of evaluation questions, data collection, and how to use data.

Evaluation Question	Data Sources	-Data collection -How to collect the survey -Frequency	Analysis	Reporting

Table 1. Sample of data collected during proposal & evaluation planning.

H. Critical comments from the program. Reporting all evaluation report outcomes and recommendations for improvement.

I. Iterate process for improvement. For example, annual team meeting with evaluation to reflect on the evaluation. This is so the evaluator can determine what they can do to help the grantees do their jobs better. Monthly check-ins are really handy, because if you wait too long you cannot respond quickly enough to adapt your evaluation.

J. Developmentally and culturally appropriate evaluation. You could recognize this by looking for a rationale for why these tools were selected and how it is appropriate for the audience. It is helpful to schedule support groups to discuss these topics and know that these things have been thought about.

K. Make sure you include the anticipated pitfalls and challenges.

L. Have an example of what it is going to look like.

M. Look for appropriate and rigorous methods. A way to determine this is to see if the evaluator has built on a strong and appropriate framework. Find out if the data reports are appropriate and if the instruments are known to be evaluative and appropriate.

N. There is also an element of burden. You need the evaluation to be feasible, reasonable, within the budget constraints, and make sure it doesn't take too much time during the program. Determine if it is an evaluation the staff are able/capable of conducting.

O. If you are going to do a knowledge assessment, you should see a plan for validating the instrument you are using. Are you going to have content assessments and see if this is understood by students? Are there ceiling effects? Are you taking items from other sources? If so, you still need to test this with your target population. Are you developing your survey? And if so, how is your audience going to interpret these survey questions?

P. How to analyze qualitative data should be included in your evaluation.

Q. Use good resources, like the AJE (American Journal of Evaluation)

R. You should know a Theory of Change: if you don't know what happened at each stage, you will not understand the outcomes. Data doesn't tell you what you need to know! You need to use the data to discover the outcomes.

S. Publish your methods! You can include your evaluator on these, or they can include you.

Participants:

Orestes Quesada, University of Puerto Rico
Michele Shuster, New Mexico State University
Karin Chang, University of Kansas
Sharon Locke, Southern Illinois University Edwardsville
Laurel Zhang, Exploration Place
Virginia Stage, East Carolina University
Danielle Alcena-Stiner, University of Rochester
Sandra San Miguel, Purdue Veterinary Medicine
Kelley Withy, University of Hawaii
Anne Holland, Space Science Institute
Rebecca Norlander, New Knowledge Organization
Teresa Evans, University of Texas Health Science Center at San Antonio
Grace McClure, University of Texas at Dallas
Amy Spiegel, University of Nebraska – Lincoln
Michelle Phillips, Inverness Research
Christine Cutuchache, University of Nebraska Omaha
Melinda Gibbons, University of Tennessee
Erin Hardin, University of Tennessee, Knoxville
Tania Jarosewich, Censeo Group
Brinley Kantorski, The Partnership in Education
David Clayton, University City Science Center
Farrah Jacquez, University of Cincinnati
Lisa Vaughn, Cincinnati Children's Hospital/ University of Cincinnati
Kristin Bass, Rockman Et Al
Irina Krasnova, NIH/NIGMS
Loran Parker, Purdue University
Marie Barnard, University of Mississippi
Lynne Holden, Mentoring in Medicine, Inc
Michael McKernan, The Jackson Laboratory
Weiling Li, Purdue University
Lindley McDavid, Purdue University
Michael Kennedy, Northwestern University
Adel Karara, University of Maryland, Eastern Shore
Anjan Nan, University of Maryland, Eastern Shore
Dina Drits-Esser, University of Utah
Rob Rockhold, University of Mississippi Medical Center
Emily Kuehn, US Army Medical Research and Materiel Command
Holly Brown, US Army Medical Research and Materiel Command
Kevin Morris, Walter Reed Army Institute of Research

Designing Effective STEM Experiences for Elementary-Aged Students: A Developmental Perspective

Facilitator: **Robert I. Russell, Ph.D.,** *Program Director, National Science Foundation*
Panelists: **Nancy Moreno, Ph.D.,** *Associate Provost of Faculty Development and Institutional Research, Baylor College of Medicine*
Michelle Venture-Ezeoke, Ph.D., *Program Manager, Georgia State University*
Reporter: **Anjelica Miranda,** *Denver Museum of Nature & Science*

This session covered an overview of child development for elementary aged children in grades K-5 and included presentations from two projects sharing how they have developed a science curriculum for children and applied their curriculum in the classroom.

Dr. Robert Russell began with a quick overview of how elementary-aged children think about science, how they learn, and the age-related changes in cognition for children in grades K-5. He described that first graders think science is about learning new things, the human body, having fun, and learning about what it was like in the "old days".

He went on to describe what we know about children and their way of thinking. 1) Children know more than we thought they knew, but that they have less sophisticated reasoning than adults and older children; 2) Children's scientific reasoning and modeling gradually develop over time by asking

questions; 3) Children have many misconceptions about science; 4) Change in a child's way of thinking is gradual over time. Children have age-related changes in cognition. Their learning and memory, casual knowledge, language, concepts, and mental abilities related to academic skills all change as they get older.

When creating a science program directed at children, Dr. Russell shared theories of learning which included hands-on science learning and constructivism, socio-cultural (the importance of culture), and information processing (thinking and coming up with strategies). He also went on to list the elements that should be incorporated when designing a children's science program:

- Asking questions and forming hypothesis
- Observing and recording
- Evidence
- Covariation evidence
- Modeling (have kids model the process)
- Vocabulary (connect words to context and experiences)
- Hands on and fun

Next, Dr. Nancy Moreno described how her program has developed a science curriculum and implemented it into the classroom. The goal of the program is to fill in the gaps for the topics and subjects that are not covered in student's textbooks or classrooms. There are two different ways in which the program is integrated into the classroom. The first is guided inquiry, where questions posed by the teachers and students have guide rails to help answer them. The second was open ended investigations, where the program provided resources and partnered with different institutions (NASA, BioServe, NSBRI, CASIS). These institutions were able to provide real data for the students to work with and allowed the students to ask their own questions and create their own investigations. Teachers were also provided with teaching materials, along with photos and videos via the internet.

Along with her program overview, Dr. Moreno shared some ways to help integrate science language and reading. For example, science can be made less intimidating and more engaging through the use of fiction books. Using authentic language (ex: I see = observations) fosters disciplinary literacy and engages students in specialized literacy practices. She also shared her 5E Learning Cycle Model:

1. Engagement – estimate knowledge or misconceptions, stimulate interest
2. Exploration – provide activities that guide students to an end point
3. Explanation – sense making phase, introduction to concepts, processes or skills
4. Elaboration – extends exploration to other situations, application of concepts or skills
5. Evaluation – students demonstrate understanding of a concept or skill and evaluate their own progress

Dr. Michelle Ventura-Ezeoke presented next on her project about promoting genetics literacy in elementary school settings. The goal of her project is to teach the language of DNA as a second language to children (ages 5-9), while complying with school district standards for language learning. Her program designs engaging and informative genetics modules with language that is relatable and brought down to a level students can understand. The genetics learning modules consist of 50-minute

sessions delivered to elementary school children by graduate and undergraduate students enrolled at Georgia State University. The elementary students lead the learning in small groups with facilitators (grad and undergrads) asking questions along the way to help guide the groups. Students are also given pre- and post-surveys about before and after the program.

For teachers, Dr. Ventura-Ezeoke's program provides teacher professional development where the teachers themselves get the opportunity to learn about genetics. These teacher professional development workshops give teachers confidence to teach genetics concepts and content and allow teachers to genuinely buy in to the program and its goals.

The biggest lesson learned from this session was to ensure that any program developed for K-5 children is fun and engaging.

Participants:

Anjelica Miranda, Denver Museum of Nature & Science
Kelly Furr, Northern Illinois University
Emily Mathews, Northwestern University
Gretchen Gose, Unidos Dual Language School
Edward Zovinka, Saint Francis University
Obi Onochie, Boston University
Julia Miller, Children's National Health System
Kevin D. Phelan, University of Arkansas for Medical Sciences
Krisderlawn Motley, St. Jude Children's Hospital
Mary Kay Hickey, Cornell University
Tana Chandler, Hopa Mountain
Larry Johnson, Texas A&M University
Linda Rost, Montana Tech
Patrick Brown, NIH/NIGMS
Patricia Whitehouse, Chicago Public Schools

Town Hall to Talk about Big Data and Develop a Plan for a 2020 and Longer Approach to Incorporating it into SEPA's

Facilitator: **Mike Wyss, Ph.D.,** *Professor and Director, Center for Community Outreach Development, University of Alabama at Birmingham*

Presenters: **Carla Romney, Ph.D.,** *Director of Research, Boston University School of Medicine*
Ralph Imondi, Ph.D., *Executive Director, Coastal Marine Biolabs*
Charles Wray, Ph.D., *Director, Courses and Conferences, The Jackson Laboratory*

Reporter: **Mike Wyss, Ph.D.,** *Professor and Director, Center for Community Outreach Development, University of Alabama at Birmingham*

Participants:

Krishan Arora, NIH/NIGMS
Rashada Alexander, NIH/NIGMS
George Shipley Jr, White River Middle School
Sheila Thomas, Harvard University
Stephen Koury, University at Buffalo
Chuck Wood, Wheeling Jesuit University
Bruce Stanton, Dartmouth Geisel School of Medicine
Carmen Maldonado-Vlaar, University of Puerto Rico
Summer Kuhn, HSTA
Linda Morell, University of California – Berkeley
Tim Herman, Milwaukee School of Engineering
Dina Markowitz, University of Rochester
David Petering, University of Wisconsin – Milwaukee
Kristine Wylie, Washington University
Julia McQuillan, University of Nebraska – Lincoln
Bruce Nash, DNA Learning Center
Ang Chen, University of North Carolina at Greensboro
Andrea Panagakis, Salish Kootenai College
Joan Griswold, University of Washington

National Cancer Institute Youth Enjoy Science (YES) Program Meeting

Facilitator: **Alison Lin, Ph.D.,** *Program Director, National Institutes of Health – National Cancer Institute*

Reporter: **Lisa Marriott,** *Oregon Health & Science University*

The R25 Youth Enjoy Science (NCI YES) grant originated from the P30 Continuing Umbrella of Research Experiences (CURE) program. It was designed to serve diverse youth by considering race/ethnicity, disability and disadvantaged backgrounds and is targeted to middle school through undergraduate students and teachers and faculty. Each YES application requires research experiences (except in the case of middle school applicants); curriculum/methods development; and demonstrated outreach. Research experiences are defined as individually mentored research, but for teachers curriculum/methods development meets the requirement.

Program costs include direct costs of $5,000 per participant; research expenses of $1,500 per participant per year; and housing costs of an average per participant, per year amount not to exceed $1,000.

Successful applicants will be able to cite more than youth and diversity as reasons for inclusion. They must be able to justify why their population has a specific need to participate. In addition, the application should include a clear CANCER focus. For instance, a DNA focus would not be acceptable unless it is tied to role and impact on cancer. Also, the students would need to be able to make a two year, three month commitment, per year to participate.

The ICURE programs include post baccalaureate programs at NCI, graduate student training opportunities, and postdoctoral funding: *https://www.cancer.gov/about-nci/organization/crchd/diversity-training/icure*

Several new programs were started 2018: Oregon Health & Science University, which is a tiered program for rural students; one in Kentucky focusing on high school and undergraduate students that uses cancer literacy measures to see student gains; and City of Hope – YES2Success in LA program that starts in 6th grade and serves middle and high school students.

There are also some existing programs, which were funded in 2017. They include Case Western with participants from middle school; as well as 25 high school students; 10 undergraduates; five high school teachers and college entrance support. Another program, Farber/Harvard, which includes middle school, high school and undergraduates emphasizes college readiness and concept inventory. The last two are University of Chicago – Eyes on Cancer, a partnership with industry along with the Museum of Science where students spend two years of 8-week sessions learning lab techniques; and Nebraska where Native American students (middle school to undergraduate level) do a cancer biology terminology module (will be on website).

Participants:

Alison Lin, NIH/NCI
Sara Hargrave, NIH/NCI
Etaria Omekwe, NIH/NCI
Lisa Marriott, Oregon Health & Science University
Kelli Qua, Case Western Reserve University
Alana Newell, Baylor College of Medicine
Ann Chester, West Virginia University
Marlys Witte, University of Arizona
Robin Fuchs-Young, Texas A&M University
Christopher Sistrunk, City of Hope
Eileen Dolan, University of Chicago
Bret Hassel, University of Maryland School of Medicine
Emily Mathews, Northwestern University
Kate Ayers, St. Jude Children's Research Hospital
Kim Soper, University of Nebraska Medical Center
Jeanne Chowning, Fred Hutchinson Cancer Research Center
Dave Vannier, Fred Hutchinson Cancer Research Center
Sarah Wojiski, The Jackson Laboratory
Nathan Vanderford, University of Kentucky
Chris Prichard, University of Kentucky
James Skeath, Washington University
Crystal Lumpkins, University of Kansas
Behrous Davani, NIH

Breakout Sessions
Wednesday, April 24, 2019 – 11:15 AM – 12:30 PM

Engaging Native Students in STEM Experiences

Presenters: **Kelley Withy, MD, Ph.D.,** *Professor and Director, Hawaii/Pacific Basin Area Health Education Center (AHEC), University of Hawaii*
Bonnie Sachatello-Sawyer, EdD, *Executive Director, Hopa Mountain*
Tana Chandler, *StoryMakers Program Coordinator, Hopa Mountain*
Mary Larson, MSE, *Principal Investigator, Salish Kootenai College*
Victoria Coats, *Exhibits R&D Manager, Oregon Museum of Science and Industry*
George Shipley, ME, *Principal, White River Middle School*

Reporter: **George Shipley Jr.**

The purpose of this session was to share methods and best practices for broadening the participation of Pacific Islanders and Native Americans in the STEM fields.

Best Practices Related to Inclusion Programs

- Know and use the preferred tribal name (i.e. Lakota versus the government designated term-Sioux)
- Use innovative techniques to target the core audience
- Know the target audience's history, story, culture, customs, values, and family beliefs
  - Be sensitive to Native American and Pacific Islander history as a whole
  - Partner with Native American and Pacific Islander museums
- Create mentors for the target group
  - Invest in community leaders and youth
  - Target rural areas where there are fewer examples of STEM professionals
- Connect with the target group on a family level
  - Listen first
  - Engage in positive conversations
  - Bring healthy children's books (for younger siblings)
  - Have family meetings over a meal
- Long term commitment
  - Start in middle school and stay connected with students through high school and college
    - Have high school students do outreach to elementary and middle school students
- Field trips
  - College tours
  - Culturally related trips
  - STEM related trips

- Trips that are fun, expand exposure, create background knowledge, and increase social comfort in general (museums, industrial plant tours, plays, sporting events, etc.)

Best Practices for STEM Summer Camps

- Include carefully selected academic activities
  - Activities should be taught by professors
  - Activities should be hands on and project-based
  - Activities should have planned backup activities that can be pivoted to in case an activity is not going well
- Have structured recreational and social activities
- Have time scheduled for unstructured recreational and social activities
- include role models (i.e. native professors and/or camp employees)
- Directly supervise students and facilitate parent involvement (parents concerned about safety and care of their children should be reassured and involved)
- Camp should be as close to the last day of school as possible
- Select students for camp based on talent and interests
- Have an agreement with camps concerning no-show students
- Have fun!

Participants:

Bonnie Sachatello-Sawyer, Hopa Mountain
Tana Chandler, Hopa Mountain
Abbey Thompson, Stanford University
Sheila Thomas, Harvard University
Aaron Kyle, Columbia University
Andrea Varea, NIH/NINDS
Jenica Finnegan, University of Nevada, Reno
Sheila Caldwell, NIH/NIGMS
Laurel Zhang, Exploration Place
Laurie Jo Wallace, Health Resources in Action
Michael Carapezza, Columbia University
Michael McKernan, The Jackson Laboratory
Marnie Gelbart, Harvard Medical School
Regina Wu, Fred Hutchison Cancer Research Center

Exploring Common Themes in Diabetes and Obesity Education

Presenters: **Joan Griswold, MIT,** *GEMNet Program Manager and Principal Investigator, University of Washington*
Atom Lesiak, Ph.D., *Director of Genome Sciences Education Outreach, University of Washington*
Reporter: **Brandon Morgan**

The first question was: What are two to three take-home messages you want your stakeholders to know/understand about type 2 diabetes, obesity and metabolic disease?

Presenters agreed that understanding the genetic and environmental components is important. This can be done by encouraging stakeholders to use the science-based solutions to make changes in their lives. In addition, building knowledge about nutrition and type 2 diabetes through education that spans the elementary through high school years should be implemented. Also, it's important to address societal issues underlying problems with obesity and metabolic disease for stakeholders to understand that small changes to their behavior can make a significant impact on health.

The second question was: How might you incorporate the intersectionality of race and social justice with type 2 diabetes/obesity education?

First, they said we need to address the problems of food scarcity, food deserts and lack of access to healthy food. Another strategy would be to use the study of genomics/DNA to educate people about type 2 diabetes and obesity risk. It was also suggested that we should empower youth with a sense of agency to solve this problem. However, it may be tough to do this when most kids don't do the shopping or cooking. Perhaps making a cost analysis of healthy vs. junk food would be a useful exercise, or teaching youth how to cook. At any rate, this question seemed to cause participants anxiety in knowing how to approach the conversation and how to . The presenters emphasized the importance of knowing your audience by having an understanding of their food culture and researching acceptable adaptations and modifications. They also suggested using student advocates, which would work in some populations/cultures, but not others.The third question was: What strategies do you use, or are you aware of, to build student self-efficacy?

Presenters said they first consider the context of culture, identity, etc. (Social Structures) to meet learners/students where they are. They said it's important to remember not to define cultures using generalizations, but still to understand pre-dispositions to diabetes. Then, they provide tools and foundational knowledge that will allow everyone to experience a feeling of success (empowerment). In this way students identify goals and problems and they determine the solution that works best for them. During this process facilitators must avoid blaming and shaming and keep in mind that change can be incremental and slow.

Q4: What are the major misconceptions you've found people to have around type 2 diabetes and obesity? How do you address those?

Major Misconceptions include the belief that type 2 diabetes is determined completely by either genetics or a person's choices such as what they define as "healthy" food, or that it is a disease of the elderly. Many people also believe that once a person develops type 2 diabetes, the situation cannot be changed

However, there are solutions. Education, Involving, and Addressing. First the problem must be dealt with on a policy level with solutions that increase access to healthy foods, while keeping in mind cultural and practical considerations, such as not having enough time to cook. Media and advertising can also be influencers as long as it has been determined who people will believe when delivering the message. Lastly the hardwired desire most people have to enjoy sugar and sweets needs to be considered.

Participants:

Obi Onochie, Boston University
Kelly Furr, Northern Illinois University
Stephanie Tammen, Tufts Medical School
Brandon Morgan, Health Resources in Action
Carlos Penilla, University of California, San Francisco
Georgia Hodges, University of Georgia
Linda Morell, University of California – Berkeley
Tim Herman, MSOE
Sandra San Miguel, Purdue Veterinary Medicine
Renee Bayer, Michigan State University
Sequoia Wright, University of Maryland, Baltimore
Atom Lesiak, University of Washington
Julia Miller, Children's National Health System
Elizabeth Parker, University of Maryland, Baltimore

Short- and Long-Term Evaluation for SEPA/INBRE and COBRE Partnerships

Facilitators: **Rashada Alexander, Ph.D.,** *Program Director, Division for Research Capacity Building, National Institute of General Medical Sciences*
Krishan Arora, Ph.D., *Program Director, Division for Research Capacity Building, National Institute of General Medical Sciences*
Reporter: **Rashada Alexander,** *National Institutes of Health, NIGMS*

The session began with an introduction and overview of the session format by Rashada Alexander, Program Director, NIGMS. Session panelists were introduced and gave approximately seven-minute presentations, which were followed by questions, answers, and general discussion from the audience, panelists and session co-chairs (Drs. Alexander and Krishan Arora, Program Lead for the INBRE Program).

Dr. Alexander asked that participants to consider the following:

- Each SEPA and the partnerships it forms will be unique. No one is expected to do exactly what the panelists did or what someone else did. The information can serve as a potential template, but does not need to be replicated.
- Many of the things discussed may have originally been new or uncharted territory for the programs involved, so consider applying that concept of pushing into new spaces where possible.
- Take the opportunity to ask a question about a partnership or evaluation aspect you have been considering.

Panelists:

- Ann Chester: WVU, Health Sciences and Technology Academy (HSTA), a program that involves extracurricular activities and coordinated research experiences.

- Marisa Pedulla: Montana Tech, Bringing Research into the Classroom (BRIC) Program, a phage discovery program that has over 8,000 student-participants.
- Rob Rockhold: University of Mississippi Medical Center, Science Teaching Excites Medical Interest (STEMI) program, which includes a laboratory research prep program with nearly 200 graduates, and teacher professional development and enhanced science education.

Ann Chester:

- HSTA's success involved breaking down siloes, as she was unaware of the WV-INBRE for at least a decade before engaging with the program.
- Within the last 10 years, 52 HSTA-affiliated educators have received internships to work in biomedical research with WV-INBRE-funded mentors and labs, 157 INBRE representatives have participated in HSTA events, and 55 HSTA scholars have received internships to work in biomedical research in INBRE-funded labs.
- Over 60% of the HSTA scholars graduated with STEM degrees, and nearly a third are in STEM careers or in undergraduate programs in STEM fields.
- Getting this type of data is difficult and takes lots of time. Tracking is helped by coordination with the INBRE, but is still challenging.

Marisa Pedulla:

- Bringing Research into the Classroom (BRIC) Program started from INBRE seed funding for Dr. Pedulla, and evolved into being SEPA-funded. Program philosophy: You don't need to be a physicist to ride a bike. You don't need a Ph.D. in microbiology to discover a virus.
- Over 8,000 students and 46,000 miles traveled across Montana since 2014, resulting in substantive research done by high school students and also presented at national and international science fairs.
- Worked with the INBRE program to foster a pipeline from high school to undergraduate researchers, and piloted an expansion program in 2018 for BRIC graduates to do research at Montana Tech.
- Response was enthusiastic, with more applicants than expected. Hustled to find funding across both programs for the students, and faced challenges for those students who had family and other competing priorities for summer time.
- Placed four former BRIC students in INBRE labs, and implemented intensive career and research development, including RCR and safety trainings, and grad school application preparation. Culminated in research poster presentations.
- Lessons learned: Start earlier in application and logistical preparation and coordinate evaluation with MT-INBRE.

Rob Rockhold:

- Focusing on shorter-term evaluation as the MS-INBRE-STEMI partnership is newer. Collaboration aimed to provide maximum benefit to both SEPA and INBRE, and the goals were: enhance networks to support Flipped Learning and research-focused programs in K-12, enhance K-12 STEM curriculum, enhance the student pipeline into biomedical/health careers.
- STEMI provides small grants to K-12 teachers, allowing for additional support for teachers to develop innovative science education programs. Can aid with the challenge of attracting students to STEM

programs prior to high school. Resulting curricula include: Base-Pair Program (high school research experience), a PCR-based competition, and an outdoor exploratory classroom. Programs average 15-411 students served and/or involved per year.

- The Base Pair Program specifically has served 207 students to date and resulted in 350+ published abstracts and research presentations. Also serves as a pipeline into the MS-INBRE Research Scholars Program, with 21 students making this transition. Twelve (12) additional students from eight high schools also participated in the program as seniors prior to beginning their undergraduate careers, furthering the link between STEMI and INBRE. Collaboration also includes STEMI participation in the MS-INBRE annual research symposium.
- Future challenges and efforts include tracking of the students.

Discussion and Q&A:

How to frame and report outcomes outside of students getting Ph.D.'s or going into STEM research careers?

Discussion:

- Multifaceted consideration of the outcomes is helpful and supported by NIH, as SEPA's goals include health-literacy and pre-K-12 STEM engagement. PIs and applicants should consider the program goals and the context in which the program is situated (e.g., important issues for the locality or region the program will be in). SEPA programs benefit from collaboration and community buy-in and support, the goals of which may be different from other NIH programs.
- In addition, NIH recognizes the importance of students being exposed to STEM career options and that many of them may not go into research careers. For instance, matriculation into undergraduate STEM programs and graduation rates are considered a success for many of the communities that have SEPA programs, regardless of whether the students pursue Ph.D.'s.

How to align priorities of multiple partners?

Discussion:

- Referring to the funder's priorities and collecting data that can address those.
- Putting in "sweat equity" to engage with partners and learn what their priorities are.
- Flexibility and compromise in trying to address as many priorities as feasible.
- Finding out what your potential audience (local organizations, legislators, etc.) might want to see or respond to.

Suggestions for building partnerships across multiple INBRE/COBRE institutions and programs?

Discussion:

- Early and frequent conversations with INBRE or COBRE PIs
- Engage in ongoing INBRE/COBRE activities (e.g., calls for applications, research symposia)
- Clear communication of goals and intent, early on and often
- Consider developing/using "SEPA ambassadors" who can share information about the program and serve as channels for opportunities

Broader challenges for collaborations:

- Perceived differences in program goals and the students involved in the respective programs: SEPA students may not be perceived as likely to matriculate into PUIs or INBRE/COBRE programs may have topic areas unrelated to SEPA programs.

Potential strategies to facilitate collaborations:

- Dedicated staff at either or both the SEPA and INBRE levels for tracking efforts and/or coordinating collaboration between the programs.

Suggestions for NIH:

- Administrative supplements to build SEPA-INBRE/COBRE collaborations.

Participants:

Rashada Alexander, NIH/NIGMS

Kevin Morris, Walter Reed Army Institute of Research

Holly Brown, US Army Medical Research and Materiel Command

Rayelynn Brandl, Montana Tech

Amy Spiegel, University of Nebraska – Lincoln

Irina Krasnova, NIH/NIGMS

Bryan Silver, NSF

Roger Sloboda, Dartmouth College

Patti Parson, PBS NewsHour

Bruce Stanton, Dartmouth Geisel School of Medicine

Marisa Pedulla, Montana Tech

Marie Barnard, University of Mississippi

Loran Parker, Purdue University

Lindley McDavid, Purdue University

Karin Chang, University of Kansas

Eve Wurtele, Substrate Games

Rob Rockhold, University of Mississippi Medical Center

Ann Chester, West Virginia University

Preparing Students for Research Experiences

Panelists: **Debra L. Yourick, Ph.D.,** *Director, Walter Reed Army Institute of Research*
Jennifer A. Ufnar, Ph.D., *Executive Director, Center for Science Outreach; Research Assistant Professor of Teaching and Learning, Vanderbilt University*
Gwendolyn M. Stovall, Ph.D., *Director, High school Research Initiative, University of Texas at Austin*
Rebecca Smith, Ph.D., *Co-Director, Science & Health Education Partnership, University of California, San Francisco*
Farrah Jacquez, Ph.D., *Associate Professor & Assistant Head, Department of Psychology, University of Cincinnati*
Lisa Vaughn, Ph.D., *Professor, Cincinnati Children's Hospital & Medical Center*
Reporter: **Anjelica Miranda,** *Denver Museum of Nature & Science*

For this session, presenters gave a brief overview of their projects, discussed the preparation that is needed for their projects, as well as the challenges their projects have faced.

Research Experiences at the Walter Reed Army Institute of Research (WRAIR)

Program Overview:

Informal and in-classroom internship projects are taught by trained near-peer mentors, with modules designed to be novel, hands on, inquiry based, and highly engaging for high school students. The modules are also focused on student-centered learning where students pose questions, obtain evidence, generate conclusions, and they also allow the students to learn basic laboratory skills associated with biomedical research.

Preparation and Challenges:

All of the modules align with the high school curriculum and the NGSS and Common Core Science Standards. Modules were designed and developed by the near-peer mentors and WRAIR scientists to support the current curriculum, as well as making sure they were beneficial to both the teachers and students. There were several challenges faced when implementing this program, the first being the need to more successfully connect students to real research experiences. Another challenge was that the near-peer mentors had the responsibility to excite the students about scientific research.

High School Research Initiative – University of Texas at Austin

Program Overview:

The high school Research Initiative is a scientific inquiry center with three main objectives: 1) provide dual enrollment research courses that adhere to the rigor of the university courses, while also engaging high school students and teachers in authentic science inquiry, 2) train teachers to successfully lead research and inquiry experiences and courses, and 3) provide support and resources to introduce and lead scientific inquiry experiences in a high school classroom environment.

Preparation and Challenges:

Teachers are trained with professional development courses and are provided with resources to build confidence and broaden skill sets in order to lead research and inquiry experiences. There are various challenges in the High School Research Initiative. These are that teachers need to supervise about 15 different independent research projects in a variety of disciplines, all with varying timeframes, background, and complexity of the projects. Another challenge is because this dual enrollment course

is unlike a traditional course structure, a program like this requires new approaches and flexibility from both the teacher and students. The final challenge is that it is difficult to ensure that all inquiry experiences are equal.

UCSF Science and Health Education Partnership

Program Overview:

Two different programs were discussed, the High School Intern Program and the San Francisco Health Investigators program. Briefly, the High School Intern Program selects 20+ rising seniors from public schools, per year to be a part of the lab research program. The students are chosen with the criterion that the experience will make a significant difference in the life of the student. Students receive a whole group lab orientation to learn the basics up front and learn to ask questions, and are mentored by volunteers in the labs. Students have weekly meetings, receive college counseling and path to science talks from guest scientists. The program ends with students giving a 10-minute scientific talk and a poster presentation session for family, teachers, and school district leaders.

The San Francisco Health Investigators (SFHI) program recruits 20 students per year, all rising juniors from public schools. Students are selected with the same criterion as the Intern Program. This program has a community-based model where students work together to design health messages based on results from surveys they conduct in the community. The program aids the students in building community amongst themselves, building trust, and learning how to disseminate messages in the community.

Preparation and Challenges:

For High School Intern Program, mentors go through mentor workshops where the entire cohort of students learns basic lab skills; about lab culture and they build a community. Students also receive weekly check-ins and coaching for talks and posters. Because the High School Intern Program has students working in labs, the biggest challenge is recruiting labs to collaborate with and that allow students to work in them.

For the San Francisco Health Investigators, students receive human subjects training, learn content, role play, build community, and learn to become peer leaders. Challenges in the SFHI include that students are faced with long days, which a can be very intense for them and that there is a compressed timeline for students to complete their work.

Health in Our Hands, CREATE from STEM

Program Overview:

Health in Our hands is a 10 week project-based learning science curriculum that connects the classroom to the community and gives middle school students and adults an understanding of gene and environment interactions. The projects are structured around the subjects of type 2 diabetes or addiction and focus on the genetic factors and environmental factors in the risk for disease. Students develop a model for how they can improve health; ask questions and gather data; analyze the data and make recommendations based on their data. At the end of the project, students present results to peers, family, and the community at health summits.

Preparation and Challenges:

To prepare for this project, classes are transformed into a research team; students are given sample community action research questions; teachers are provided with structured guidance and professional learning and judges at the summit undergo an orientation. The challenge this program faces is that this project is a shift in instruction for teachers, so they need support and structured guidance. Another challenge is that it is difficult for students to generalize their findings.

Youth Built Change: Creating Community Researchers in STEM, University of Cincinnati

Program Overview:

Youth conduct research on drug abuse and addiction in their communities over one academic year, and are involved in all aspects of the research. They develop questions; design, collect and analyze data; and present results to the community. The overall goal of this program is that it is community based participatory research, with the ultimate goal of taking action in the community.

Preparation and Challenges:

To prepare, process milestones are created for the student's time lines and teachers receive viable training. The challenges are creating authentic connection to community issues, creating appropriate rubrics for both student and teachers and redefining teacher roles and student expectations.

Participants:

Lisa Vaughn, Cincinnati Children's Hospital/ University of Cincinnati

Farrah Jacquez, University of Cincinnati

Gwendolyn Stovall, University of Texas at Austin

Laura Courtney, Washington University

Anne Van De Ven, Northeastern University

TanYa Gwathmey, Wake Forest School of Medicine

Mary Kay Hickey, Cornell University

Melinda Gibbons, University of Tennessee

Erin Hardin, University of Tennessee, Knoxville

Orestes Quesada, University of Puerto Rico

Brett Taylor, University of Montana

Susan Hershberger, Miami University

Alexander Chang, Seattle Children's Research Institute

Jacque Ewing-Taylor, University of Nevada, Reno

Carmen Maldonado-Vlaar, University of Puerto Rico

Madison Spier, Texas A&M Health Science Center

Berri Jacque, Tufts Medical School

Karen Yanowitz, Arkansas State University

Geza Varhegyi, Cuyahoga Community College

Krisderlawn Motley, St. Jude Children's Hospital

Rachel Smilow, Children's National Research Institute

Donna Cassidy-Hanley, Cornell University

Luke Bradley, University of Kentucky

Jan Straley, University of Alaska Southeast

Anjelica Miranda, Denver Museum of Nature & Science

Stephanie Alphee, University of Maryland, Baltimore

DEMO of How Big Data Programs Can Advance Learning

Facilitator: **Kristin Bass, Ph.D.,** *Senior Researcher, Rockman Et Al*
Presenters: **Stephen Koury, Ph.D.,** *Research Associate Professor, University of Buffalo*
Andrea Panagakis, *Program Coordinator, Salish Kootenai College STEM Academy*
Bruce Nash, Ph.D., *Assistant Director for Science, DNA Learning Center*
Reporter: **Elizabeth Grace,** *Washington State University*

As big data becomes increasingly available, opportunity exists to incorporate it into the K-12 educational context. In an effort to prepare students to quickly and comprehensively analyze data for making health care decisions, some SEPA projects have developed educational programs that integrate big data into their programs. In "DEMO of Big Data," three SEPA projects gave an overview of how big data is used in their curriculum to foster authentic research experiences for students and allow time for hands-on interaction with software and Q&A about their programs. The intention of this session was to encourage the use of big data as a learning tool in K-12, while providing examples of how this is successfully underway in current projects.

Salish Kootenai College STEM Academy – Andrea Panagakis

- STEM academy is a dual enrollment high school program in the Flathead Indian Reservation.
- Students take high school courses in the morning and then commute to SKC for college classes in the afternoon.
- The goal of the STEM academy is to engage high school students in authentic research experiences beginning at the high school level.
- Students participate in SEA-PHAGES (Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science).
- Phages are abundant viruses that prey on bacteria.
- Through SEA-PHAGES students participate in three-phases:
    1. Discovery, Isolation, Purification
    2. Annotation of Viral Genome
    3. Annual Symposium
- During the session, we mainly discussed phage genome annotation and how students work to determine: 1) Is it a gene? 2) Where does it start? 3) What is the gene's function?
- Why is this program successful?
    - Students are active phage hunters; they go out into their environment and collect the soil samples.
    - They participate in an authentic scientific research experience.
    - Students experience the concepts on different scales from ecosystem, to virus, to genome, giving them context for their understanding.
    - Students actively participate in scientific discovery and collegiality: publishing results; naming their phage; reaching out to other students to share their experience.

GENI-ACT – Stephen Koury

- GENI-ACT: Guiding Education through Novel Investigation Academic Collaboration Toolkit
- Authentic research experience for students: students evaluate the accuracy of computer annotations of genes. They are the first human eyes looking at a gene, therefore, they become the expert of the gene.
- Program is positioned as a hook to get students interested in the power of big data. After this experience students will know the types of big data that are out there.
- It is accessible to students using a web browser, therefore, not much additional cost or infrastructure is necessary.
- Involves crowdsourcing of genome annotations and sequencing.
- Students use the "Scientific Method" throughout the process:
    - Purpose: to evaluate accuracy of computer pipeline annotations of genes
    - Research Question: how are microbial genomes sequenced and analyzed?
    - Hypothesis: the pipeline annotation of gene is correct or incorrect
    - Experiment: take protein sequence in GENI-ACT modules to collect data
    - Analysis: use notebooks to record data
    - Conclusion: propose a final annotation

Big Data to Knowledge (BD2K) Microbiome Project - Bruce Nash

- BD2K works with high school student who use DNA sequencing to identify biodiversity in the region.
- BD2K views microbiome research as an entry point into data science.
- Due to DNA sequencing data becoming more productive, biologists want to use this data more frequently.
- However, students are unprepared for this level of data science in college because high school teachers and students do not have the experience or knowledge to access and make sense of these data.
- One goal of BD2K is to get students into data analysis earlier. This project is focused on high school but encourages more data analysis in middle school as well.
- There is a need for more students who are data savvy, which creates a need for resources to support students in becoming data savvy.
- Educational goal of program is to pilot and develop tools that let students study microbiomes in their environment, including how to perform a microbiome analysis.
- Why is this successful?
    - Scalable diverse projects
    - Integrates molecular biology and ecology
    - Combines lab work with data science
    - Enables discovery and publication
    - Accessible and relevant to students

Following a 15-minute introduction by each of the project leaders above, the remaining 30 minutes were spent in breakout sessions to allow attendees to ask questions and view program materials directly.

Participants:

Martin Weiss, New York Hall of Science
Nancy Moreno, Baylor College of Medicine
Alana Newell, Baylor College of Medicine
William Folk, University of Missouri
David Petering, University of Wisconsin – Milwaukee
Chuck Wood, Wheeling Jesuit University
Libby Grace, Washington State University
Molly Kelton, Washington State University
Grace McClure, University of Texas at Dallas
Donald DeRosa, Boston University
Kristine Wylie, Washington University
Sarah Wojiski, The Jackson Laboratory
Louisa Stark, University of Utah
Michele Morris, HudsonAlpha Institute for Biotechnology
Dirk Swart, Wicked Device LLC
Ralph Imondi, Coastal Marine Biolabs
J. Michael Wyss, University of Alabama at Birmingham
Adam Hott, HudsonAlpha Institute for Biotechnology
Roy Womack, Georgia State University
Neil Lamb, HudsonAlpha Institute for Biotechnology
Patrick Brown, NIH/NIGMS
Andrea Panagakis, Salish Kootenai College

Teacher Professional Development Curricular Quality

Presenters: **Melani Duffrin, Ph.D.,** *Professor of Interdisciplinary Health Professions, Northern Illinois University*
Virginia Stage, Ph.D., *Assistant Professor, East Carolina University*
Facilitator: **Alison Lin, Ph.D.,** *Program Director, National Institutes of Health – National Cancer Institute*
Reporter: **Mason Arrington** *from the Center for Interdisciplinary Inquiry and Innovation in Sexual and Reproductive Health at the University of Chicago*

This session focused on how to accomplish effective professional development for teachers. The key to this is centered around engaging with teachers. At the start of the session we all listed some ways that we had each found successful in our own experience which included a number of strategies that they hoped to teach us such as:

- In Person or Live Video Chat Conversations
- Video Clips
- Flipped Learning
- Simulations/Roleplay
- Hands-On Activities
- Follow ups
- Tech Support
- Material Support

Another thing that was mentioned was the importance of having an online presence. Educators generally have low resources so making resources freely available online can be a boon for most

(especially public) educators. Essentially the hope is to make professional development as accessible as possible.

Along with this framing we were given a template for how to very efficiently put together a curriculum specifically for teacher professional development. The worksheet, and considering how we might use it for our own teacher professional development, were the focus of the original content because we spent a lot of time listing techniques that had been used successfully by some of the professionals. There was quite a lot of experience in the room from both those who had developed curriculum for teacher professional development and also a number of teachers who'd already gone through a fair amount of professional development. Some of them had successful techniques to share, but others talked about their experience with some of the worst examples of teacher professional development. We ultimately ended up with a short list of good traits for quality teacher professional development including:

- Knowing your audience
- Empowering teachers to act as professionals
- Having a sustainable curriculum

Participants:

Barbara Hug, University of Illinois

Tania Jarosewich, Censeo Group

Robin Fuchs-Young, Texas A&M University

Emily Kuehn, US Army Medical Research and Materiel Command

Amanda Jones, Seattle Children's Research Institute

Rebecca Carter, Seattle Children's Research Institute

Pascale Creek Pinner, Albert Einstein Distinguished Educator Fellow

Mason Arrington, University of Chicago

Melissa Kurman, University City Science Center

Kate Ayers, St. Jude Children's Research Hospital

Charlie Geach, American Physiological Society

Jane Disney, MDI Biological Laboratory

Dina Markowitz, University of Rochester

Danielle Alcena-Stiner, University of Rochester

Michelle Ezeoke, Georgia State University

Sean Freeland, West Virginia University

Bret Hassel, University of Maryland School of Medicine

Waynetta Turner, Birmingham City Schools

Katherine Bruna, Iowa State University

Charles Wray, The Jackson Laboratory

Rebecca Norlander, New Knowledge Organization

Sharon Locke, Southern Illinois University – Edwardsville

Jackie Shia, Wheeling Jesuit University

Christopher Kvaal, St. Cloud State University

Larry Johnson, Texas A&M University

Mary Jo Koroly, University of Florida

Linda Rost, Montana Tech

Breakout Sessions
Wednesday, April 24, 2019 – 4:00 PM – 5:15 PM

Engaging Middle School Students in Hands-On, After-School Science Activities while Enhancing the Workforce Preparation for Undergraduates Via the NE STEM 4U Intervention

Presenters: **Christine Cutucache, Ph.D.,** *Haddix Community Chair of Science; Associate Professor of Biology, University of Nebraska at Omaha*
Julia McQuillan, Ph.D., *Professor and Chair of Sociology, Worlds of Connections, University of Nebraska - Lincoln*
Michelle Phillips, Ph.D., *Evaluator, Worlds of Connections, University of Nebraska - Lincoln*
Amy Spiegel, Ph.D., *Research Associate Professor, Worlds of Connections, University of Nebraska - Lincoln*
Grace Stallworth, BA, *Project Coordinator, Worlds of Connections, University of Nebraska - Lincoln*
Trish Wonch-Hill, Ph.D., *Director of Learning Research, Worlds of Connections, University of Nebraska - Lincoln*
Reporters: **Christine Cutucache, Julia McQuillan, Michelle Phillips, Amy Spiegel, Grace Stallworth, Trish Wonch-Hill**

The authors approached this session as a storytelling venture with an opening ice-breaker worksheet activity, and then encouraged active discussion between the authors and participants throughout the session.

- Welcome and Activity of "find your sticker" (are you a faculty member? Staff? Informal educator? All of the above?) -8 mins (with introductions)
- Introduction of the entire team on the Worlds of Connections (WoC) Project
  - Who we are (WoC team) and their visions for NE STEM 4U (interdisciplinary STEM to include network science)
  - The authors introduced the NE STEM 4U program and its goals and how it is being used as one component of the interdisciplinary Worlds of Connections SEPA project (*http://worldsofconnections.com*). Briefly, the NE STEM 4U program is an afterschool program for K-8 youth provided by undergraduates who participate in professional development workshops called "STEMinars" to enhance their critical thinking and problem-solving skills. One aim of the SEPA Worlds of Connections project (PI: Dr. Julia McQuillan, *jmcquillan2@unl.edu*) is to see if youth who do not identify as interested in "STEM" concepts, become excited and engaged in the concepts via network science activities as a gateway to recruitment and retention into the biomedical workforce.
- Agenda:
  - Themes for the day:

1. Student voices through the pipeline,
2. Storytelling on packaging the data (i.e. how to design for data collection, analysis, and ultimate packaging to publications for various audiences & stakeholders), and, a bookmark of example publications was distributed.
3. Voices from an "established franchise" of the NE STEM 4U program (major challenges and rewards from a year-1 pilot for the replication of the NE STEM 4U afterschool program targeting middle school youth as run by faculty and students from the University of Nebraska-Lincoln)
4. Steps they've taken toward sustainability (i.e. how they've worked strategically to engage all stakeholders and build a clear vision for the future and longevity)

- MAJOR THEME 1, STUDENT VOICES:
  - The authors described the need to actively build the pipeline (i.e. not middle school only), as most students decide whether they "like" science or not by 4th grade, then it's our job to continue to foster their engagement through middle school and beyond. Therefore, stories of our work-to-date for each of the levels of students were described. The authors highlighted the need for near-peer mentors, but with facilitated professional development as critical to the success of the program. Focusing on the student voices as representatives from different parts of the pipeline:
    - Elementary school youth (kids choose whether they "like" science or not by 4th grade)
    - Middle school (students lose interest in science & become fearful of math during this time. School day doesn't allow for active process of being "scientist"—informal education supplements & expands upon NGSS & allows for new connections that best prepare a workforce and help students find what they like or don't like, while sharing with them what career options exist and providing near-peer mentors to help encourage them to see higher education as accessible)
    - Undergraduate (and two high school programs to date; challenges exist with supervisory ages)
    - Graduate (graduate advisors, research data collection and analysis, and publications to specifically prepare them for careers as teachers or informal educators AND in lieu of serving as a teaching assistant—different age groups)
- MAJOR THEME 2, PACKAGING THE DATA:
  - The authors described the importance and the struggle of packaging science (and STEM) education research on differing grade levels, and in an informal setting, for publication. This challenge leads to data sitting on shelves for extended periods of time, and getting into an issue of mis-match of readers based on the venue chosen for dissemination of the work. Authors highlighted the need to be very thorough in thinking about data collection, but more so in considering theoretical framework and rigorous methods for best success when publishing. The authors highly recommended a mixed-methods approach.
- MAJOR THEME 3, ESTABLISHED FRANCHISE REWARDS AND CHALLENGES:
  - Each member of the group shared their personal takeaways from the pilot of the franchise of NE STEM 4U to a new location. Included in the discussion was the need to have some items

consistent location to location, and other items to be adapted to needs at the new site. For example, utilizing existing interview structures and procedures was advised for consistency. The group identified the importance of professional development training to the undergraduate mentors to encourage them to be independent and impactful of youth in their work. Finally, the need to be adaptable and candid was highlighted.

- Other core items discussed as part of a more open discussion included the following:
  - Trust – Trust among undergraduate mentors and middle school and elementary school youth, plus trust between NE STEM 4U – Omaha and the new Lincoln Franchise members.
  - Emphasis on Youth Voice – Do research, be a scientist
  - Dimensions of Success Evaluation emphasizes youth voice
  - Hard to help youth know that what they are doing is "science"–they might enjoy activities and projects but not know when they are doing "science." Also true of math issues, e.g. fractals where students do not always see the underlying math. These are the challenges of mindsets that do not see the possibility of working hard to succeed
  - Bringing in Sociology–new for STEM programs
  - The NOYCE Teacher project and the NE STEM 4U project–leaders emphasize the Importance of expanding networks (middle school youth meeting college students, college students working with scientists)
  - NOYCE teachers–the need to encourage weekly meetings, connections, community, bringing different majors together
  - Many Undergraduates are "pre-med" but few (~12%) will get into medical school–NE STEM 4U may open college students up to other kinds of health careers.
  - 96% of NE STEM 4U undergraduates graduate; 97% stay in STEM and 100% get the job they want
  - STEM Ecosystem is helping too–plus external funding (e.g. Buffett, Toyota) – focus on sustainability–external funders, legislature "buy in" and support; investment in workforce; Pre-Post evaluations result in increased NESA state test scores, content gains
  - Professional development–STEMinars, experiment nights, practice, active listening, teamwork
  - NE STEM 4U underserved faculty leaders need to get to know mentors for support to navigate college with issues such as cost, loans, buildings
  - Undergraduate mentors are important to the success of the program and their success helps to show supporters (e.g. legislators/companies) that there are people close to the employment stage who can already provide Return on Investment (ROI).

- MAJOR THEME 4, SUSTAINABLITY:
  - The authors highlighted the need to be consistent with messaging, delivery, and quality for the program to thrive. Similarly, the group addressed the need for ongoing conversation between many stakeholders for long-term sustainability. Such stakeholders included were: school district leaders, school staff, K-12 teachers, out of school time staff, community organizations, and lawmakers/decisionmakers (The Nebraska Legislature).

Closing: The authors closed the session by inviting those in attendance to ask questions and share any feedback for improvement to the NE STEM 4U program. Finally, the authors encouraged collaboration and partnership from all audience members.

Participants:

Debra Yourick, Walter Reed Army Institute of Research
Melissa Kurman, University City Science Center
Anjan Nan, University of Maryland, Eastern Shore
Bryan Silver, NSF
George Shipley, White River Middle School
Neil Lamb, HudsonAlpha Institute for Biotechnology
Rebecca Smith, University of California, San Francisco
Katherine Bruna, Iowa State University
Anastasia Thanukos, University of California, Berkeley
Jackie Shia, Wheeling Jesuit University
Christine Cutuchache, University of Nebraska Omaha
Grace Stallworth, University of Nebraska – Lincoln
Amy Spiegel, University of Nebraska – Lincoln
Julia McQuillan, University of Nebraska – Lincoln

SEPA Synergies Across Federal Programs

Introductions: Mike Wyss, Ph.D., *Professor and Director, Center for Community Outreach Development, University of Alabama at Birmingham*

Presenters: **Robert I. Russell, Ph.D.,** *Program Director, National Science Foundation*
Patrick Brown, Ph.D., *Program Director, National Institute of General Medical Sciences, National Institutes of Health*
Kathleen B. Bergin MSP, Ph.D., *Program Director, National Science Foundation*

Reporter: **Dina Drits-Esser,** *University of Utah*

ROBERT NOYCE TEACHER SCHOLARSHIP PROGRAM

Kathleen Bergin, Education and Human Resources Directorate, Division of Undergraduate Education, Contact: *kbergin@nsf.gov*

National Science Foundation

General Info on NSF 17-541

- Proposals were due August 27, 2019 (last Tuesday of August), then annually thereafter
- Noyce primary goal: encourage talented STEM majors and STEM professionals to become K-12 STEM teachers
- Provides scholarships, stipends to fellowship recipients who are then required to teach in a high-need school district for a specified number of years
- Institutions are responsible for tracking recipients and monitoring teacher service

Definition of High-Need LEA

- High percentage of individuals (at least 50%) from families with incomes below the poverty line
- A high parentage of secondary school teachers (at least 35%) not teaching in the content area in which they were trained to teach
- High teacher turnover rate (at least 15%)

Track 1: Scholarships and Stipends (undergraduate STEM majors and/or STEM professionals)

Track 2: NSF Teaching Fellowships (STEM professionals)

Track 3: NSF Master Teaching Fellowships (Exemplary, experienced STEM teachers)

Track 4: Noyce Research (Research related to STEM teacher effectiveness, persistence, and retention in high-need LEAs)

Requirements for each track

Requirements/ Features	Track 1 (S&S)	Track 2 (TF)	Track 3 (MTF)	Capacity Building
STEM Major	✓	✓	Degree in field	
Scholarships/ Fellowships	✓	✓	✓	
High-Need District Partner	✓	✓	✓	
Non-Profit Partner		✓	✓	
PI/co-PI Team of STEM & ED Faculty	✓	✓	✓	✓
Evaluation/ External Feedback	✓	✓	✓	✓
Cost Sharing		✓	✓	
Funding Amount	Up to $1.2M*	Up to $3M*	Up to $3M*	Up to $75K**

*$250K Community College Incentive **$50K Community College Incentive

Descriptions of CB and Track 1 – 4 Projects

Track 1

Scholarships:

Jr. and Sr. STEM majors (and post-baccalaureate)

Equal to or greater than $10,000

Stipends:

STEM Professionals enrolled in a teacher certification program

Equal to or greater than $10,000

Additional:

internships for freshman and sophomores to attract STEM majors into teaching; recruit STEM majors that may not have considered teaching; involve master teachers

Track 2

Fellowship and salary supplement

Equal to or greater than $10,000 while enrolled in 1-year master's degree program

Equal to or greater than $10,000 per year for five years while teaching in a high-need school district

Take on leadership role within school or LEA

Mentoring; curriculum development; plan/implement professional development; participate in pre-service education

Track 3

Fellowship and salary supplement

For Bachelor's, 1-year fellowship support while in Master's program; up to four years while teaching

Equal to or greater than $10,000 per year for four years while teaching in a high-need school district

Take on leadership role within school or LEA

Mentoring; curriculum development; plan/implement professional development; participate in pre-service education

Track 4

No previously funded Noyce projects required

Researchers + STEM faculty + STEM education faculty

Up to $800K for up to five years

Noyce Projects substantively involved

Researchers + Noyce projects + STEM faculty + STEM education faculty

Up to $800K + $100K for each Noyce project not to exceed $2.3M for up to three years

Proposals: Common Weaknesses for Each Track

Track 1

1. Does not follow guidelines for Noyce Program
2. Failure to indicate students will complete STEM major
3. Little information about teacher preparation program
4. Unrealistic projections
5. Recruitment and selection strategies not well described
6. Lack of support for new teachers
7. Lack of involvement of STEM faculty (or education faculty)
8. Lack of plans for monitoring compliance for teaching requirement
9. Weak evaluation or lacks objective evaluator
10. Does not address Prior Results or Lessons Learned

Tracks 2 & 3

1. Insufficient details for preservice and induction program for TFs or professional development program for MTFs.
2. Vague recruitment plans.
3. Selection plans do not follow guidelines.
4. Master Teacher roles and responsibilities not discussed.
5. Limited identification of leadership development focus.
6. Matching funds not identified.
7. Role of non-profit organization not clear.

8. Weak school district partnership.
9. Weak evaluation plan.
10. Limited innovativeness or establishment of need for project.
11. CB Projects
12. Institution already has needed capacity.
13. Requests CC incentive but no CC involvement.
14. No clear indication of how proposed work can lead to future Track 1, 2, or 3 proposals.
15. Unrealistic plans for a one-year project.
16. No form of evaluation included.

Track 4

1. Studies that involve examination of only a single institution's teacher preparation program are discouraged unless the proposal provides a compelling argument that the results can be generalized to the larger community.
2. Failure to address effectiveness, persistence or retention in HNSD
3. Failure to clearly articulate the research questions, their relationship to the data to be collected, the methods of analysis, and the project's ability to authoritatively answer the research questions.

NSF Merit (Required) Review Criteria

Intellectual Merit

- Importance to advancing knowledge and understanding
- Creative, original and/or potentially transformative
- Proposers' qualifications are considered
- Sufficient access to resources
- Proposed activity well-conceived and organized
- Data management plan
- Post-doc mentoring plan, if applicable
- Evaluation

Broader Impacts

- Promotes teaching, training, and learning
- Broadens the participation of underrepresented groups, new
- Institutions, influence on field, etc.
- Enhances the infrastructure for research and education
- Encourages partnership development
- Disseminates results broadly
- Benefits society

Additional Resources

- *nsfnoyce.org*
- *NSF 19-1*:
  - NSF Proposal and Awards Policies and Procedures Guide (PAPPG) includes detailed instructions on items such as required biosketches, required Data Management Plan, IRB approval, allowable budget items, etc.
- See Additional Resources listed in NSF solicitation *NSF 17-541*

Other EHR Programs of Possible Interest

- Improving Undergraduate STEM Education (IUSE: EHR *NSF 17-590*)
- EHR Core Research (NSF *19-508*)

BRIDGES TO THE BACCALAUREATE PROGRAM

Patrick Brown, Director, Division of Training, Workforce Development, and Diversity, patrick.brown@nih.gov
NIH/NIGMS

The Bridges to the Baccalaureate Program provides support to institutions to help students make transitions at a critical stage in their development as scientists. The program is aimed at helping students make the transition from 2-year junior or community colleges to full 4-year baccalaureate programs. The purpose of the program is to increase the pool of community college students who go on to research careers in the biomedical sciences and eventually NIH-funded research. To accomplish this, the program promotes institutional partnerships between community colleges or other 2-year post-secondary educational institutions that grant associate degrees and colleges or universities that offer the baccalaureate degree.

In order to participate, the partnership/consortium must involve at least two colleges or universities including the applicant institution. The bachelor's degree-granting institution(s) in the consortium must have a strong science curriculum and a track record of enrolling, retaining and graduating students who pursue advanced degrees in biomedical research fields. Community colleges and other 2-year post-secondary educational institutions in the consortium must offer associate degree programs with an emphasis on the biomedical sciences.

Participants:

Robert Young, Saint Francis University
Irene Wolf, Saint Francis University
Anne Holland, Space Science Institute
Martin Weiss, New York Hall of Science
Christopher Kvaal, St. Cloud State University
Diane Munzenmaier, Milwaukee School of Engineering
William Schneller, Substrate Games
Bill Thornton, University of Nevada
Jacque Ewing-Taylor, University of Nevada, Reno
Adam Hott, HudsonAlpha Institute for Biotechnology
Grace McClure, University of Texas at Dallas
Victoria Coats, Oregon Museum of Science & Industry
Donna Cassidy-Hanley, Cornell University
Dave Vannier, Fred Hutchinson Cancer Research Center
Sara Erickson, Iowa State University
Dina Markowitz, University of Rochester
Pascale Creek Pinner, Albert Einstein Distinguished Educator Fellow
Luke Bradley, University of Kentucky
Anne Van De Ven, Northeastern University
Atom Lesiak, University of Washington
Lynne Holden, Mentoring in Medicine, Inc
Patrick Brown, NIH/NIGMS

Spreading the SEPA: Exploring Fidelity and Outcomes Across Sites Nationwide

Presenters: **Loran Carleton Parker, Ph.D.,** *Associate Director, Senior Evaluation and Research Associate, Purdue University*
Lindley McDavid, Ph.D., *Research and Evaluation Associate, Purdue University*
Weiling Li, Ph.D., *Evaluation and Research Associate, Purdue University*
Sandra F. San Miguel, Ph.D., *Associate Dean and Professor, Purdue University*
Adrianne Fisch, *Engagement Program Manager, Purdue University*
Grace Craig, *Administrative Assistant, Purdue University*
Reporter: **Sandra F. San Miguel, Ph.D.,** *Associate Dean and Professor, Purdue University*

The This Is How We "Role" program is an after-school program where veterinary medical students deliver veterinary STEM lessons to kids through community center partnerships, with the ultimate goal of diversifying the veterinary workforce. To enable scalability, the program–a fun and engaging, minimal resource curriculum–was developed. To facilitate replication, veterinary colleges across the United States teamed up with community partners serving disadvantaged children. Faculty and students at each site were certified to deliver the curriculum. Teams were provided checklists; startup kits; STEM Lessons mapped to NGSS; scripts; activity handouts; and assessment tools. The program has been replicated at 19 U.S. veterinary colleges.

A three-step evaluation approach was used to assess the impact of preliminary results: (1) Is the program achieving outcomes related to learning and attitude development? (2) Is there implementation fidelity (variation across sites in engagement and teacher relationships), (3) Does our theory hold (relationships with teachers -> attitudes, content, engagement ->content learning)?

The utility of meta-analysis was discussed when analyzing data from multiple sites with low sample sizes, heterogeneity of samples, and missing data. Preliminary findings and results were presented and discussed for the meta-analysis of data from six sites. Using engagement as a proxy to learning was found to be theoretically sound. The use of meta-analysis helps us avoid throwing away or underrepresenting findings. Attendees discussed the utility of this approach in the context of their SEPA programs. Future applications were discussed.

Post Report: As a follow-up to the presentation, two attendees contacted Dr. San Miguel: 1) Dr. Marnie Gelbart, Director of Programs, Personal Genetics Education Project, Harvard Medical School inquired on the application of the How We "Role" online role model certification for their SEPA Program. She was given access to the certification to see if it would benefit her SEPA. 2) Dr. Holly Brown, Walter Reed Army Institute of Research, asked about recommendations for scaling programs and how to frame the expansion of an existing program within a grant proposal to emphasize innovation. The latter exchange resulted in an excellent conversation and will lead to a partnership among programs.

Participants:

Berri Jacque, Tufts Medical School

Marie Barnard, University of Mississippi

Stephanie Tammen, Tufts Medical School

Holly Brown, US Army Medical Research and Materiel Command

Inclusive Measurement of STEM Development Among Students: Supporting Equity and Early Identification of STEM Disparities

Presenters: **Lisa Marriott, Ph.D.,** *Assistant Professor, Oregon Health & Science University*
Kristin Bass, Ph.D., *Senior Researcher, Rockman Et Al*
Alana Newell, Ph.D., *Assistant Professor, Baylor College of Medicine*
Reporter: **Brandon Morgan** *(Health Resources in Action)*

In this session, leaders and participants discussed cultural considerations that support measurement and equity in STEM assessment as well as critiquing various evaluation measures that are commonly used for diverse populations.

Format

The format of the workshop was a "gallery walk". The "gallery walk" included examining validated measures on flipchart paper posted on the walls. Participants were asked to critique each measure to determine if it was culturally competent based on our experiences and knowledge of the subjects of the research project. The various posted flipchart included the following categories:

- Cognitive function/Intellectual Engagement
- Other Educational Instruments
- Barriers and Supports
- Cultural Considerations
- STEM Attitudes
- STEM Interest
- STEM Identity
- Motivation
- Mindset and Motivational Resilience
- Self-Efficacy
- Impulsivity/Self-Regulation

After individuals wrote their responses on the flipchart paper, there was a debrief of the responses.

Challenges

- Reading Level: Many of the validated surveys proved to be difficult for low literacy populations, public school students, and English Language Learners.
- Participants taking surveys (particularly younger students) often misunderstood the questions on surveys and may have answered differently if they'd understood the intended meaning.

Possible Solutions

- Recruiting stakeholders in survey development: For example, there was an individual working with Prince George County high schools, and their survey instruments were misunderstood by the youth they were working with. They asked a high school student to look over their questions and modify them so they would be more easily understood by the youth.

- For younger students who might find it difficult to decipher what surveys are asking them, an "emoji scale" was developed to help them answer the questions since emoji faces are more familiar to them than words.
- For individuals with developmental disabilities (this can be used for other individuals as well), one can explain survey instruments to the participants and then ask them to define responses in their own words.

Participants:

Alana Newell, Baylor College of Medicine
Sharon Locke, Southern Illinois University Edwardsville
Kristin Bass, Rockman Et Al
Susan Hershberger, Miami University
Brandon Morgan, Health Resources in Action
Rebecca Norlander, New Knowledge Organization
Sara Hargrave, NIH/NCI
Melinda Gibbons, University of Tennessee
Erin Hardin, University of Tennessee, Knoxville
Kevin Morris, Walter Reed Army Institute of Research
Abbey Thompson, Stanford University
Dina Drits-Esser, University of Utah
Regina Wu, Fred Hutchison Cancer Research Center
Joan Griswold, University of Washington
Kevin D. Phelan, University of Arkansas for Medical Sciences
Karin Chang, University of Kansas
Anja Scholze, The Tech Museum of Innovation
Dave Vannier, Fred Hutchinson Cancer Research Center

Authentic Research Experiences for K-12 Teachers and Students: Programs Aimed at Increasing STEM Workforce Diversity

Panelists: **Robin Fuchs-Young, Ph.D.,** *Professor, Texas A&M Health Science Center*
Taylir Schrock, STEM Academy Research Coordinator, Salish Kootenai College
Laurie Jo Wallace, MA, *Project Director, Health Resources in Action Inc*
Kelley Withy, MD, Ph.D., *Professor and Director, Hawaii/Pacific Basin Area Health Education Center (AHEC), University of Hawaii*
Reporter: **Anjelica Miranda,** *Denver Museum of Nature & Science*

The session gave presenters the opportunity to give a brief overview of their projects and then gave participants the opportunity to participate in a small group activity.

- Robin Fuchs-Young described her project wherein students are embedded in research labs on the Texas A&M campus over the summer. Students in the program are given the opportunity to choose from various topics depending on lab availability, while teachers have the choice between engineering and biomedical science.
- Kelly Withy described her project, which directs students to a research program in health resources research. This program has a large and diverse group of students that facilitates communication skill building and preparation for students to apply to various summer research programs.
- Michael Kennedy described his project, which focuses on teachers with the aim of reshaping their views so that they see themselves as science thinkers. This project encompasses a three-week summer program where teachers work with scientists to conduct authentic experiments that give them the opportunity to ask questions and see themselves as scientists and science thinkers.
- Laurie Jo Wallace described the LEAH Knox Scholars project, which aims at providing authentic research for students in the community. This five-week summer program gives students biomedical research experience and the chance to work alongside professors at MIT. The students build communication and networking skills and what might be called "soft skills". For the second summer of the program, students are placed in real labs and in various research projects.
- Taylir Schrock's project provides dual enrollment credits for Native American high school students in an after-school program. During the first year, students go through a science research course, learn lab skills, and present their project findings at the end of the year. In the students' second year, they are able to take classes of their choosing and are given the opportunity to come up with their own research proposals/projects.

Once presenters were finished giving their project overviews, session participants were asked to pair up with another participant and discuss three questions:

1. Who were you when you were 16-17 years old? What was happening in your life? Think of a moment in that time that made you feel like you mattered.
2. Think of a time when you were in a positive learning environment. What made it so?
3. What is an authentic experience?

Through these questions, the group was able to collectively make a list of what is needed to create an authentic research experience for both students and teachers.

- Students want to feel like they matter:
  - They want to do the activities themselves
  - They want to lead, which allows them to stay engaged
  - They want to be valued, included, and recognized
  - They want to be treated like professionals
- To have an authentic experience:
  - Participants should be able to make discoveries, have failures, and generate new questions
  - Have a collaborative experience
  - Build authentic relationships
  - The project-manager must care about the research and the students

Participants:

Orestes Quesada, University of Puerto Rico
Laurie Jo Wallace, Health Resources in Action
Michael Kennedy, Northwestern University
Kelley Withy, University of Hawaii
Madison Spier, Texas A&M Health Science Center
Stephanie Alphee, University of Maryland, Baltimore
Elizabeth Parker, University of Maryland, Baltimore
Gretchen Gose, Unidos Dual Language School
Regina Wu, Fred Hutchison Cancer Research Center
Marlys Witte, University of Arizona

Sharing Resources and Strategies for Teaching Data Analysis

Presenters: **Carla Romney, DSc,** *Director of Research, Boston University School of Medicine*
Donald DeRosa, EdD, *Clinical Associate Professor, Boston University*
Carl Franzblau, Ph.D., *Executive Director, Boston University*
Obi Onochie, Ph.D., Education Program Administrator, Boston University

Reporter: **Mason Arrington** *from the Center for Interdisciplinary Inquiry and Innovation in Sexual and Reproductive Health at the University of Chicago*

This session was all about teaching young people how to collect, analyze and use data. We started by listing things that we've found successful in the past. Each group collected a list of about seven or so techniques or considerations and put them on large post-it notes around the room. At that point we all voted on three of the different things listed around the room, talking about some of the top choices along the way.

Once we'd finished this exercise, we realized that we were collecting data and not only that, but we were doing data analysis. The presenters had basically walked us through their process without us knowing what we were doing.

The process can be looked at like a checklist:

- Data should be personally relevant to the youth
- Students need to understand the data (what's behind the data)
- Data needs to be accessible
- Students need to be able to work towards the meaning of the data by themselves by finding where meaning is relevant.
- Students need to be able to unpack data and see patterns
- Students need to visualize the data
- And finally, students need to propose next steps

The session leaders had us practice their methodology by making the small amount of data we were collecting relevant to the session. By the same token to properly implement this with youth groups involves ensuring that the data and the meaning found in the data is relevant to the targeted youth, which gives them a desire to drive the data analysis process. The example they presented to us had to do with youth collecting data about the best times in running squash drills at the afterschool squash program.

In the example, youth were immediately inclined to find meaning in the data because they wanted to know which of them was the best. Wanting to know who's the best requires them to figure out how they might measure it and the different ways those measurements might be interpreted. In this way the process is essentially powered by youth interest which takes the challenge out of motivating youth in what many of them tend to assume is inherently uninteresting.

Participants:

Carla Romney, Boston University

Donald DeRosa, Boston University

Obi Onochie, Boston University

Ralph Imondi, Coastal Marine Biolabs

Emily Kuehn, US Army Medical Research and Materiel Command

Michele Morris, HudsonAlpha Institute for Biotechnology

Brett Taylor, University of Montana

Ido Davidesco, New York University

Adel Karara, University of Maryland, Eastern Shore

Jane Disney, MDI Biological Laboratory

David Petering, University of Wisconsin – Milwaukee

Ralph Imondi, Coastal Marine Biolabs

Mason Arrington, University of Chicago

Laura Courtney, Washington University

Kristine Wylie, Washington University

Etaria Omekwe, NIH/NCI

Danielle Alcena-Stiner, University of Rochester

Roy Womack, Georgia State University

Karen Yanowitz, Arkansas State University

Chuck Wood, Wheeling Jesuit University

Best Practices and Logistics for Teacher Professional Development: On-site, Extended, and/or Online – Your Pick!

Panelists: **Gwendolyn M. Stovall, Ph.D.,** *Director, High school Research Initiative, University of Texas at Austin*
Louisa A. Stark, Ph.D., *Professor of Human Genetics; Director, Genetic Science Learning Center, University of Utah*
Nancy Moreno, Ph.D., *Associate Provost of Faculty Development and Institutional Research, Baylor College of Medicine*
Mary Jo Koroly, Ph.D., *Research Associate Professor; Director, Center for Pre-Collegiate Education and Training, University of Florida*

Reporter: **Elizabeth Grace,** *Washington State University*

The goal of this breakout session was to share professional development (PD) models and to converse about best practices in designing and implementing PD. The session began with a short brainstorm of questions that attendees had about professional development. These included:

- How do you measure teacher content knowledge?
- How do you measure fidelity of implementation after the PD?
- How do you address different needs/expectations of different teacher formats/disciplines? How do we make sure that facilitators are on the same page across sectors?
- How do you recruit teachers to participate?
- Scalability? How do you deliver PD to someone who is not geographically near you?

Louisa Stark – Engaging Teachers in the Curriculum Design Process (University of Utah)

Louisa described the professional development conducted at the Genetic Science Learning Center for teachers from across the country.

- Four-day professional development.
- Throughout PD, teachers collaboratively design supplementary curriculum materials.

- All PD sessions start by making group norms explicit. Question is posed to participating educators: How can we work collaboratively together?
- Educators determine their compass point: this activity helps individual teachers understand and communicate their preferences in group work.
- Readings are assigned ahead of time so teachers may arrive with some common knowledge and talking points.
- As part of the PD, three to five scientists come and talk to teachers, leaving plenty of time for questions and discussion.
- Teachers identify important concepts from the scientists on sticky notes. Teachers also discuss pre-readings and discuss main points that were particularly compelling. They take main topic areas from scientists and readings and self-select which topic they want to design a curriculum around. Once main topics are decided, they sort out objectives.
- Teachers move through a silent conversation where they contribute to main topics, objectives, and each other's ideas through writing and drawing.
- In small groups, teachers design curriculum.
- Throughout the design process, small groups share designs to receive feedback from the larger group.

It has been found through this model that teachers employ more advanced science knowledge and processes as well as more student-centered learning practices.

Nancy Moreno – Center for Educational Outreach (Baylor College of Medicine)

Nancy discussed a variety of teacher education models and highlighted what made some more effective than others. She then shared some guiding principles to consider when developing teacher PD.

- Professional Development models: some are more in-depth and reach a smaller audience, while others reach more teachers, but are less thorough. As you move further down the list, the larger the audience you reach.
  - Teacher/scientist partnerships
  - Peer mentoring circles
  - Curriculum development teams
  - Teacher professional development series (rarely one-off workshops, prefers two weeks in the summer with school year follow up)
  - Network of partner magnet schools – this includes embedded faculty members who spend 90% of their time working beside teachers.
  - Online courses and educator resources.
- Guiding principles for teacher professional development:
  - Co-plan with schools and districts.
  - Include instruction with education-minded scientists and master teachers.
  - Emphasize science content understandings and appropriate teaching strategies (pedagogical content knowledge).

- Help teachers address Texas standards (TEKS) or other applicable standards
- Include formative and summative evaluations; evaluation strategies change based on nature of program.
- Focus on learner-centered approaches–participants should engage as students.
- Magic number is 60 hours a year for a PD to be effective.

- What we've learned from experience designing and implementing PD?
  - Keep showing up as a resource for educators.
  - Change takes time (five to 10-year timeline in education to see change).
  - Continue to work with partners.
  - Expect the unexpected, be ready to change directions.
  - Look for ways to leverage to existing models.

Mary Jo Koroly – CATALySES: Collaborating to Advance Teaching and Learning of Science Educators and Students (University of Florida)

Mary Jo Koroly listed the goals of CATALySES in the following way: improve teachers' design expertise, lesson planning, and science identity, which will lead to improved student content knowledge and attitudes towards science. They also want students to know there are continued paths to science and health-related careers. Below are components of the program.

- Recruits mostly high school biology and chemistry teachers from across the state of Florida. Targets rural low-income communities to focus on science education around emerging pathogens.
- Two-week summer institute of about 20 teachers. Teachers work with University of Florida science and education researchers to develop lessons and lab exercises with the goal of translating CATALySES experiences into classroom action.
- During the two-week summer institute, teachers are primarily in labs doing research activities.
- While the program is focusing on science content, there is also significant emphasis placed on career knowledge.
- At the end of the institute, teachers present a research proposal that states what they will bring back to their classrooms. During the school year, they complete this action research.
- Participating teachers come back to University of Florida for a state-wide symposium to present their research, in other words–what they did and what their students learned.
- Some teachers return the following summer as interns to support graduate students in writing curriculum translating research into educational settings. PD participants pilot curriculum in classes and present results to graduate students.

Participants:

Libby Grace, Washington State University
Brinly Kantorski, The Partnership in Education
Kelly Furr, Northern Illinois University
Stephanie Tammen, Tufts Medical School
Bret Hassel, University of Maryland School of Medicine
Mary Kay Hickey, Cornell University
Georgia Hodges, University of Georgia
Barbara Hug, University of Illinois
Rob Rockhold, University of Mississippi Medical Center
Gwendolyn Stovall, University of Texas at Austin
Sheila Thomas, Harvard University
Kim Soper, University of Nebraska Medical Center
Molly Kelton, Washington State University
Atom Lesiak, University of Washington

Thursday, April 25, 2019 – 8:30 AM – 10:00 AM

Preparing Competitive Grant Proposals: A Multi-Agency Perspective

Panelists: **Tony Beck, Ph.D.,** *Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH*
Christina S. Chhin, Ph.D., *Education Research Analyst, Program Officer – STEM Education Research, Institute of Education Sciences, National Center for Education Research, U.S. Department of Education*
Alison Lin, Ph.D., *Program Director, Diversity Training Branch, NIH/NCI Center to Reduce Cancer Health Disparities, National Cancer Institute, NIH*
Rajesh Mehta, Ph.D., *Program Director for Educational Technologies and Applications, SBIR Program, National Science Foundation*
Edward Metz, Ph.D., *Research Scientist and Program Manager, SBIR Program, Institute of Education Sciences, National Center for Education Research, U.S. Department of Education*
Robert L. Russell, Ph.D., *Program Director, Division on Research and Learning, Directorate for Education and Human Resources, National Science Foundation*
Facilitator: **J. Michael Wyss, Ph.D.,** *University of Alabama at Birmingham*
Reporter: **Kristin Bass, Ph.D.,** *Rockman et al*

This session presented funding opportunities applicable to the sustainability and expansion of SEPA awards. Panelists answered six questions about program requirements at the agency they represented.

1. Are there different types or levels of funding at your agency?

Edward Metz, U.S. Department of Education. *The Small Business Innovation Research (SBIR)* program has two phases.

- Phase I, for the development and evaluation of prototypes, offers up to $200,000 for eight months.
- Phase II awards fund full scale development and evaluation, with a cap of $900,000

Rajesh Mehta, National Science Foundation.

- Phase I *SBIR awards* offer a maximum of $225,000 for six – 12 months.
- Phase II provides up to $750,000 for two years. With supplemental awards, it is possible to get up to $1.5 million.

Christina Chhin, U.S. Department of Education, Institute for Education Sciences. Five levels of funding for IES *education research grants*

- Goal 1, Exploration (build theory, test associations): two year secondary data analysis study, $600,000, or four-year primary data analysis and collection study, $1.4 million

- Goal 2: Development and innovation (test the promise of an intervention): four years, $1.4 million
- Goal 3: Efficacy and follow-up (initial study of causal impact): five years, $3.3 million
- Goal 4: Replication (independent analysis of interventions under routine conditions): five years, $4 million
- Goal 5: Measurement (development and validation of content measures): four years, $1.4 million

Alison Lin, National Cancer Institute, NIH. *Youth Enjoy Science (YES) R25 award*,

- $500,000 per year for a maximum of five years. As youth participants get older, they may be eligible for individual training awards.

Robert Russell, National Science Foundation. Innovative Technology Experiences for Teachers and Students (*ITEST*) "vaguely parallels SEPA."

- Louisa Stark recommends starting with an exploratory grant (up to three years for up to $400,000).
- There are also grants for developing innovations (up to four years for up to $1.5 million) and scaling innovations (up to five years for up to $3 million).

Tony Beck, NIH. There is *SBIR/STTR funding* for SEPA-specific interactive digital media:

- Phase I, six months, $225,000 or
- Phase I/II Fast Track, two years, $1.5 million

Louisa Stark asked what the requirements are for SBIR/STTR funding.

- ***Edward Metz*** (ED SBIR) replied that the prime applicant needs to be a small business, and that some academics start their own small businesses.
- ***Mehta*** (NSF SBIR) answered that the PI has to be a small business and have 51% employment with the company. Beck agrees.

- Read NSF's overall guidelines in the *Proposal and Award Policies and Procedures Guide (PAPPG)*. Each program may have its own specific requirements.
- You should also write a strong, compelling literature review, which provides the intellectual foundation for the project. If I learn something from your literature review, I'll recommend it for funding.
- There's no official way to float your idea with a program officer. You can send a one-page description of your project to the program officers listed in the funding announcement, and we'll follow up with a follow up call.
- Take advantage of opportunities to review proposals. It's a lot of work, but a great way to learn. Contact a program officer for details.

Louisa Stark pointed out that you have to be a PI to review for NIH, but that anyone can review for NSF.

Beck (NIH SEPA). Don't just read the funding announcement, study it.

Metz (ED SBIR). Successful applicants have a crystal ball for their project. They have a vision for their product two to three years from now. 50-60% of proposals don't have this.

Mehta (NSF SBIR).

- NSF accepts a one-page pitch describing the product and its commercial viability. This year we're accepting five-paragraph pitches that the program director (myself) reviews quickly.
- Don't call me to find out if NSF is interested in your idea. We're open to anything under the Sun.

3. How does the theoretical framework need to be placed in your agencies' proposals?

Metz. We assume that the applicant is the ultimate expert on the product. The applicant should make the case, and find the research to support his/her/their argument.

Mehta. I agree with Dr. Metz. Sometimes applicants provide good preliminary data, but lack a theoretical framework.

Russell. Make sure to describe the research design and the student experience. Describing the research context makes the proposal much more interesting.

Chhin.

- Strong, competitive proposals have a theory of change, or the ways in which the intervention relates to the proximal or distal outcomes. Proposers need to explain how you get from Point A to Point B: for example, is it by affecting teachers, or student engagement?
- Outline your research process with the theoretical rationale. Make sure everything matches, including the measures.

Lin. In an NIH Research Education (R25) grant, a theoretical framework in education is not required, but can enhance a proposal if it's good.

Beck. SEPAs are also R25. Innovation is difficult to derive, but a logic model defines where we need to be. Proposers should provide a logic model and allude to it throughout the narrative.

4. How much innovation is needed in competitive proposals?

Metz.

- An applicant can create something from scratch or add a new feature. Either way, what's being proposed has to be innovative.
- If you're proposing something from scratch, it's ideal to have user concept testing or product mockups. Include that data in your proposal.
- If you're proposing an add-on, that's incredible as well. You need to provide research showing that your product is promising. About half of these proposals don't have this, which is surprising.

Russell. The need for innovation depends on the type of project you're proposing. Exploratory projects should be innovative, but later stages of work are already testing something that exists.

Mehta. There needs to be a high level of innovation. The existing product needs to be a significant step up from what already exists. The higher the degree of risk, the more interested NSF will be.

Beck. The NIH SBIR program welcomes ideas that are too risky for venture capital. The product needs to be better or less expensive than what's currently out there.

Chhin. Innovation is part of each IES goal, including Replication. The work proposed should contribute new information. This includes studying an innovation with a new population or outcome measure.

Lin. Innovation is program specific. Read the paragraph in the YES funding announcement. It's possible to be innovative without discarding successful approaches. For example, building trust with diverse populations can be innovative, as is providing access to populations that are not near a training program, or that are not participating in a research-heavy community. Innovation is specific to each population and outcomes.

5. What level of research and evaluation is required by your agencies' programs?

Metz. Ideally, you've done some concept testing or pilot testing. In the proposal, iterative research and development is critical. You should propose pilot studies to demonstrate the feasibility, usability, and promise of your product. Read the RFP and give me a call.

Louisa Stark asked if validated instruments are required.

Metz. It depends on your claims and whether you need quantitative or qualitative data. Definitely check in with us.

Beck. The key for Phase I SBIRs is proof of principle. You need some evaluation for that. In Phase II, you need a really good research plan with validated instruments.

Mehta. You're asking the public to make an investment in your proposal to reduce the risk of carrying it out into practice. With your Phase II proposal, you're trying to convince another set of investors.

Chhin. The Common Guidelines for Education Research and Development describe requirements for different types of research, each of which has distinct research questions and design approaches that are considered rigorous. For example, correlational studies are appropriate for Exploratory

Research, while Scale-up Research requires Randomized Controlled Trials (RCTs). There's a misconception that all IES work is RCTs, which isn't the case for a lot of Goal 1 and 2 work.

Lin.

- YES is a Research Education grant, not educational research. We look at the research focus for the students. You are not required to study the educational model, but such a study is a plus if it's done well.
- Evaluation is required. We prefer that you come in with an already-tested model. You need a logic model, outcomes, and a specific population.

Russell. NSF requires evaluation and research, but there's no cookie cutter approach. For example, you can have a ramped-up advisory committee that provides iterative feedback on implementation. Another option is to conduct a process evaluation that shows if the project did what it set out to do and was successful.

Beck.

- SEPA has lots of options. The project drives the evaluation. As you go through the application process, you'll figure out what you need. There's no limit to the innovation in evaluation.
- A dazzling evaluation plan will be scored much higher.
- The review panel is very clear that validated instruments are a given, or a plan to validate items that you create.

6. What are the requirements for dissemination?

Metz.

- SBIRs require a commercialization plan. How will your product be widely disseminated to schools and students? How will you sustain the product over time? This is crucial even for Phase I proposals.
- In Phase I, it's important to have up to three strong letters of endorsement from partners who can assist with dissemination. We probably lose half of the submitted proposals here.

Mehta. I agree with Dr. Metz. NSF also requires up to three letters of support. You need to have a clear commercialization plan to explain how you will meet as many people as possible.

Beck. For SBIRs, you need to convince a panel of peer reviewers who are also product developers. You may originally be trying your program with a test audience that may not represent your entire market. You need to make your commercialization plan accurate and understand your market.

Chhin. IES dissemination plans should not only include publishing in peer-reviewed journals, but also reaching practitioners. This may include social media and contacts with Congress. Goal 3 and 4 proposals also require data sharing and management.

Lin. I agree with Dr. Chhin. YES proposals require a basic level of dissemination that are specific to what you are doing.

Russell. I prefer the term "communication plan or strategy" to dissemination. You need to think about who needs to hear what you have to say, and what are the most effective ways of reaching that

audience. Consider the teachers, parents, and general public who may be program beneficiaries.

Q & A

What should you do if the grant's review criteria don't match the rest of the RFA?

Russell. Follow the RFA. It's hard to tell a story without the grant requirements. It's important to read the guidelines.

Lin. Call the program officer.

Do your organizations want to see evidence of prior or additional funding for the program you're proposing?

Chhin. You can write about additional funding, but we don't expect that or publication records for early career researchers. We look at the experience of the team as a whole.

Lin. Prior funding is great. We have a $500,000 annual cap for direct costs, but it's never enough.

Beck. I don't want to see a SEPA proposal that can only be done with extra funding. Other money is a bonus, but not required.

Russell. NSF rules prohibit cost sharing.

Thursday, April 25, 2019 – 10:00 AM – 10:30 AM

Leveraging Your SEPA Grant for Additional Funding

Panelists: **Melinda Gibbons, Ph.D.,** *Professor of Educational Psychology & Counseling, University of Tennessee Knoxville*
Berri Jacque, Ph.D., *Assistant Professor of Medical Education, Tufts Medical School*
Lisa K. Marriott, Ph.D., *Assistant Professor of Health Promotion & Environmental Systems and Human Health, Oregon Health & Science University*
Kim Soper, MS, *Munroe Meyer Institute, University of Nebraska Medical Center*
J. Michael Wyss, Ph.D., *Professor and Director, University of Alabama at Birmingham*

Reporter: **Kristin Bass, Ph.D.,** *Rockman et al*

In this session, five panelists discussed the ways they have sustained their SEPA programs with funding from other federal and regional sources.

Melinda Gibbons, University of Tennessee Knoxville

SEPA project: PiPES: Possibilities in Postsecondary Education and Science for Rural Appalachian Youth

- Funding from NSF S-STEM (Scholarships in Science, Technology, Engineering, and Mathematics), which provides scholarships for low-income students. Her program also provides two years of ongoing mentoring and research opportunities.
- Additional funding from the Appalachian Regional Commission to extend the hours of local community career centers.
- Tip: Use your network! Consider what your community needs to build new opportunities.

Berri Jacques, Tufts University

SEPA project: The Great Diseases: Bringing Biomedical Science to the High school Classroom

Has focused on the sustainability of multiple strands of SEPA programming and research.

- In response to teachers' requests for career information, the project team applied for funding from the NSF ITEST program. It took three tries, because the team had to strengthen its theoretical framework to be successful.
- Received funding from the National Institute for Allergy and Infectious Disease (NIAID) to disseminate the project's Infectious Disease Module at scale.
- Teachers wanted course credit for their participation, so the team applied for $1 million in funding from the Bingham Trust to fund curriculum training with continuing education credits
- Tip: Have overlapping funding efforts. Small amounts of money can lead to larger grant applications.

Lisa Marriott, Oregon Health Sciences University

SEPA project: Let's Get Healthy!

- Dual parallel processes led to the development of health materials for adults and children. Adults preferred the children's materials.
- The children's materials led to a collaboration in Thailand to develop web-based health fair materials.
- Funding is from the National Cancer Institute focusing on community education and afterschool programs
- New SEPA looking at psychosocial development
- Applied for funding from NSF Education and Human Resources Division Core Research program to extend the SEPA grant's informatics infrastructure to assess STEM undergraduates' psychosocial development
- All of this funding was possible because the SEPA project was kid-friendly and kid-focused.

Kim Soper, University of Nebraska

SEPA project: Accelerating Access: Health Science Education in Native American Communities

- The project team has built face time and relationships with Native American communities. This has opened up other funding opportunities including an NIH Youth Enjoy Science (YES) grant to engage students in cancer research.
- The team has also received an NIH Innovative Programs to Enhance Research Training (IPERT) grant for tribal colleges
- Tips:
  - Don't promise more than you can deliver
  - Projects don't always go as planned
  - Successful relationship-building requires trust, flexibility, reliability, and integrity

J. Michael Wyss, University of Alabama Birmingham

SEPA project: Science Education Enabling Careers (SEEC)

- Funding through an NSF Noyce grant to train and fund preservice teachers. SEPA synergizes beautifully with this grant because it enables science majors to receive teacher training.
- Tip: Reach out to Schools of Education for assistance.
- Funding through an NIGMS Bridges to Baccalaureate grant that prepares students attending 2-year community college programs to earn a bachelor's degree. The grant is a pipeline for underrepresented minorities who often attend community colleges because they're inexpensive and close to home. UAB's program provides students with internships and research experiences, and has had a 100% success rate.

Panel Q & A

- When did you start thinking about additional funding?

    - Almost immediately after getting the SEPA
- Did you have discussions with program officers about project and funding overlaps?
    - Yes, and it's important to make the projects distinct.
- How do you recommend transitioning from SEPA to NSF?
    - Partner with someone who has NSF experience
    - Prepare a strong theoretical framework
    - Distinguish between research and evaluation, and between biology and health
    - Keep trying! Don't be discouraged by an unsuccessful application.

Breakout Sessions
Thursday, April 25, 2019 – 10:45 AM – 11:45 AM

Connecting the Dots: An Introduction to Logic Models for Project Planning, Management and Evaluation

Presenters: **Nancy Moreno, Ph.D.,** *Associate Provost of Faculty Development and Institutional Research, Baylor College of Medicine*
Ann Chester, Ph.D., *Assistant Vice President for Education Partnerships, Director of Health Sciences & Technology Academy, West Virginia University*
Robin W. Rockhold, *Ph.D., Professor of Health Sciences; Deputy Chief Academic Officer, University of Mississippi Medical Center*
Reporter: **Brandon Morgan** *(Health Resources in Action)*

Summary:

In this session, participants shared their knowledge of logic models, gained an overview of logic models from the session leaders based on the Kellogg Foundation Model, and had an opportunity to practice using logic models in a case study.

Best Practices:

Logic models frame the intervention one is attempting to implement. It's important that these models be iterative, especially when making changes to programming. It's also helpful to work backwards, starting with outcomes and working towards inputs.

Overview of Logic Models:

Logic models use the following order: Inputs–to Activities–to Outputs–to Outcomes–to Impact

- Inputs: These are the things that are required to create an activity. It is best to think of these as "raw materials." The major material used is funding. We have each been given NIH grants to purchase necessary materials or hire human resources. Inputs can also include staff members.
- Activities: Activities are actions taken using the acquired resources. Ultimately, activities are in the pursuit of creating outputs. An example of an activity might be training youth to teach a health concept. Both inputs and activities are in your planned work.
- Outputs: These are the items that are being produced. This includes any deliverables. It can include physical artifacts produced and nonmaterial things as well. This can range from curriculum created to workshops delivered to biomedical research results.
- Outcomes: Outcomes include short-term and long-term goals. This is usually what your project aims to accomplish. In reference to individuals, this can include influencing attitudes, beliefs, and impressions. The timeline for short-term outcomes can range anywhere from six months to two years. Since they are proximal, they are easier to measure. Long-term outcomes are more difficult to assess since they are more distal. A long-term outcome might be a youth in a program eventually starting a STEM career.
- Impact: Impact is another long-term outcome that is very difficult to assess. It usually includes

something on the scale of societal change. An example of an impact is "improved health status" of a certain population. Outputs, outcomes, and impact are your intended results.

Case Study Activity:

After the group learned about the various components of logic models, participants in the session worked with those at their tables and began to practice creating logic models using a case study or an existing logic model they already use. Afterward there was a debrief with the larger group.

Participants:

Laura Courtney, Washington University
Brandon Morgan, Health Resources in Action
Adel Karara, University of Maryland, Eastern Shore
Alana Newell, Baylor College of Medicine
Elizabeth Parker, University of Maryland, Baltimore
TanYa Gwathmey, Wake Forest School of Medicine
Barbara Hug, University of Illinois
Orestes Quesada, University of Puerto Rico
Rayelynn Brandl, Montana Tech
Marisa Pedulla, Montana Tech
Jenica Finnegan, University of Nevada, Reno
Luke Bradley, University of Kentucky
Melissa Kurman, University City Science Center
Anja Scholze, The Tech Museum of Innovation
Rashada Alexander, NIH/NIGMS
Christopher Kvaal, St. Cloud State University
Roy Womack, Georgia State University
Laurel Zhang, Exploration Place
Charles Wray, The Jackson Laboratory
Bonnie Sachatello-Sawyer, Hopa Mountain
Marlys Witte, University of Arizona
Rebecca Norlander, New Knowledge Organization
Grace McClure, University of Texas at Dallas
Susan Hershberger, Miami University
Holly Brown, US Army Medical Research and Materiel Command

Writing a Rigorous Evaluation Plan for Your Next Proposal: Practical Considerations

Presenters: **Kristin Bass, Ph.D.,** *Senior Researcher, Rockman Et Al*
Louisa A. Stark, Ph.D., *Professor of Human Genetics; Director, Genetic Science Learning Center, University of Utah*
Dina Drits-Esser, Ph.D., *Senior Research Associate, Genetic Science Learning Center, University of Utah*
Reporter: **Anjelica Miranda,** *Denver Museum of Nature & Science*

Session participants were given the most recent version of the SEPA RFA, describing the requirements for the evaluation plan of their projects. Participants were given time to review the document and were then instructed to break into groups of two to three people to discuss the SEPA evaluation plan requirements and write down questions that came up to discuss later with the bigger group.

- Questions:
  - Does teacher professional development fall within the category of inside or outside the classroom?
  - What is the division of labor between internal and external evaluators?
  - Are there increased qualifications for external evaluators?
  - What is the role of cultural competence?
  - What is a STEM pathways model?
  - Technical assistance for designing an evaluation plan?
  - Delayed implementations as a control group?
  - Who should you get feedback from for your proposal?

Once questions were asked and written down, the presenters began discussing how and when to start working with an evaluator. The discussion stressed the importance of beginning your work with an evaluator very early on in the project design and proposal writing. This way questions could be asked and answers received early in the design phase of the project proposal.

It is important to note that evaluation of the project needs to be a partnership, the evaluator of your project wants to help create the best program possible, therefore choosing the right evaluator is critical. It was recommended that when choosing an evaluator, more than one person is interviewed. PIs and project staff want to find an evaluator they can work well with, that is flexible, and that makes them feel understood and not like they are being judged.

Another recommendation was to work with the evaluator to design the instruments and plan for data collection, as well as for survey and instrument validation. Validating the data collecting instruments ensures the correct data is being collected. Asking stakeholders of the project to take a look and review surveys and instruments will help improve them and help validate the instruments. Validation will also help ensure that the instruments being used are culturally competent. Dr. Louisa Stark offered session participants her help in obtaining resources for instrument validation.

When writing the project proposal, recommendations/things to consider were proposed for what to

include in the evaluation plan. These inclusions were: evidence that the evaluator was involved in the writing of the project; the training plan for technical assistants aiding in the evaluation data collection; and showing the plan for the instruments to be used.

As overall tips for writing a SEPA project proposal, session participants were told to consider making the evaluator of the project one of the key personnel (including both internal and external evaluators, if applicable), and to mention the potential challenges of the project and how they might be addressed. The final tip was to acknowledge and recognize the limitations of the project being proposed and of the funding.

Before the end of the session, Dr. Dina Drits-Esser provided everyone with a copy of an Evaluation Plan Checklist, which was modified with permission from EvaluATE (*http://www.evalu-ate.org/*) to fit the SEPA standards

Participants:

Lynne Holden, Mentoring in Medicine, Inc
Anjelica Miranda, Denver Museum of Nature & Science
Michael Kennedy, Northwestern University
Kelli Qua, Case Western Reserve University
Ido Davidesco, New York University
Mason Arrington, University of Chicago
Kevin Morris, Walter Reed Army Institute of Research
Bill Thornton, University of Nevada
Jacque Ewing-Taylor, University of Nevada, Reno
Mary Larson, Salish Kootenai College
Karen Yanowitz, Arkansas State University
Loran Parker, Purdue University
Michelle Ezeoke, Georgia State University

How Do Small Businesses Get Started with SBIR and STTR Programs?

Presenters: **Melani Duffrin, Ph.D.,** *Professor of Interdisciplinary Health Professions, Northern Illinois University*
Dina G. Markowitz, Ph.D., *Professor of Environmental Medicine; Director, Life Sciences Learning Center, University of Rochester*
Tim Herman, Ph.D., *Director, MSOE Center for BioMolecular Modeling, Milwaukee School of Engineering*
Reporter: **Taylir Schrock, M.S.,** *Research Coordinator, Salish Kootenai College STEM Academy*

The session began with a suggestion to spend more time listening and thinking about the process and not the outcomes because when you slow down, you can make some thoughtful decisions and not make mistakes. The result will be a more profitable endpoint.

ICORE: *https://www.icore.com/*

- Blank canvas model (all these resources are found online).
- Talk about value propositions–what value do you deliver to the customer?

Next, a question was posed: How do you know if you have a potential commercial product? The answer: Anything can be!

The presenters emphasized that it's important to first identify the "problem"

- Is there a "problem" that you/others are experiencing? Write a problem paragraph describing what problems you are trying to find a solution to.
    - They came up with a "Science Take-Out Kit" as the solution to their particular problem
        - Easy to use for high school and middle school students
        - Each kit contains all the materials needed. There is no lab prep needed.
        - The kit activities do not require lab equipment.
- They identified five distinct types of customers ("market segments") for the Science Take-Out kits
    - Science teachers
    - School districts
    - Science teacher education programs
    - Homeschool educators
    - Informal educators
- In their business plan they looked at who their competitors were. They compared everything (prices, prep, disposability, etc.).
- They asked if the customers would actually buy those products or not?
    - To do this, they had a workshop setting and had a sit-down discussion with teachers to see if this was something that they would actually buy.
    - They had prototypes of the kits and had teachers use them on their own as well with their classes. The teachers supplied very rich feedback.
    - They also did a Science Kit Purchasing survey (they surveyed 225 teachers)
    - They asked if the teachers didn't use lab kits, then why not
- Finally. they created a value proposition: the value the company promises to deliver to the customer should they buy the product.

Participants:

Taylir Schrock, Salish Kootenai College
Weiling Li, Purdue University
Kelly Furr, Northern Illinois University
Elizabeth Ozer, University of California, San Francisco
Berri Jacque, Tufts Medical School
Linda Morell, University of California – Berkeley
Jackie Shia, Wheeling Jesuit University
Chuck Wood, Wheeling Jesuit University
Melinda Butsch-Kovacic, University of Cincinnati
Atom Lesiak, University of Washington

Thursday, April 25, 2019 – 12:00 PM – 12:30 PM

Town Hall

Presenter: **Tony Beck, Ph.D.,** *Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH*

Reporter: **Barbara Hug,** *University of Illinois Urbana Champaign*

Dr. Beck began by saying he is looking forward to next year's conference and if anyone is interested in participating in organizing it, make certain to either contact Louisa Stark or respond to her e-mail request for participation.

Organizing committee:

- Organizing committee members are co-leaders of a conference strand
- Each conference strand has two leaders

Conference strand leaders' responsibilities include:

- Identify types of sessions
- Find people to lead the sessions
- Help identify the focus of plenary sessions

Reasons to join the committee

- Have a chance to determine what happens
- Be part of the community

Responsibilities of the planning committee has evolved over the time to reflect more of the community

- Conference is for the SEPA community, but
- Impact on visitors is also good
- Need to have people volunteer: please volunteer!

Evaluation of the conference: important to give comments about the conference

- As a new PI (or PI to be), looking to have input/comments
- Need comments back from all participants—all voices/views important to hear
- Need to have feedback about comments about whether or not we should have yearly conference
- What is the value of the meeting to individual people for networking across the community? Please send comments.

Why is the evaluation of the conference important?

- Process for applying for a 5-year conference grant similar to all grants: need to demonstrate evidence that the conference is worthwhile and valuable

Annual conference report

- Session notes needed
- Pictures welcome; send to Tony
- Looking back through the conference reports: have become an archive of the SEPA program
- Useful for informing people outside the SEPA community about the program

Annual progress report of the conference grant: evaluation data needed

- Annual reports are read by program officers

Requests of next steps:

- Request that people upload posters to the NIH SEPA website. Do this through "conference posters" in each program section of the website.
    - Posters are helpful to Tony
- Please take time to go to SEPA website, make certain that the website is updated and represents the current
    - Up to date webpage on SEPA website is important, SEPA program officers use the site for information and to direct people
- NIGMS communication people: want pictures

Social media:

- Tag the twitter handle @NIHSEPA and @NIGMStrain (see earlier session on SEPA updates for additional details)

Question from evaluation session:

- In the current SEPA RFP, it talks about a logic model, or STEM pathway model being required
    - question of what STEM pathway model is: similar to logic model?

SEPA funding announcement: any questions, ask Tony.

- There is template text that needs to be there, but can add additional information.
- If need to have clarification, will provide this information but need to know what is confusing

Tony talked about overlap between curriculum for high school and community college and possible sharing of resources.

- Posed the question of how SEPA should be opened to community college participation: how can the community colleges be made aware of the SEPA materials?
    - Question of how to disseminate more broadly
- PIs and project personnel thinking ahead in ways that others might not be thinking; Are community colleges another place to maximize what is done in different SEPA programs?

Great to have SEPA and have it as part of the NIGMS pipeline; look to see how partnerships can be established to support connections across the trajectory/pipeline

Need to think about how to extend out the SEPA program goals:

- What are the natural connections between high school/community college/college

- Interest in science graph showing decline over time: need to identify how to either stop the decline, increase support and/or bring people back in

Suggestion: include Community College and Bridges community in the NIH SciEd conference.

- Not a funding point, but rather as an opportunity to bring people into the community and start a conversation about what is needed in the different communities and what can be shared across communities

YES awardees being pulled into the NIH SciEd conference to broaden participation and communication

- possible to pull in other groups as well? Suggestions?

BUILD sites as a way to leverage effort by NIH regarding pipeline issues

- large infrastructure grants; community college to universities: NIGMS BUILD students getting opportunities for research
- https://www.nigms.nih.gov/training/dpc/Pages/build.aspx

Anne Chester: Journal of STEM Outreach looking to highlight programs

- Special Journal issue of replication: program that has been around for more than five years, that has a positive outcome and is at the point for replication
- $250 to publish if abstract is selected
- Virginia Shepard will be sending out the details of the call for abstracts

Posters and Interactive Media Abstracts

Authentic Research Experiences for Students & Teachers

1. **Turning the Phage: A Teacher's Unexpected Journey with Authentic Graduate Research**
   Linda Rost, Baker High School

   A teacher from rural Montana was involved in the Bringing Research into the Classroom NIGMS SEPA, which included visiting scientists conducting phage discovery in the classroom.

   Teachers received professional development online and had opportunities to work in microbiology labs during two summer research academies. This teacher conducted microbiology research as part of her M.S. in Science Education degree and it changed the way she teaches a Science Research class to her high school students. The teacher is the 2019 Montana Teacher of the Year Finalist and will be offering professional development in science research to other teachers through these experiences.

   Funded by: NIGMS SEPA

   Keywords: Research Experiences for Students, Research Experiences for Teachers, Students – Classroom Science Enrichment, Teacher Professional Development

2. **Pathways to Cancer Research – Authentic Experiences for Students and Teachers Dave Vannier,**
   Jeanne Ting Chowning, and Beverly Torok-Storb, Fred Hutchinson Cancer Research Center

   Pathways to Cancer Research is an authentic research program with components for 1) high school students 2) undergraduate students and 3) high school teachers. Rising 10th and 11th graders are exposed to cancer research and careers through a two-week summer immersion program. First- and second-year undergraduates and teachers engage in two summers of mentored research; participate in a cancer biology education series; professional development workshops; and social activities. These components dovetail with existing Fred Hutch internship opportunities. The programs give students from backgrounds underrepresented in biomedical science the opportunity to explore, clarify and strengthen their research-related career interests.

   Funded by: NCI YES

   Keywords: Broadening Participation, Diversity & Equity, Research Experiences for Students, Research Experiences for Teachers, Big Data/Data Science/Bioinformatics

3. **LEAH Knox Scholars Project: Year One Results**
   Laurie Jo Wallace, Brandon Morgan, Lisa Asian, Valerie Polletta, Chloe Cheung, Health Resources in Action

   The LEAH Knox Scholars Program in Biomedical Research (LKS), seeks to diversify the pipeline of new investigators by identifying and supporting high school students from predominately minority schools in Boston. These students, once selected, are supported from the summer after tenth grade through

high school graduation. Applicants are recruited through local Boston schools with the assistance of the Private Industry Council. The Knox Scholars begin with an intensive, summer long introduction to molecular biology lab skills taught at MIT by MIT instructors. During the school year, they participate as LEAH Mentors. Using the youth development approach that emphasizes the strengths and resources of young people and promotes resiliency, the LEAH Project recruits, trains, and employs low- income, high school students of color in Boston Public Schools to become LEAH Mentors. LEAH Mentors receive stipends to teach hands-on science lessons, provide homework help, and act as role models to elementary school students in afterschool programs and have several science-based afternoon science enrichment programs.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Informal Science Education, Research Experiences for Students, Students – Out-of-School Program

4. **Data to Action: A Secondary School-based Citizen Science Project to Address Arsenic Contamination of Well Water**
Jane Disney, MDI Biological Laboratory; Bruce Stanton, Dartmouth College; Anna Farrell and Duncan Bailey, MDI Biological Laboratory

   The long-range goal of the "Data to Action" project is to pilot a national model of STEM education that engages students as citizen scientists in addressing the issue of drinking water contamination. Arsenic contamination of well water is our focus, being a pressing public health issue in Maine and New Hampshire. Students collect tap water from their homes for analysis and then scientist partners help teachers and students make sense of their data and share findings with the public. This project will contribute to state agency efforts protect public health, while increasing student competency and interest in science.

Funded by: NIGMS SEPA

Keywords: Citizen Science, Research Experiences for Students, Students – Classroom Science Enrichment, Teacher Professional Development

5. **BRIC to PHAGES: Final Outcomes of the BRIC project, Planning for Sustainability, and Creating Legacy in Montana Classrooms**
Marisa Pedulla, Rayelynn BrandL, and Christopher Doyle, Montana Technological University

   The Bringing Research Into the Classroom (BRIC) project provided authentic research experiences for teachers and students. Teachers took online graduate coursework and participated in two weeklong summer research academies; designing and completing genuine research projects enabled them to translate research experiences for their students. Travelling over 40,000 miles, university scientists visited classrooms throughout Montana providing annual 3-day bacteriophage discovery outreach for over 8,100 students. Students named the phages they discovered and added them to phagesdb.org. Several students completed further research with the BRIC team. The poster highlights student and teacher outcomes, phage discoveries, and plans for program expansion and sustainability.

Funded by: NIGMS SEPA

Keywords: Authentic Research Experiences for Students & Teachers, Broadening Participation, Diversity & Equity, Citizen Science, Classroom Science Enrichment, Teacher Professional Development, Bacteriophage Discovery

6. **BrainWaves: An EEG-based High School Neuroscience Program**
   Ido Davidesco, Steven Azeka, and Wendy Suzuki, New York University

   BrainWaves is a semester-long high school neuroscience curriculum, where students become brain scientists in an original study of their own creation. Students are provided with the content knowledge and practices to design and conduct a comprehensive neuroscience research study in their own classroom with the use of portable low-cost brainwave measuring devices (electroencephalography (EEG) headsets). The curriculum is accompanied by app that guides students through the process of designing their experiments, as well as collecting and analyzing data. Preliminary evaluation results suggest that students' content knowledge and self-efficacy in conducting research have significantly improved after participating in the program.

   Funded by: NIGMS SEPA

   Keywords: Broadening Participation, Diversity & Equity, Citizen Science, Curriculum Development, Research Experiences for Students, Research Experiences for Teachers, Students – Classroom Science Enrichment

7. **BioSTORM**
   Andrea Panagakis, Salish Kootenai College

   Mission: To prepare high school students on the Flathead Indian Reservation for entry into college degrees and careers in biomedical and biobehavioral research through a dual enrollment STEM Academy.

   Funded by: NIGMS SEPA

   Keywords: Broadening Participation, Diversity & Equity, Research Experiences for Students, Students – Out-of-School Programs, Big Data/Data Science/Bioinformatics

8. **Rural Alaska Students in One-Health Research (RASOR)**
   Jen Straley, Ellen Chenoweth, and Arleigh Reynolds, University of Alaska; Chris Whitehead, Kari Lanphier, and Esther Kennedy, Sitka Tribe of Alaska; Janet Clarke, Kristen Tiemann, and Lisa Busch, Sitka Sound Science Center; Paul Cotter

   Rural Alaskan students are underrepresented in biomedical science, including Alaska Native, low-income, first generation college, and rural. Geographic isolation defines these communities and can limit the exposure of students to scientifically-minded peers, role models, and career pathways. We will implement place-based mentored research projects with students in rural Alaskan communities at the high school level. The biomedical one-health approach will build connections between student experiences of village life in rural Alaska and biomedical research. Projects are designed to demonstrate the practicality of scientific research, that science has the ability to support community and cultural priorities and to provide career pathways.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Research & Evaluation, Research Experiences for Students

9. **Screening Cancer: A Health Message Campaign Developed by Student Researchers in San Francisco Health Investigators**
Rebecca Smith, Ben Koo, and Jenna Bernard, University of California San Francisco; Shruti Bathia and Linda Morrell, University of California – Berkeley

San Francisco Health Investigators (SFHI) engages 20 high school students annually in a year- long research project to investigate their community's knowledge and awareness about a health topic. Students use their research to inform the design of targeted health messages, then study the effectiveness of these messages. The 2018 theme for SFHI was cancer. SFHI Student Researchers surveyed nearly 500 San Francisco residents about their knowledge and awareness of cancer and cancer prevention and utilized these data to inform their health message campaign. This year's campaign was titled "Screening Cancer" and focused on breast, liver, colon, prostate, and tobacco induced cancers. At the poster, we will share our program design, the Screening Cancer campaign, and project outcomes.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Research & Evaluation, Research Experiences for Students, Students – Out-of-School Programs, Health Messages

10. **(a) The Appalachian Career Training In ONcology (ACTION) Program**
Nathan Vanderford, Chris Prichard, and B. Mark Evers, University of Kentucky

Kentucky has the highest all-site cancer incidence and mortality rates in the United States with the highest burden of cancer localized to the Appalachian region of the state. Residents of Appalachian Kentucky also experience high rates of poverty and below-average education attainment. Through funding from the National Cancer Institute's Youth Enjoy Science R25 program, the Appalachian Career Training In ONcology (ACTION) Program at the University of Kentucky Markey Cancer Center provides enhanced cancer-focused education and training for students from rural, low-socioeconomic, and low-education-attainment communities and works to develop a better understanding of cancer and cancer education within these underserved communities.

Funded by: NCI YES

Keywords: Research Experiences for Students, Students – Classroom Science Enrichment

10. **(b) Knight Scholars Program**
Lisa Marriott, Jackilen Shannon, and Brian Druker, Oregon Health & Science University

The Knight Scholars Program provides cancer research experiences to diverse, rural high school students using a stepped approach: a short "introduction" (7 day) experience followed by a longer (1 month) "immersion" research training designed to expose students to a wide- range of cancer research areas. Students use this immersion experience to select a research focus for their 2-month

research "intensive" at OHSU the following summer. Experiences are supplemented with local clinical shadowing, outreach, and reinforced with a Scholar-led mentored research project in their own communities. Teachers from participating high schools engage in summer professional development to reinforce and extend content.

Funded by: NCI YES

Keywords: Broadening Participation, Diversity & Equity, Research Experiences-- Students, Teacher Professional Development

11. **Project SCORE (Student-Centered Outcomes Research Experience)**
Marie Barnard, Erin Dehon, Caroline Compretta, Allison Ford-Wade, Andrew Notebaert, Whitney White, and Rob Rockhold, University of Mississippi

Compared to youth in other states, Mississippi youth report engaging in significantly riskier health behaviors. Existing education, prevention, and intervention efforts to improve health outcomes have been developed largely without youth input. Project SCORE (Student-Centered Outcomes Research) engages high school and graduate health sciences students from communities with significant health disparities in the development of relevant health behavior research questions by training them in basic research methodology, including problem identification and the development of good research questions. Students develop a health promotion research agenda and execute projects to answer these questions.

Funded by: NIGMS SEPA

Keywords: Citizen Science, Informal Science Education, Research Experiences for Students, Students – Out-School Programs

12. **Research Education on Air and Cardiovascular Health (REACH)**
Tony Ward and Brett Taylor, University of Montana

The Research Education on Air and Cardiovascular Health (REACH) Program will work with a network of 50 teachers in over 30 schools located in rural and American Indian / Alaska Native communities throughout Montana, Idaho, and Alaska. We will test the overall hypothesis that the REACH Program can be successfully utilized in rural, underserved areas to increase middle/high students' interest in careers in basic and clinical medical research. We will test this hypothesis through the following Aims: Aim 1) Citizen Science; Aim 2) Science communication; Aim 3) Student mentoring, and Aim 4) Teacher Professional Development.

Funded by: NIGMS SEPA

Keywords: Citizen Science, Curriculum Development, Curriculum Testing, Research Experiences for Students, Research Experiences for Teachers, Teacher Professional Development

13. **Best Practices and Achievements of the Neuroscience Undergraduate Training Program to Increase Diversity (NeuroID) at the University of Puerto Rico-Piedras**
Carmen Maldonado-Vlaar and Jose E. Garcia Arraras, University of Puerto Rico – Rio Piedras

The Neuroscience Research Opportunities to Increase Diversity (NeuroID) from the University of Puerto

Rico Rio Piedras Campus aims to increase the opportunities for undergraduate students in the area of Neurosciences. The main goal is to increase diversity in the neurosciences by establishing a cohort of interested students that will receive academic and professional training in neuroscience-related research. NeuroID is a comprehensive research experience based on a research-with-purpose training philosophy that consists of research experience, academic training and student development. The proposed activities and the mentoring program with role models from underrepresented groups will serve to increase competitiveness and career success.

Funded by: NIH-BP Endure

Keywords: Broadening Participation, Diversity & Equity, Citizen Science, Research Experiences for Students

14. **The High School Research Initiative: Engaging Teachers and Students in a Dual- Enrollment Research Course**
Gwendolyn Stovall, Jill Rhoden, and Deanna Buckley, University of Texas at Austin

The High School Research Initiative (HRI) is an inquiry training resource center, providing teacher training, dual-enrollment research courses, and supportive resources to lead scientific inquiry in the classroom. At the forefront of the HRI program is the "Scientific Inquiry and Collaboration" dual-enrollment course, which offers high school students experiences in open- inquiry research and university- collaborative research. This course is taught at high school campuses by teachers, who have completed the 3-wk training program.

Teachers and students receive teaching, curriculum, and research support in-person and virtually, as well as program evaluation feedback throughout the yearlong course.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Research Experiences for Students, Teacher Professional Development

15. **Empowering Pre-service Teachers and Students with Environmental Health Research**
David Petering, Craig Berg, and Renee Hesselbach, University of Wisconsin – Milwaukee,

The goal of the UW-Milwaukee NIGMS SEPA program is to prepare pre-service teachers to introduce inquiry/research into their teaching that connects concepts in life science to related issues in environmental health and thereby addressing the NGSS standards. The significance of this program is that it combines pre-service teacher professional development with student activities that involve in-depth authentic experimentation. The NIGMS SEPA poster describes each of the modules, as well as various components of the program such as current science standards that drive the program, the in-depth pre-service teacher training, various student

learning opportunities (e.g., research activities, Student Research Conference), and program evaluation.

Funded by: NIGMS SEPA

Keywords: Research Experiences for Students, Research Experiences for Teachers, Teacher Professional Development, Inquiry-based research

16. The Vanderbilt Day of Discovery Program

Jennifer Ufnar and Virginia Shepherd, Vanderbilt University

The Vanderbilt Day of Discovery (DoD) was designed to implement a half-day pull out program to provide authentic STEM learning experiences for area middle school students. The DoD provides students with experiences in designing and implementing research projects in the STEM fields. The first two years of the program focused on designing the curriculum, solving logistical issues, developing co-teaching partnerships, and creating evaluation instruments. This year has focused on refinement of the curriculum, evaluation of the program, and dissemination to a third site. Evaluation of the program has shown increased interest, confidence, and motivation in STEM for participating students.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Dissemination, Research Experience for Students, Students – Out-of-School Programs

17. In-School Internships for Teachers and Students in Underserved Schools Using the Near- Peer Mentor Model

Debra Yourick, Kimberly V. Aguilar, Margery K. Anderson, R. Jerome Anderson, Holly M. Brown, Emily D. Kuehn, Edgar D. Rowton, and Laura S. Tenenbaum, Walter Reed Army Institute of Research

At the conclusion of this five-year program we have succeeded in achieving our project aims by: (1) Creating 30+ novel, inquiry-based, NGSS-aligned laboratory investigations, (2) Providing students of four underserved high schools with in-classroom opportunities to learn laboratory skills, (3) Supporting 3-5 recent post-baccalaureates annually in a research and education internship as near-peer mentors, and (4) Offering 1-2 teachers annually innovative strategies for implementing laboratory investigations that link to classroom curriculum. Our program had significantly positive impacts on students' science attitudes and some academic measures.

Given the program success, we will pursue funding for wide dissemination of our enrichment model.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Research & Evaluation, Research Experiences for Students, Students – Classroom Science Enrichment

18. HSTA Citizen Science: Adolescents Addressing Childhood Obesity through Early Childcare Facilities

Ann Chester, Sean Freeland, Merge McMillon, Summer Kuhn, Cathy Morton, and Lynne Cossman, West Virginia University

This poster describes the features of the Health Sciences & Technology Academy (HSTA) at West Virginia University. It also presents statistics and findings related to the impact HSTA has on graduates who matriculate through the program. The NIGMS SEPA-funded Biomed Summer Camp is highlighted, focusing on the impact it has on HSTA students and the children of West Virginia. These HSTA students are working in communities across the state to research health patterns and to educate children in an effort to improve diet and exercise habits in order to prevent childhood obesity and the adult diseases related to it.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Citizen Science, Research Experiences for Students, Students – Out-of-School Programs

Big Data, Data Science and Bioinformatics

19. NeuroLab Residential Research Experiences
Ralph Imondi and Linda Santschi, Coastal Marine Biolabs Integrative Biosciences Institute; Kristin Bass and Ruchita Patel, Rockman Et Al

The NeuroLab project is aimed at providing precollege students with early exposure to the daily practice of science and early membership into the research community as data contributors. To this end, small cohorts of predominantly female students participate in residential research experiences that bridge comparative genomics and developmental neuroscience. The hands-on student research workflow involves the adaptation of research products generated by the Berkeley Lab to identify new tools for targeted gene delivery in embryonic neurons. Assessment data reveals positive program effects on students' knowledge, self-efficacy for conducting research, persistence on challenging tasks, collaborative abilities, and attitudes towards scientific research.

Funded by: NIGMS SEPA

Keywords: Citizen Science, Informal Science Education, Research Experiences for Students, Students – Out-of-School Programs, Big Data/Data Science/Bioinformatics

20. Citizen Science to Advance Health and Diversity- Evaluation of Informal Science Education Programming to Increase Interest in STEM
Adam Marcus, Theresa Gillepie, and Jasmine Mille Kleinhenz, Emory University

The Citizen Science Health & Diversity (CSHD) Program of Emory University is a National Institutes of Health Science Education Partnership Award-funded initiative that aims to implement community-relevant, STEM activities targeting low-income, minority and under- represented middle school students throughout the state of Georgia. CSHD has four main components that build on citizen science concepts with a focus on health and underrepresented students in STEM: 1) informal STEM education programs; 2) summer Big Data Academy for middle school girls; 3) community outreach through schools and organized events (e.g. Atlanta Science Festival); and 4) web-based Citizen Science. Utilizing pre-and post-course evaluations and small group discussion-based questions, we have generated quantitative and qualitative data from our informal STEM education programs and our Big Data Academy.

Results of these evaluations indicate that our programs increased participants' interest in science and their desire to study science in college. Participants also indicated more favorable attitudes towards science's impact on society. In addition to determining the impact of these programs on students with regards to their inclination to pursue STEM careers, this data has been used to provide insights to improve future CSHD programming.

Funded by: NIGMS SEPA

Keywords: Citizen Science, Curriculum Development, Informal Science Education, Research &

Evaluation, Research Experiences for Students, Research Experiences for Teachers, Students – Out-of-School Programs, Big Data/Data Science/Bioinformatics

21. Filtered: Early Stage Development and Strategies
Neil Lamb, Michele Morris, Madelene Loftin, and Adam Hott, HudsonAlpha Institute for Biotechnology

Filtered is an online, multi-platform digital learning activity focused on core concepts used in DNA analysis, specifically in modern computation biology and bioinformatics. Using the storyline of a pandemic infectious disease, students are challenged to master and use computational tools (filters) to analyze both human and non-human DNA sequences ultimately leading to a better biological understanding of the infectious agent and the humans that are naturally resistant. Early stage development of Filtered is underway with learning targets identified, master narrative written, student interactions defined, and an assessment plan, including both in and out of activity measures, under development.

Funded by: NIGMS SEPA

Keywords: Interactive Multimedia for STEM Learning, Big Data/Data Science/Bioinformatics

22. Teaching the Genome Generation: Teacher Professional Development and the Integration of Human Genetics into High Schools
Charles Wray and Sarah Wojiski, The Jackson Laboratory; Dana Waring and Alison Kieffer, Harvard University

Teaching the Genome Generation (TtGG) is a multifaceted teacher professional development program focused on human genetics, ethics and bioinformatics. The primary goal of TtGG is to increase genomic and genetic literacy by training and reinvigorating high school teachers. TtGG uses summer professional development courses to train teachers and during the academic year supplies portable laboratory kits, as well as support to participating schools. Participating teachers from New England and northern California implement the curriculum at a high rate in a variety of biology classrooms. Evaluation data collected over several years indicate that TtGG has increased teachers' abilities to integrate complex concepts of genomics and bioethics into their high school classes.

Funded by: NIGMS SEPA

Keywords: Students – Classroom Science Enrichment, Teacher Professional Development, Big Data/Data Science/Bioinformatics

23. The Science and Ethics of Genome Editing
Tim Herman, and Diane Munzenmaier, Milwaukee School of Engineering

The Science and Ethics of Genome editing is a professional development experience designed to increase both the content knowledge of teachers and to sharpen their pedagogical skills. The content focus of the project will address the integration of basic concepts of genetics with the molecular genetics of today, and the new science of genome engineering that will shape tomorrow. The project will also train teachers in a pedagogy that values questions over answers and encourages students to develop their critical thinking skills. This project represents a partnership between MSOE, the UC Berkeley IGI, the Protein DataBank, and Science Olympiad.

Funded by: NIGMS SEPA

Keywords: Dissemination, Informal Science Education, Students – Out-of-School Programs, Teacher Professional Development, Big Data/Data Science/Bioinformatics

24. STEM Assessment and Reporting Tracker (START)
Lisa Marriott, Oregon Health & Science University

This project adapts an existing research informatics platform to create a robust online evaluation tool that engages students with immediate, tailored e-feedback aimed at supporting their STEM development while rapidly informing STEM programs' efforts. Project activities include working with stakeholders to identify common needs for assessment while defining informatics architecture and schema to support reporting outputs, data security, governance structures, and linkage with other data sources. We will iteratively develop student-generated e- feedback for START modules using project-based learning with secondary students. Finally, we will identify professional development needs to support educators in working with students based on START-identified needs.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Research & Evaluation, Big Data/Data Science/ Bioinformatics

25. Application of IRT to Develop and Refine a Scale to Measure Researcher Identity
Linda Morell, Shruti Bathia, Rebecca Smith, Ben Koo, and Mark Wilson, University of California – Berkeley

Often students choose careers that complement who they perceive themselves to be (identity) and what they are capable of (ability). While "ability" can be measured through cognitive assessments, measuring student identity is a formidable task. Given this, we developed a survey to measure the aspects of "Researcher Identity" (RI) of secondary school students. We analyzed data from the Researcher Identity Scale (RIS) using item response theory. Data were gathered from 863 high school students in the fall of 2018. This poster describes the process to develop the scale; and collect valid, reliable, and fairness evidence for interpretation and use.

Funded by: NIGMS SEPA

Keywords: Informal Science Education, Research & Evaluation, Big Data/Data Science/Bioinformatics

26. Bioinformatic Analyses of Microbial Genomic Data
Stephen Koury, Shannon Carlin, and Rama Dey Rao, University at Buffalo; Kimberle Kelly, Oak Ridge Associated Universities

The Western New York Genetics in Research and Healthcare Partnership is designed to help improve locally what is recognized nationally as a lack of public knowledge about bioinformatics and genomics. This program targets teachers and students from schools in Western New York with the highest rates of underrepresented students. It is designed to serve as a pipeline for the recruitment of 9–12 students into STEM careers, with an emphasis on Genomics and Bioinformatics. A summary of our use of GENI-ACT (geni-act.org) to allow students to use publicly accessible tools to analyze sequences from

microbial genomes will be presented.

Funded by: NIGMS SEPA

Keywords: Informal Science Education, Research Experiences for Students, Sustainability, Teacher Professional Development, Big Data/Data Science/Bioinformatics

27. Medicines and Me: Understanding and Using Medicines Safely
Danielle Alcena-Stiner, Susan Holt, and Dina Markowitz, University of Rochester

The goal of our "Medicines and Me" project is to increase adolescents' understanding of concepts essential for the safe use of medicines and to increase awareness of the drug development and clinical trials processes. We developed and disseminated engaging, hands-on lessons for use by teachers in classrooms and through outreach programs led by University of Rochester scientists at the Life Sciences Learning Center (LSLC). Supplemental funding also led to the development of Big Data and Health Science classroom lessons to engage students in investigating how "big data" is used to study the effectiveness of calcium dietary supplements in preventing osteoporosis.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Informal Science Education, Teacher Professional Development, Big Data/Data Science/Bioinformatics

28. Washington University Science Education Partnership Program
Laura Courtney, Jim Skeath, and Kristine Wylie, Washington University in St. Louis

The NIGMS SEPA program at Washington University in St. Louis (WU-NIGMS SEPA) aims to give under-represented minority students access to state- of-the-art classroom instruction and experiential learning opportunities to increase participation in STEM education and exposure to STEM careers. To achieve these aims, WU-NIGMS SEPA has formed a successful partnership with Jennings Senior High School (JSHS), a largely African-American school in St. Louis County. We have completed our first year of programming with JSHS, which included a summer internship and classroom curriculum with hands-on projects in bioinformatics. As we enter our second year of programming, we will expand our program and enhance our curriculum.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Research Experiences for Students, Big Data/ Data Science/Bioinformatics

Curriculum Development

29. Developing Skills in Health Literacy
Anne Westbrook, BSCS Science Learning

The Developing Skills in Health Literacy project is developing curriculum modules for use in both middle school and high school science or health classes. Through these lessons, students will develop skills that will help them to better evaluate health- or science-related information that they encounter

on the internet or in other media. During the lessons, students will learn how to assess the quality of websites, accuracy of health-related information, persuasion techniques used by marketers, and the potential risks and benefits associated with health products or treatments.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Research & Evaluation

30. Hk Maker Lab: Engineering Design for Secondary Schools

Aaron Kyle and Michael A. Carapezza, Columbia University: Christine Kovich, HypotheKids Inc.,

The Hk Maker Lab is a suite of programs that focus on enhancing STEM learning for high school students. We host a six-week summer workshop that brings students to Columbia to learn and apply engineering design. In coordination with the summer program, we help high school teachers create design-centric curricula that are subsequently implemented in their home schools. Finally, we facilitate internships for the summer program alumni, helping them find research opportunities in engineering and science labs at Columbia. We have successfully trained over 140 students in engineering design with the majority of these students coming from groups underrepresented in STEM. We have facilitated over 30 internships and our design- based curricula are currently being used in four NYC high schools.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Students – Out-of-School Programs, Teacher Professional Development

31. Sharing ASSETs: Expanding Science Opportunities in K-12 Classrooms

Ted Clark, Donna Cassidy-Hanley, and Mary Kay Hickey, Cornell University

ASSET is developing inquiry-based K-12 biology curricula featuring hands-on manipulation of live Tetrahymena thermophila, a safe, easily grown single-cell protozoan. The teacher and student friendly lab modules are designed to increase student understanding of fundamental scientific concepts and the scientific process. In addition, a unique program facilitating independent Tetrahymena based research in the high school classroom, supported by an equipment lending library, is currently being implemented. Grade appropriate cross-curricula activities engaging students in a dynamic consideration of the inter-relatedness of science and society are also being developed.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Research Experiences for Students, Students – Classroom Science Enrichment, Teacher Professional Development

32. Dartmouth Rural STEM Educator Partnership

Roger Sloboda, Vicki May, Michele Tine, Amanda Skinner, Greg DeFrancis, and V. Lynn Foster- Johnson, Dartmouth College

The problems facing middle school STEM teachers are pronounced in low-income rural areas where (i) students perceive STEM has little relevance to their lives; (ii) there is minimal STEM - related infrastructure; and (iii) STEM teachers often teach outside the area in which they were trained, have little support in preparing science units, and lack a network of readily available STEM teachers with

whom to interact. To enhance rural STEM education, we will create an interactive teacher network, collaborate with teachers to develop and implement NGSS aligned, active learning instructional units, and introduce engineering principles to rural STEM education as the foundational component of these units.

Funded by: Pending NIGMS SEPA

Keywords: Curriculum Development, Students – Classroom Science Enrichment, Introduce Engineering to Middle school STEM Education

33. Frontiers in Cancer Research

Jeanne Ting Chowning and Regina Wu, Fred Hutchinson Cancer Research Center

Frontiers in Cancer Research aims to increase public understanding of molecular and cellular biology, explores how these disciplines are used to develop cancer therapies, and considers the ethical implications of cancer research-related topics. We are developing NGSS-aligned curricula and kits which focus on research at Fred Hutch, such as immunotherapy, that promises to fundamentally change cancer treatment. We are also providing teacher professional development and creating opportunities for underrepresented students to visit Fred Hutch and consider future careers. Our approach leverages the scientific resources of a comprehensive cancer research center and the prior work of Fred Hutch's education programs.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Curriculum Testing, Teacher Professional Development

34. Examining Middle School Students' Knowledge, Attitudes, and Behavior Following Participation in the Health in Our Hands Curriculum

Idit Adler, Joseph Krajcik, Renee Bayer, and Consuelo Morales, Michigan State University

Health in Our Hands, a school-community-academic partnership, designed a middle school science curriculum coordinated with community activities focused on diabetes to help students and adults understand gene-environment interactions and risk for disease. For final projects, students conduct community action research to improve their school or neighborhood environment to prevent or reduce diabetes. Students present back results to peers, family members, and community in a health summit event. The curriculum was tested twice district- wide in urban, racially diverse classrooms (N=1500 students). This poster examines the impact of the curriculum on students' knowledge, attitudes, and behavior.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Curriculum Testing, Research Experience for Students

35. Simplifying Science with FAN Cards: Creating and Utilizing Mini Science Lessons to Excite Learner Curiosity

Melani Duffrin, Kelly Furr, and Georgia Mcartney, Northern Illinois University

The FoodMASTER team is developing a set of food and nutrition (FAN) cards that align with the existing curricular materials. The FAN cards provide informal science learning environments with quick and easy to implement science lessons and formal education environments with mini science lessons to introduce the more extensive FM activities. The purpose of this presentation is to provide one example FoodMASTER activity and explain the creative process for developing FAN cards. Educators will be able to use the example activity in most any learning environment and discuss the utility of mini science lessons in exciting learner curiosity.

Funded by: NIGMS SEPA

Keywords: Curriculum Development

36. PAGES (Progressing through the Ages: Global change, Evolution, and Societal well- being): What Have We Done and Where Are We Going Next?

Barabara Hug and Becky Fuller, University of Illinois Urbana Champaign; Tania Jarosewich

In this poster, we present our early curriculum and professional development efforts focused on designing NGSS aligned K-12 curriculum materials. Here, we highlight our work by using a middle school unit, "How Do Eggs Become Chickens or Other Living Things?" as an exemplar. This unit illustrates how we can help students uncover the role of cells in the growth and development of living organisms through pursuing questions and ideas for investigations raised by students, rather than needing to teach students about the related science ideas ahead of time before having them plan and conduct such investigations. Curriculum and professional development efforts across the project will be addressed.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Dissemination, Research & Evaluation, Teacher Professional Development, Next Generation Science Standards

37. Linking Science and Literacy for All Learners

William Folk, Delinda Van Garderen, Amy Lannin, Torrey Palmer, Will Romine, Zack Miller, Eric Queathem, Rachel Juergensen, and Jiyung Hwang, University of Missouri

The LS&L4AL Program is developing innovative multimodal STEM text sets, linked inquiry and teacher professional development. The Program tests the hypothesis that use of multimodal STEM text sets and linked inquiry in supportive classrooms will strengthen diverse learners' interest in STEM careers and achievement of NGSS and CCSS-ELA.RST Practices and Performance Expectations.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Curriculum Testing, Research & Evaluation, Students – Classroom Science Enrichment, Teacher Professional Development, and Literacy

38. The Science of Essential Balance

Ang Chen, University of North Carolina at Greensboro

The Science of Essential Balance (SEB) is a project to develop and field-test a science-enriched high school physical education curriculum to teach nutrition and exercise knowledge about energy-balance in human body. The poster presentation will highlight the project's development in the first year, including formation of the University-schools partnership, work accomplished by the curriculum writing team, and the research design and progress. Details included in the poster presentation are background of the project, purpose, proposed curriculum and science standards it addresses, design of the instructional system, and research methods to evaluate the efficacy of the SEB curriculum.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Research & Evaluation, Teacher Professional Development

39. Genes and Microbes: Engaging Students and Teachers in NGSS-Aligned Curricula and Professional Development

Louisa Stark, Kevin Pompei, and Dina Drits-Esser, University of Utah; Kristin Bass, Rockman et al

This project is developing two NGSS-aligned curriculum units; genetics for high school, and cell biology for middle school. The high school unit engages students in an in-depth study of genetic disorders to learn fundamental molecular genetics concepts and how human traits are shaped. The middle school unit will explore the structure and function of microbes and their impact on our health. Both units will employ engaging phenomena, guiding questions, and 3D learning. The efficacy of the units for student learning will be studied through an RCT. Online courses and in-person workshops will support teachers in implementing the units with students. Results from the pilot test of the high school unit, which is gathering classroom feedback for refinement, will be reported.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Students – Classroom Science Enrichment, Teacher Professional Development

40. It takes an Interdisciplinary Village: Type 2 Diabetes Education in Health and Biology

Joan Griswold, Helene Starks, Maureen Munn, and Atom Lesiak, University of Washington

This poster highlights Year 2 of our project by showing how the increase in type 2 diabetes diagnoses over the last 20 years is a phenomenon that can be used to anchor concepts taught in health and biology classes through a unified set of enduring understandings. The poster illustrates our study design that asks questions about learning gains and shifts in behavior and self-efficacy for students who receive the curricular intervention in one, two, or more classes over time. Successes and challenges in recruiting teachers for the study and for PD are indicated, as are plans for additional curriculum development.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Research & Evaluation, Teacher Professional Development

41. Life Science Disciplinary Literacy for Students in Grades K–2

Nancy Moreno and Alana Newell, Baylor College of Medicine; Misty Sailors, Sarah Aguirre, and Janine Garcia, University of Texas, San Antonio; Dolores Garay, Martha Young, Travis Kelleher, and Gregory Vogt, Baylor College of Medicine

Scientists and educators at Baylor College of Medicine are developing and disseminating new teaching resources for grades K–3 focused on life science themes and disciplinary literacy skills. A randomized field test with more than 900 second grade students concluded in March 2019.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Testing, Early STEM Learning (PK-3)

42. More PEAS Please! Bridging the Gap Between Preschool and K-12 Science Learning Environments

Virginia Stage and Archana Hegda, East Carolina University; L. Suzanne Goodell, North Carolina State University; Lucia Mendez, University of North Carolina at Greensboro; Valerie McMillan, North Carolina A&T State University

The poster will present aims for the Preschool Education in Applied Sciences (PEAS) project. PEAS will develop, evaluate, and disseminate an innovative multi-component professional development program that will focus on building a stronger preschool STEM educator workforce. Strengthening the preschool educator workforce will build teachers' science teaching knowledge, science teaching interest, and science teaching efficacy; improve the quality of early STEM experiences for underrepresented minority children; improve children's science knowledge and development of language within the context of healthy living; and ultimately feed the STEM pipeline with individuals prepared for careers in the health sciences. Over the course of the program, we will impact over 350 teachers and 3,400 children with hands-on, inquiry-based science learning, with thousands of additional children reached through teachers who continue implementing the PEAS approach in subsequent years.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Early STEM Learning (PK-3), Research & Evaluation, Students – Classroom Science Enrichment, Teacher Professional Development

43. Interactive Family Learning in Support of Early Brain Development

Victoria Coats, Cecilia Nguyen, Joe Bartley, Jaclyn Barber, Annie Douglass, Veronika Nunez, and Carla Herran, Oregon Museum of Science and Industry

OMSI is creating a bilingual (Spanish/English) traveling exhibition and educational programs about healthy brain development in young children up to age 5. The target audience is adult caregivers of young children and their families. During Year 2, the project team is testing strategies for communicating with adult caregivers about brain development and designing activities that encourage adult/child interaction and active play. OMSI is prototyping and evaluating exhibits and activities with museum visitors and community partners.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Early STEM Learning (PK-3), Informal Science Education, Programs for Families & the Public, Research & Evaluation

44. This Is How We "Role" TM: Inspiring Future Researchers through Veterinary Medicine
Sandra San Miguel, Loran Carleton Parker, Lindley McDavid, Wilella Burgess, Adrianne Disch, and Grace Craig, Purdue University

The program goal is to diversify the veterinarian-scientist workforce by providing STEM experiences and role models for educationally disadvantaged K-4 students. The program consists of a scalable, veterinary medicine-centered math and science curriculum; training for veterinary student role models to deliver the program; and tools for assessing impact. Books and an online certificate program promote health science literacy and encourage careers in the veterinary profession. In 2018, the program expanded to 17 additional Colleges of Veterinary Medicine. The intent is nationwide distribution to all 30 U.S. colleges of veterinary medicine.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Curriculum Testing, Early STEM Learning (PK-3), Sustainability

45. Virtual Vet: Creating, Implementing, and Assessing a Serious Educational Game for Learning in Elementary Classrooms
Georgia Hodges, Kayla Flanagan, Alex Turbyfield, Cynthia Ward, and Al Cohen, University of Georgia

Virtual Vet is a serious educational game created to engage elementary learners with conceptual understanding of the human body and health literacies, specifically diabetes and obesity. Findings from two studies with over 500 students will be shared.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Early STEM Learning (PK-3), Research & Evaluation, Students – Classroom Science Enrichment Informal Science Education

46. Discover SCIENCE with Dr. Bear
Naomi Luban, Rachel Smillow, Julia Miller, Heather Stemas, and Sandy Dietrich, Children's National Medical Center

"Discover SCIENCE (a Scientific Creative Innovative Engaging New Cool Experience) with Dr. Bear" ("SCIENCE") incorporates lessons learned from our previously funded NIGMS SEPA, based in 5 Title I elementary schools in the District of Columbia and Prince George's County Maryland. "SCIENCE" engages a new audience of learners in their out of school time in the setting of community libraries. We provide programming that uses hands-on, inquiry-based learning opportunities based on an art and science curriculum designed to improve the physical, cognitive and social development of children and their families. "SCIENCE" adds new instructional units and 'hands on/ brains on' activities, combining STEM with a focus on health issues of concern to our community including asthma, stress, cardiometabolic risk, sleep, behavioral issues including bullying, genetic diseases like sickle cell disease, and injury prevention at home, in school and associated with sports. We provide professional development training for librarians, informal educators and peer mentors.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Dissemination, Early STEM Learning (PK-3), Informal Science Education, Programs for Families & The Public, Students – Out-of- School Programs

47. WE Engage for Health

Melinda Butsch Kovacic, Cincinnati Children's Hospital Medical Center; Susan Hershberger, Miami University

WE ENGAGE: Data and Stories to Improve Science Literacy and Community Health, is an informal citizen science program designed in partnership with and for middle schoolers to adults living in under-resourced minority communities. Using the power of data collection and storytelling, its purpose is to engage citizens in health science/science research education and training to encourage a diverse future workforce and to sustainably build capacity to ask and answer health and environmental questions relevant to their communities. By engaging citizens and giving them a more equitable stake in the research process, they are better able to discover their own solutions.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Citizen Science, Informal Science Education, Interactive Multimedia for STEM Learning, Programs for Families and the Public

48. Using Digital Comics to Engage Children in Science Skills

Martin Weiss, Wren Thompson, and Laycca Umer, New York Hall of Science

NYSCI's Transmissions: Gone Viral poster defines how digital comic books can engage children in inquiry skills important in science, describes how an interactive digital comic book can increase students' understanding of zoonotic disease patterns and why we are susceptible to diseases from animals that do not look like us. In addition, it describes how we conducted a research program to assess the effectiveness of a digital comic book on developing inquiry skills in science.

Funded by: SEPA

Keywords: Informal Science Education, Interactive Multimedia for STEM Learning, Research & Evaluation

49. More Than A Taste of Community Science

Nicole Garneau, Tiffany Nuessle, Esmarie Swisher, and Anjelica Miranda, Denver Museum of Nature & Science; Joseph Polman, University of Colorado – Boulder, Patty McNamara, Independent Evaluator

Over the last three years, the Genetics of Taste Lab has increased the opportunities for community scientists to participate in all aspects of the scientific process, opened the door for participation to communities underrepresented in STEM, and used learning research and evaluation to study how these changes impact the integrity of the data being collected, the community, and the community scientists. Here we share results from the increased participation, as well as lessons learned for those in other informal science institutions who conduct or are considering implementing community-based scientific research.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Citizen Science, Informal Science Education, Research & Evaluation

50. Partnership in Neuroscience Education: Lessons Learned and a Look to the Future
John A. Pollock and Brinley Kantorski, Duquesne University

The Neuroscience Partnership in Education was first funded in 2014 and over the past 5 years has produced a multitude of multimedia projects focused on improving STEM and health literacy for students and the public. We have successfully produced animated movies, television programs, mobile applications, all with accompanying curriculum pieces. Utilizing evidence-based design principles and robust educational theory, we have shown that our products are both engaging and effective at improving health literacy. The future of the project involves a focus developing multimedia pieces that can help students to manage stress, anxiety, and pain in positive ways.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Informal Science Education, Interactive Multimedia for STEM Learning

51. Promoting Genetics Literacy in a Culturally Relevant Setting
Michelle Ezeoke, Edroyal Womack III, and Gretchen Gose, Georgia State University

To create a scientifically literate society, diverse populations must be given the opportunity to master the fundamentals of DNA and genetics. We have addressed this need by creating engaging and informative DNA learning modules that can be adapted to multiple age groups and backgrounds. We started initially by targeting students at the K-5 level, and subsequently expanded our participant base to K-12. More recently, we have formed partnerships with informal science venues such as libraries and community centers that serve Georgia's large immigrant populations. We are currently designing new modules that are culturally relevant for new immigrants and their families.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Early STEM Learning (PK-3), Informal Science Education, Programs for Families & the Public, Students – Out-of-School Programs, Teacher Professional Development

52. The Mosquitoes & Me Summer Camp
Katherine Richardson Bruna, Sara Erickson, and Stephanie Schneider, Iowa State University, Lyric Bartholomay, University of Wisconsin at Madison

The poster will provide an overview of the Mosquitoes & Me Summer Camp Curriculum, as well as its foundational frameworks and relationship-building rituals. Three-year evaluation data will also be summarized.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Informal Science Education, Teacher Professional Development

53. Biohealth Learning Lab and Makerspace for the Community

Abbey Thompson, Stanford University Department of Genetics, Caitlin Nealon, James Wong, and Anja Scholze, The Tech Museum of Innovation; Michael Cherry, Stanford University Department of Genetics; Jeff Hayward, People, Places & Design Research

The Tech and Stanford University Department of Genetics have partnered to create a experimental museum space for engaging the public in the life sciences - a community bio- makerspace and learning lab with a repertoire of custom hands-on experiences at the intersection of biology, design, technology and making. We are developing open ended bio- tinkering activities and more scaffolded ones that aim to empower everyone to use biological systems as creative, problem solving mediums. We will share our progress with the first 4 activities - Bio Inks, CRISPR, Making with Microbes, and Ancient DNA - as well as results from our first summative evaluation.

Funded by: NIGMS SEPA

Keywords: Informal Science Education

54. Cerebro Edu: Exploring Neuroscience, Celebrating Latinx Families!

Rita Karl, Twin Cities PBS

CEREBROedu is Twin Cities PBS' project that empowers Latinx middle school learners, their families and educators around neuroscience learning and career pathways. This bilingual (Spanish/English) initiative employs a culturally responsive mix of professional development, media and activities, helping informal educators implement programming that:

- Illuminates current research around structure and function of the healthy and unhealthy brain;
- Explores technologies that provide a dynamic understanding of brain function and brain disorders, such as Alzheimer's, depression and epilepsy; and
- Helps eliminate stigma around brain disorders and mental health issues, and offers culturally responsive help, hope and resources to Latinx communities nationwide.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Dissemination, Informal Science, Education, Interactive Multimedia for STEM, Learning, Programs for Families & the Public, Research & Evaluation, Students – Out-of-School Programs, Teacher Professional Development

55. STEM Escape: Immersing Urban and Rural Families in a Biomedical Mystery

Anastasia Thanukos and Lisa Witte, University of Museum of Paleontology; Teresa MacDonald, University of Kansas

Escape rooms are a game format in which a team of players is "locked" in a room and challenged to solve a series of narrative-embedded puzzles encoded in the room's artifacts in order to "escape." The University of California Museum of Paleontology, University of Kansas Natural History Museum, and California Academy of Science are developing an escape room that engages diverse families in solving a biomedical mystery, while teaching fundamental concepts in biology, engaging critical-thinking and collaboration skills, and stimulating interest in biomedical careers. The pop-up room will travel to natural history museums, science centers, and libraries across country.

Funded by: NIGMS SEPA

Keywords: Informal Science Education, Programs for Families & the Public

56. Accelerating Access: Health Science Education in Native American Communities
Kim Soper, Liliana Broner, Shrawan Kumar, Jenenne Geske, and Maurice Godfrey, University of Nebraska Medical Center

The long-term goal of our SEPA program is to increase the numbers of Native Americans who will pursue careers in science and health care. Our focus is teachers and students in K-12 schools on six Indian reservations in Nebraska and South Dakota. What we hope to measure in the near term is an increased appreciation for science and health and the introduction of the myriad of career paths in these areas. We hope to be a model for success in these American Indian populations as judged by the careful and comprehensive evaluations of teachers, their students, and summer program participants.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Informal Science Education, Students – Classroom Science Enrichment, Students – Out-of-School Programs, Teacher Professional Development

57. Worlds of Connections: Engaging Youth with Health Research through Network Science
Julia McQuillan, University of Nebraska – Lincoln; Christine Cutucashe, Patricia Wonch Hill, Amy Spiegel, Bilal Khan, Kirk Dombrowski, and Michele Phillips, University of Nebraska – Omaha; Colleen Syron and Emily Tran, Philips and Associates

The lack of public understanding about the role of network science in the basic biological and social health sciences limits career options and support for underrepresented groups whose diverse viewpoints will help solve the next generation of health problems. The Worlds of Connections project will combine network science, social science, learning research, biology, computer science, mathematics, emerging media arts, and informal science learning expertise to create activities for middle school aged youth. Broad dissemination of the curriculum and project impacts will employ virtual reality technologies to bring new and younger publics into health-related STEM careers.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Dissemination, Informal Science Education, Research & Evaluation, Students – Out-of-School Programs, Teacher Professional Development, Big Data/Data Science/Bioinformatics

58. Community of Bilingual English-Spanish Speakers: The Inaugural Cohort
Jenica Finnegan, Jacque Ewing and Bill Thornton, University of Nevada – Reno

This poster summarizes recruitment efforts, applicant demographics, selection processes, and the next steps for the CBESS program.

Funded by: NIGMS SEPA

Keywords: Informal Science Education, Programs for Families & the Public

59. Hopa Mountain's Health Scholars of Promise
Bonnie Sachatello-Sawyer, Hopa Mountain

Hopa Mountain is piloting a new college preparation program entitled Health Scholars of Promise. This initiative is designed to encourage rural and tribal teens to explore health degrees and career options while preparing for higher education opportunities.

Funded by: NIGMS SEPA

Keywords: Informal Science Education, Broadening Participation, Diversity & Equity, Students – Out-of-School Programs

60. The MENTORS (Model Education Networks To Optimize Rural Science) Project
Madison Spier, Robin Fuchs-Young, Oluwatosin Bewaii, Timothy Lightfoot, and Carolyn Cannon, Texas A&M Health Science Center

The MENTORS (Model Education Network To Optimize Rural Science) Project aims to stimulate interest in and enhance preparation for STEM and health careers particularly in underserved and underrepresented communities along the South Texas border (Hidalgo, Co.). This is achieved through school-based and field experiences focusing on career exploration and scientific inquiry for high school students from a variety of backgrounds; collaboration between biomedical, public health, engineering and educational researchers and classroom teachers on the development of new, evidence-based, student-centered materials and instruction; and rigorous professional development for K-12 educators. Our programs for teachers consist of the Summer Educator Fellowship and K-12 Summer Institute. And, our programs for students consist of Field Experiences, Lab Rats, and SHARE (School-based Health Awareness and Regional Education).

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Dissemination, Research Experiences for Students, Research Experiences for Teachers, Students –Out-of-School Programs, Teacher Professional Development

61. One-health App Brings STEM Learning to Rural Students' Fingertips
Larry Johnson, Christine Budke, William Klemn, Julie Harlin, Nicola Ritter, and Hank Walker, and Torri Whitaker, Texas A&M University College of Veterinary Medicine. Department of Veterinary Integrative Biosciences

The goal is to provide rural middle school teachers with instructional strategies and resources for teaching science in the context of One Health (human, animal, and environmental health). The app under development will facilitate student-centered classrooms. Objectives are to provide learning materials to teachers and students in rural areas to increase their knowledge of STEM based activities and jobs and rural outreach including allowing veterinary students to communication their interest and knowledge of veterinary medicine in rural schools, zoos, animal shelters, and youth groups, as they become lifelong advocates of youth learning. "PEER by Numbers" illustrates the scope of PEER.

Funded by: NIGMS SEPA

Keywords: Rural STEM, Broadening Participation, Curriculum Development, Dissemination, Interactive Multimedia for STEM Learning

62. PiPES: Possibilities in Postsecondary Education and Science
Melinda Gibbons and Erin Hardin, University of Tennessee – Knoxville

PiPES is now entering year 5 of its services in providing postsecondary and STEMM programming to rural Appalachian high school students. Major program activities include a multi-week curriculum for all 10th graders, an optional summer camp, an optional leadership program, and other support programming. In this poster, we highlight our program and evaluation results and summarize the publications that have resulted from this project.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Dissemination, Research & Evaluation, Students – Out-of-School Programs, Teacher Professional Development

63. A Brief Educational Intervention Enhances Cancer Literacy in Appalachian Kentucky High School Students
Nathan Vanderford, Kerrigan M. Samons, L. Todd Weiss, and B. Mark Evers, University of Kentucky

Appalachian Kentucky residents experience extreme disparities including high poverty rates, low education attainment, and high rates of cancer incidence and mortality. The Appalachian Career Training In ONcology (ACTION) Program at the University of Kentucky Markey Cancer Center, an NCI Youth Enjoy Science R25-funded program, conducted a brief cancer educational intervention in two Appalachian Kentucky high schools. Following the intervention, there was a significant improvement in scores on 10-item knowledge measure ($N = 166$; pre- intervention mean: 53%, SD: 0.15; post-intervention mean: 83%, SD: 0.12; $p < 0.0001$). These data suggest that brief cancer education interventions can enhance students' cancer literacy.

Funded by: NCI YES

Keywords: Informal Science Education, Research & Evaluation

64. Health Education through Arts-based Learning (HEAL): A Partnership to Investigate Interdisciplinary Science Programs in Rural Communities
Molly Kelton, Elizabeth Grace, Jeb Owen, Robert Danielson, Patricia Butterfield, Alson White, and AnaMaria Martinez, Washington State University

This poster will share early curriculum materials, research findings, and approaches from the NIGMS SEPA-funded HEAL (Health Education through Arts-based Learning) project. The poster content will focus on two arts-based rural afterschool pilot programs related to ecological dynamics of mosquito-borne illness and relationships between human and microbial scales in the context of issues of health and wellness. Design features of the two programs will be shared along with the development of novel outcomes measures related to biomedical science interest and systems thinking.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Informal Science Education, Students – Out-of-School Programs

Student Science Enrichment

65. CityLab and Urban Squash: A New Pathway to Achieve STEM Success
Carl Franzblau, Donald DeRosa, Obi Onochie, and Carla Romney, Boston University

Now in its third year, this project integrates applications of science and technology into students' athletic experiences to inspire young people to engage in science. The project works with pre-college student squash players and provides follow-on opportunities for interested students to participate in extended science experiences. The overarching goal of this project is to test a new paradigm for NIGMS SEPA that leverages a unique partnership model to increase the number of underrepresented minority and economically-disadvantaged students who plan to pursue additional study of the biomedical sciences.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Informal Science Education, Students – Out-of-School Programs

66. Hexacago: Play to Learn
Mason Arrington, Melissa Gilliam, Ellen McCammon, and Allea Sitites, Center for Interdisciplinary Inquiry and Innovation

We use our last NIGMS SEPA project, Hexacago Health Acadamy, as a framework to discuss how games can be used to encourage STEM interest in underrepresented minorities. This poster presents our participatory design process, which integrates learning objectives, curriculum development, and game design principles, using our HHA games as the primary example. By harnessing students' enthusiasm for play, we model complex systems and STEM topics in a way that is accessible and engaging for youth.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Citizen Science, Curriculum Development, Curriculum Testing, Dissemination, Informal Science Education, Interactive Multimedia for STEM Learning, Research & Evaluation, Students – Classroom Science Enrichment, Students – Out-of-School Programs

67. Mobile Lab Experiences and TRIPs (Teacher-Research Institute Partnerships) to Inspire Middle School Students
Amanda L. Jones, Seattle Children's Research Institute

This project brings together teachers, scientists and engineers to create two novel NGSS- designed curriculum modules and a one-day science conference for students in grade eight. Four of the five lessons will be taught in the classroom by teachers; the fifth will take place onboard Seattle Children's mobile science lab. The project utilizes a well-matched comparison group study design

and will assess the short-term impact of students completing the lessons and attending the conference in grade eight, and the medium-term impact in grades nine and ten. The curriculum will be broadly disseminated to the national and international mobile lab community.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Students – Classroom Science Enrichment

68. Using interactive digital media to make learning organic chemistry more accessible, engaging, and effective.

William Schneller, Substrate Games, Iowa State University; Eve Syrkin Wurtele, Ross Bohner, Amy Dixon, George Kraus, Arthur Winter, and Amy Andreotti, Iowa State University; Sam Von Gillern, Jui-Teng Li, James Pennington, and Lei Fang, Texas A&M University

This poster will provide an overview of the creation of the prototype for an interactive organic chemistry learning app and highlight early research into usability and effectiveness. Further, we will outline our next steps for research and development, including the creation of new content, instructor-centered tools for classroom integration, and a longitudinal efficacy evaluation at Texas A&M University.

Funded by: NIGMS SEPA

Keywords: Interactive Multimedia for STEM Learning, Research & Evaluation

69. ArkanSONO: Student and Teacher Evaluation of an Ultrasound Technology Classroom Outreach Experience

Kevin D. Phelan, University of Arkansas for Medical Sciences; Karen L. Yanowitz, Arkansas State University; Mohsin Syed, Noor Akhter, Gregory R. Snead, and Billy R. Thomas, University of Arkansas for Medical Sciences

ArkanSONO is a partnership with the Little Rock School District to provide an ultrasound- focused technology outreach exposure program for 9th grade students. Our first outreach session involved visits to 50 NIGMS SEPArate classrooms in 3 high schools and involved ~880 students. Students used hand-held devices to image blood vessels, muscles, tendons and nerves and then used what they learned in a group application exercise. Student evaluation was overwhelmingly positive even in those who did not consider themselves a science type of person. Teachers indicated that student engagement was high, created a positive attitude for STEM and an interest in college.

Funded by: NIGMS SEPA

Keywords: Students – Classroom Science Enrichment, Teacher Professional Development

70. Health Quest: Engaging Adolescents in Health Careers with Technology-rich Personalized Learning

James Lester, North Carolina State University; Elizabeth Ozer, University of California – San Francisco

The goal of this project is to create Health Quest, an immersive career adventure game that

deeply engages adolescents' interest in health science careers. Health Quest will leverage significant advances in personalized learning technologies to create online interactions that enable adolescents to virtually explore health research careers in action. The project will investigate the impact of Health Quest on adolescents' knowledge of, interest in, and self- efficacy to pursue health science careers and examine the effect of Health Quest on diverse adolescents by gender and racial/ethnicity.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Interactive Multimedia for STEM Learning, Students – Classroom Science Enrichment, Students – Out-of-School Program

71. Environmental Health Investigators: Building STEM Interest to Promote Careers in the Health Sciences

Sharon Locke, Ben Greenfield, Georgia Bracey, and Jennifer Zunercher, University of Edwardsville

We will develop, implement, and evaluate an out-of-school time program in which racial minority youth in grades 6 and 7 carry out community environmental assessments that integrate technology-enhanced personal exposure monitoring. Youth will co-create authentic science projects with guidance from scientists, community members, and teachers, focusing on environmental issues relevant to their health and the health of their community. The project's educational design draws on research-based practices in urban education, place-based learning, community-based participatory research, and project-based learning, combining salient aspects of each to build and support science interest development among minority youth.

Funded by: Pending NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Research Experiences for Students, Students – Out-of-School Program

72. Hawaii Science Career Inspiration (HiSCI)

Kelley Withy, University of Hawaii

Hawaii Science Career Inspiration (HiSCI) has created a group of 1,200 local students interested in science careers who participate in regular seminars, trainings, mentoring, shadowing, research and other experiences to prepare them for careers in science.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Students – Out-of-School Programs

73. UMB CURE Connections: An Integral Link in a Baltimore Minority STEM Education Pipeline

Bret Hassel, S. Alphee, S. Wright, M. Twomey, M. Hetrick, M. Bahr, D. Gioia-Hasick, B. Sturdivant, T. Bailey, E. Stines, E. Blatter, S. Harrison, A. Essien, J. Palinski, T. McKenna, G.B. Carey, R. Saunders, K.J. Cullen, J. Perman, C. D'Adamo, and E. Parker, University of Maryland

The University of Maryland Baltimore Continuing Umbrella of Research Experiences (UMB CURE) Scholars program provides STEM enrichment for middle school (MS) students from severely disadvantaged West Baltimore communities. A holistic approach leverages the resources of UMB

professional schools to integrate robust mentoring, family support, STEM curricula and community outreach components. To foster the scholars' continued engagement in science through high school (HS) and college, UMB CURE Connections (C2) was developed to provide HS curricula that connects MS with college programs in a minority STEM education pipeline. C2 goals, components, outcomes and lessons learned in six months of implementation are presented.

Funded By: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Research Experiences for Students, Students – Out-of-School Programs, Sustainability

74. **Ignite-Engage-Sustain: A Comprehensive Approach to Motivate, Involve, Educate, and Mentor Native American Students and Their Communities in Cancer Prevention, Treatment, and Research**
Kim Soper, Regina Robbins, Liliana Bronner, Misty Pocwierz-Gaines, Shrawan Kumar, Aislinn Rookwood, Robert Pawloski, Maurice Godfrey, and Joyce Solheim, University of Nebraska Medical Center

Improving science instruction in classrooms serving Native American students is key to this project. We will develop and adapt hands-on, age-appropriate lessons and by engagement with technology, Indigenous research methods, and Native science. Student engagement will be enhanced through summer experiences from science camps for middle school to longer enriching programs for high school students. Select high school and undergraduate students will participate in long term research projects with the support of mentors. Programs reaching beyond the classroom will be designed to give parents and elders the sense of excitement and an understanding of what students feel when doing science.

Funded by: NCI YES

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Informal Science Education, Programs for Families & the Public, Research Experiences for Students, Students – Classroom Science Enrichment, Teacher Professional Development

75. **PBS NewsHour Health Literacy: Informing the Public and Training NextGen Communicators**
Patti Parson and Leah Clapman, WETA/PBS Newshour; Jena Barchas-Lichtenstein, Rebecca Norlander, and John Fracer, NewKnowledge

NIH NIGMS SEPA funding supported PBS NewsHour's experiment to increase public health literacy related to the opioid epidemic. The transmedia story included 14 broadcast segments, 4 livestreams, 10 written articles, 3 interactive Twitter chats and over 200 supportive media assets on a half-dozen platforms. The project revealed a new strategy for public literacy advancement through journalism. In parallel, the project also demonstrated the effectiveness of engaging high school youth in developing literacy through these media tools and targeted training in journalism as a tool for self-directed health inquiry and literacy advancement.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Informal Science Education, Interactive Multimedia for STEM Learning, Programs for Families & the Public, Research & Evaluation, Students – Classroom Science Enrichment, Teacher Professional

76. Natural Disasters & Health

Charles Wood, Jackie Shia, Manetta Calinger, Lori Kudlak, and Debbie Tyrrell, Wheeling Jesuit University

Natural Disasters have been prominent news for many days over the last few years: floods, wildfires, blizzards, volcanic eruptions, hurricanes, and heat waves; 500-year events now occur regularly. Each of these disasters causes immediate and delayed health crises. Drownings, burns, snake bites, hypothermia, broken bones, infectious diseases. Natural Disasters & Health will immerse upper middle school kids into the medical response of a simulated disaster, starting with triages. Then students will apply knowledge of body systems and diseases to deduce the best treatments and recovery strategies, and how to minimize health consequences from future disasters.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Dissemination, Interactive Multimedia for STEM Learning, Research & Evaluation, Students – Classroom Science Enrichment, Sustainability, Teacher Professional Development.

Teacher Professional Development

77. Learning About Professional Learning for NGSS

Hilleary Osheroff, Kristina Yu, Julie Yu, and Tammy Cook-Endres, Exploratorium

From the publication of the Next Generation Science Standards in 2013 to the present, the interpretation of the standards by the education community of teachers, researchers, curriculum creators and professional learning providers continues to evolve. This evolution is informed by a growing depth of familiarity with this new style of learning, on-the-ground experiences in classrooms around the country, and the early implementation of instructional materials and assessments. Throughout the course of an Exploratorium-led project to collaborate with teachers and scientists to create NGSS-aligned classroom resources, our approach has grown from the creation of stand-alone resources to the development of tools and resources for teachers to plan towards phenomena-based, practice- rich instruction in their classrooms.

Funded by: NIGMS SEPA

Keywords: Teacher Professional Development

78. ARC: Building Awareness, Respect, and Confidence through Genetics

Marnie Gelbart and Ting Wu, Harvard Medical School; Elizabeth McMillan, Sanford Research

Building Awareness, Respect and Confidence through Genetics (ARC) is a partnership between the Personal Genetics Education Project (pgEd.org), genetics institutions, and teachers to bring the latest developments in genetics into classrooms and communities across the nation. ARC is part of a broader initiative to engage high school students and communities in conversations about the benefits and implications of advances in personal genetics. Here, we present our progress creating a transdisciplinary curricular unit on genetics and identity, as well as findings from our professional development workshops in Massachusetts and South Dakota.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Teacher Professional Development

79. Science Tools in the Classroom: Outcomes of our Teacher Professional Development Workshop
Michele Shuster, New Mexico State University; Krista Glazewski, Indiana University, Christopher Villa, Helix Solutions; Joann Mudge, National Center for Genome Resources; and Susan Brown, New Mexico State University

In an effort to address K-8 teacher confidence to STEM and to increase basic genetics knowledge to a level consistent with its pervasiveness in society, we have developed, implemented and assessed a 7-day teacher professional development workshop. The overarching goal of our workshop is to facilitate the use of innovative DNA inquiry activities in K-8 classrooms by (i) increasing teacher content knowledge, (ii) increasing teacher confidence in teaching STEM and (iii) getting teachers excited to use innovative activities- so they can motivate and excite students. Here we describe assessment and outcomes of the first five years of the workshop.

Funded by: NIGMS SEPA

Keywords: Teacher Professional Development, Big Data/Data Science/Bioinformatics

80. Science Club Summer Camp – Teachers and Students Learning Together
Emily Mathews, Patty Whitehouse, and Michael Kennedy Northwestern University

Science Club Summer Camp (SC2) is an innovative, practicum-based teacher professional development model for Chicago Public Schools (CPS) 3rd grade teachers. It addresses barriers to teachers' adoption of NGSS pedagogical strategies by grounding training in authentic teaching and learning experiences. In addition to deep connections with science professionals, SC2 includes a two-week summer teaching practicum at a community-based science camp.

The practicum is supported by NGSS experts, who provide real-time coaching. In this way, teachers learn and practice NGSS pedagogy in a safe, supportive environment while dozens of third grade students receive important high-quality summer learning.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Early STEM Learning (PK-3), Informal Science Education, Research & Evaluation, Students – Out-of-School Programs, Teacher Professional Development

81. Modeling for Fidelity: Mentored Dissemination of a Novel Curriculum about Infectious Diseases
Berri Jacque, Karina Meiri, Stephanie Tammen, Revati Masilamani, Carol Bascom-Slack, Elizabeth Genné-Bacon, EmilyKate McDonough, Leslie Schneider, and Jessica Wilks, Tufts Medical School

This study evaluates the impact of an innovative approach to teacher professional development designed to promote implementation of a novel high school curriculum on infectious diseases, part of the Great Diseases project. 'Modeling for Fidelity' (MFF) is based on an ongoing mentor relationship between teachers and biomedical scientists carried out in a virtual format in

conjunction with extensive online educative materials. Data demonstrates this approach is an effective method of developing extended interactions between biomedical scientists and teachers that are scalable and geographically un-constrained, facilitating implementation that increases student knowledge, engagement in science and health literacy.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Research & Evaluation, Students – Classroom Science Enrichment, Teacher Professional Development

82. The Great Diseases: Bringing Biomedical Science to High Schools
Berri Jacque, Karina Meiri, Carol Bascom-Slack, Stephanie Tammen, Revati Masilamani, Elizabeth Genné-Bacon, and EmilyKate McDonough, Tufts Medical School

US adults lack key competencies in STEM-related problem solving, hence jobs in life sciences and health go unfilled. This project aims to promote the analytical skills required for workforce preparation and health care management by expanding teacher preparation in the context of our 'Great Diseases' high school curriculum. Most teachers lack scientific knowledge underlying health and disease, so we are developing graduate-level courses for pre-service and in-service teachers that contextualize health content to classroom practice and use online mini-courses and virtual interactions between teachers and mentors to increase access to teachers in challenging urban or rural areas.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Dissemination, Research & Evaluation, Students – Classroom Science Enrichment, Sustainability, Teacher Professional Development.

83. Engaging Urban High School Students in Health Science - An Exploration of Teachers' Perceptions of Using Health Disparities Content in Diverse Communities
Megha Ramaswamy, Crystal Y. Lumpkins, Maria Alonso Luaces, Karin Chang, and Paula Cupertino, University of Kansas Medical Center

Our objective was to report on teachers' perceptions of using health disparities content to engage high school students in urban communities over the course of a summer health disparities professional development (PD) program. Teachers participated in a three- week, 80- hour summer PD, where they received content on health disparities, met with health disparities researchers, and developed project-based health disparities units. To understand teachers' perceptions of using health disparities content in the classroom, we used thematic coding to analyze data from focus groups collected before and after summer PD for three cohorts of high school teachers in two urban school districts (2016-2018, N=22 teachers). Teachers showed awareness of students' social contexts prior to the PD, and post-PD definitions of health disparities included emphasis on activism. Teachers perceived the health disparities content would empower students, and post-PD they had plans for how to incorporate community engagement and activism in teaching. Barriers included concerns about engaging with the right partners and needed resources to support these partnerships. Findings suggest that teachers are prepared to integrate information about

community context in their classes and could be furthered empowered to teach about health disparities with the right community connections and engagement infrastructure.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Citizen Science, Curriculum Development, Research Experiences for Students, Research Experiences for Teachers, Students – Classroom Science Enrichment, Sustainability, Teacher Professional Development

84. Exploring Emerging Pathogens Content and Careers in Precollege Classrooms
Erin Mack, Julie R. Bokor, and Mary Jo Koroly, University of Florida

CATALySES, focused on Emerging Pathogens, is developed and implemented by the University of Florida Center for Precollegiate Education and Training (CPET) in collaboration with the Health Science Center and the Emerging Pathogens and Clinical and Translational Science Institutes. The objectives include enriching teachers' content and biotechnology knowledge and skills, creating innovative research and standards-aligned curricula, encouraging classroom Action Research, and incentivizing teacher advancement/partnerships via access to ongoing resources, presentation and publication of action research results, and laboratory- based internships to develop and deliver collaborative curricula.

CATALySES teachers are well prepared to help students explore the continuum of paths to the science and health-related workforce.

Funded by: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Curriculum Testing, Dissemination, Research & Evaluation, Research Experiences for Teachers, Teacher Professional Development

85. Teachers and Students for Community Oriented Research and Education
Karin Chang, Maria Alonso Luaces, Megha Ramaswamy, and Maggie Cearley, University of Kansas; Paula Cupertino, Hackensack University Medical Center

Career Technical Education (CTE) has emerged as a promising platform to improve educational preparation for students underrepresented in the sciences. However, funding inequalities, lack of teacher preparation, and inadequate industry connections have limited its potential. This paper describes Teachers and Students for Community Oriented Research and Education (TSCORE), a NIGMS SEPA program that focuses on CTE health science teachers and provides pedagogical tools, knowledge, and industry connections to teachers. In TSCORE, teachers receive 85 hours of professional development and curriculum development. Pedagogical support is provided during the year as teachers implement their newly created curricular units.

Funded By: NIGMS SEPA

Keywords: Broadening Participation, Diversity & Equity, Curriculum Development, Teacher Professional Development

86. Turning K-12 Environmental STEM Education InSciEd Out

Seth Thompson, University of Minnesota

There is a strong need to develop quality students who receive undergraduate degrees in science, technology, engineering, and mathematics (STEM). Current methods, however, continue to be non-inclusive of students of color and those marginalized by socioeconomic status. Environmental issues are some of the highest priority global concerns, including climate change, food security, and water shortages, and adequately addressing these issues will require people with a high level of skill across STEM. We here propose the use of education as an intervention into student health, their environment and community, an idea we call "Prescription Education" (PE). We aim to integrate the concept of "prescription education" into STEM education reform with a focus on Environmental Science. Our specific aims include: 1) establishment of an Environmental Science hub for our program, Integrated Science Education Outreach (InSciEd Out) with a focus on toxicology; and 2) the creation of a transgenic and mutant zebrafish resource for use in environmental toxicology by all STEM researchers. The successful completion of the InSciEd Out PEwork in Environmental Sciences described herein will result in: Vetted K-12 classroom curriculum in Environmental Toxicity; A framework for scaling STEM interventions; and a molecular toolbox for improving STEM education through the use of the highly accessible zebrafish model system.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Research & Evaluation, Students – Classroom Science Enrichment, Teacher Professional Development

87. STEMI – Science Teaching Excites Medical Interest Observations of Flipped Modules on Healthcare Disparities

Marie Barnard, Edgar R. Meyer, and Ashley Crumby; Dominique McInnis and Franchesca Lewis, Germantown High School; Andrew Notebaert, Erin Dehon, Caroline Compretta, Stephen Stray, Juanyce Taylor, Shelley Thompson, Judy Gordy, and Rob Rockhold, University of Mississippi

STEMI (Science Teaching Excites Medical Interest) is a collaborative professional development program engaging high school science teachers to foster their training in developing and implementing active learning activities in their classrooms through the use of flipped classroom modules. For each module implementation, a structured observation rubric is utilized to objectively assess the module's implementation. The data gathered from these structured observations are analyzed to determine the effectiveness of both the instructors and the learning modules. Results inform the overall success of STEMI efforts to advance the skills of high school teachers in embracing twenty-first century education practices, including active learning.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Teacher Professional Development

88. Engaging Community through STEM Science Nights: An Elementary School Case Study

Teresa Evans, Rose Riggs, Chase Fordtran, and Kandi Grimes, University of Texas Health Science Center at San Antonio

Parental involvement increases K-12 student interest in STEM careers; however, when parents lack confidence in STEM content, or language and cultural barriers exist, parental engagement decreases. The Teacher Enrichment Initiatives (TEI) collects annual teacher feedback regarding the level of parental involvement with students during science nights, which laid the foundation for teachers to develop a science night training.

Using qualitative methods, this single-case study follows elementary teachers who participated in the TEI science night training as they implement a Science Night program at a majority- minority elementary school. Data were gathered by TEI staff during the inaugural and third year of the Science Night program showing an increase in attendance from 700 (2016) to 800 (2018) and an increase in parental engagement with their student in STEM-related activities from 46% (2016) to 62% (2018). The data and follow-up summary were used by the case study school teachers to write and secure grants to support an annual Science Night program.

Funded by: NIGMS SEPA

Keywords: Curriculum Development, Curriculum Testing, Research Experiences for Teachers, Students – Out-of-School Programs, Teacher Professional Development

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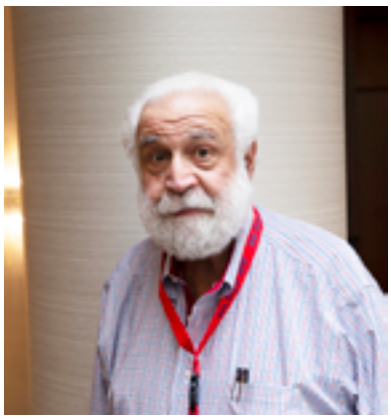

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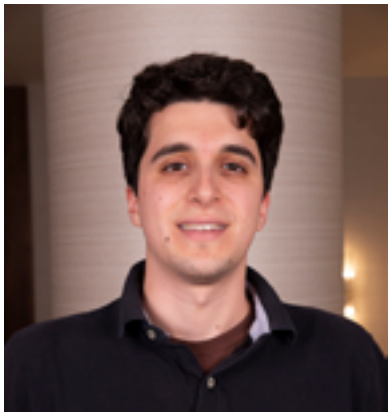

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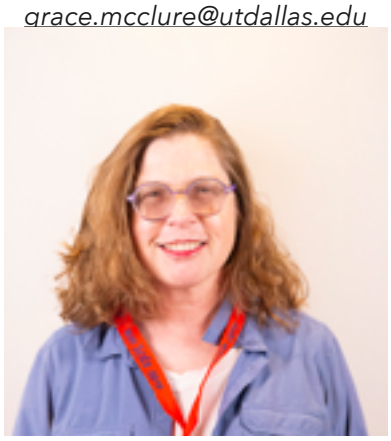

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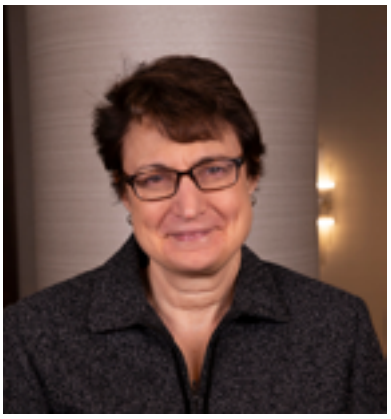

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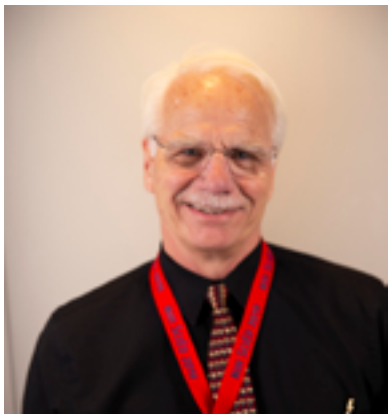

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Common Acronyms and Abbreviations

HHS - U.S. Department of Health and Human Services

AHRQ	Agency for Healthcare Research and Quality
CDC	Centers for Disease Control and Prevention
CMS	Centers for Medicare and Medicaid Services
FDA	U.S. Food and Drug Administration
HRSA	Health Resources and Services Administration
IHS	Indian Health Service
NIH	National Institutes of Health
PHS	Public Health Service • SAMHSA – Substance Abuse and Mental Health Services Administration

NIH - National Institutes of Health

• ***Note: "IC" is a commonly used abbreviation for "NIH Institutes and Centers"***

NIH Institutes	
NCI	National Cancer Institute • YES – Youth Enjoy Science Research Education Program
NEI	National Eye Institute
NHLBI	National Heart, Lung, and Blood Institute
NHGRI	National Human Genome Research Institute • Genome – commonly used name for NHGRI
NIA	National Institute on Aging
NIAAA	National Institute on Alcohol Abuse and Alcoholism
NIAID	National Institute of Allergy and Infectious Diseases
NIAMS	National Institute of Arthritis and Musculoskeletal and Skin Diseases
NIBIB	National Institute of Biomedical Imaging and Bioengineering
NICHD	Eunice Kennedy Shriver National Institute of Child Health and Human Development
NIDCD	National Institute on Deafness and Other Communication Disorders
NIDCR	National Institute of Dental and Craniofacial Research
NIDDK	National Institute of Diabetes and Digestive and Kidney Diseases
NIDA	National Institute on Drug Abuse
NIEHS	National Institute of Environmental Health Sciences
NIGMS	National Institute of General Medical Sciences
NIMH	National Institute of Mental Health
NIMHD	National Institute on Minority Health and Health Disparities

NINDS	National Institute of Neurological Disorders and Stroke
NINR	National Institute of Nursing Research
NLM	National Library of Medicine
NIH Centers	
CC	NIH Clinical Center
CIT	Center for Information Technology
CSR	Center for Scientific Review • CSR manages the annual SEPA and SEPA SBIR/STTR STEM Games reviews
FIC	Fogarty International Center
NCATS	National Center for Advancing Translational Sciences • CTSA – Clinical and Translational Science Awards
NICCIH	National Center for Complementary and Integrative Health

NIGMS - National Institute of General Medical Sciences

• ***Note: "GM" is a commonly used abbreviation for NIGMS***

DRCB – Division for Research Capacity Building *Dr. Fred Taylor, Director*	
IDeA	Institutional Development Awards • INBRE – IDeA Networks of Biomedical Research Excellence • COBRE – Centers of Biomedical Research Excellence
NARCH	Native American Research Centers for Health
SCORE	Support of Competitive Research Program
SEPA	Science Education Partnership Award Program
TWD – Division of Training, Workforce Development, and Diversity *Dr. Alison Gammie, Director*	
Bridges	Bridges to the Baccalaureate Bridges to the Doctorate
BUILD	Building Infrastructure Leading to Diversity • Career Development Awards
IMSD	Initiative for Maximizing Student Development
IRACDA	Institutional Research and Academic Career Development Awards
K99 --> R00	Pathway to Independence Award
MARC U*STAR	Undergraduate Student Training in Academic Research
NRMN	National Research Mentoring Network
NRSA-Fs	Individual Predoctoral National Research Service Award Fellowships
NRSA-F32	Individual Postdoctoral National Research Service Award
NRSA-T32	Institutional Predoctoral National Research Service Award

PREP	Postbaccalaureate Research Education Program
RISE	Research Initiative for Scientific Enhancement

NIH Grant-Associated Terms

AOR	Authorized Organization Representative
ASSIST	Application Submission System and Interface for Submission Tracking
COI	Conflict of Interest
DUNS	Data Universal Numbering System
EIN	Entity Identification Number
F & A	Facilities and Administrative Costs (also referred to as Indirect Costs)
FOA	Funding Opportunity Announcement
FOIA	Freedom of Information Act
FSR	Financial Status Report (SF-269 or 269A)
FTE	Full-Time Equivalent
GMO	Grants Management Officer
GMS	Grants Management Specialist
JIT	Just-In-Time
NoA	Notice of Award
PA	Program Announcement
PAR	Program Announcement Reviewed in an Institute
PO	Program Official
RFA	Request For Applications (Grants)
RPPR	Research Performance Progress Report
SBIR	Small Business Innovation Research
SRG	Scientific Review Group
SRO	Scientific Review Officer
STTR	Small Business Technology Transfer

NSF – National Science Foundation

• Note: "EHR" is the abbreviation for the NSF Directorate for Education and Human Resources, which includes the following, among others

DRL – Research on Learning in Formal and Informal Settings	
AISL	Advancing Informal STEM Learning
ATE	Advanced Technological Education
CSforAll:RPP	Computer Science for All
DR-K12	Discovery Research PreK–12
ECR	EHR Core Research

ITEST	Innovative Technology Experiences for Students and Teachers
S&CC	Smart and Connected Communities
STEM+C	STEM + Computing K–12 Education

America's Seed Fund	
EA	Educational Technologies and Applications • STEM Games SBIR/STTR

Other Federal Agencies Involved in STEM Education

ED	U.S. Department of Education • IES – Institute of Education Sciences • STEM Games SBIR/STTR
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
USDA	Unites States Department of Agriculture • NIFA – National Institute of Food and Agriculture


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