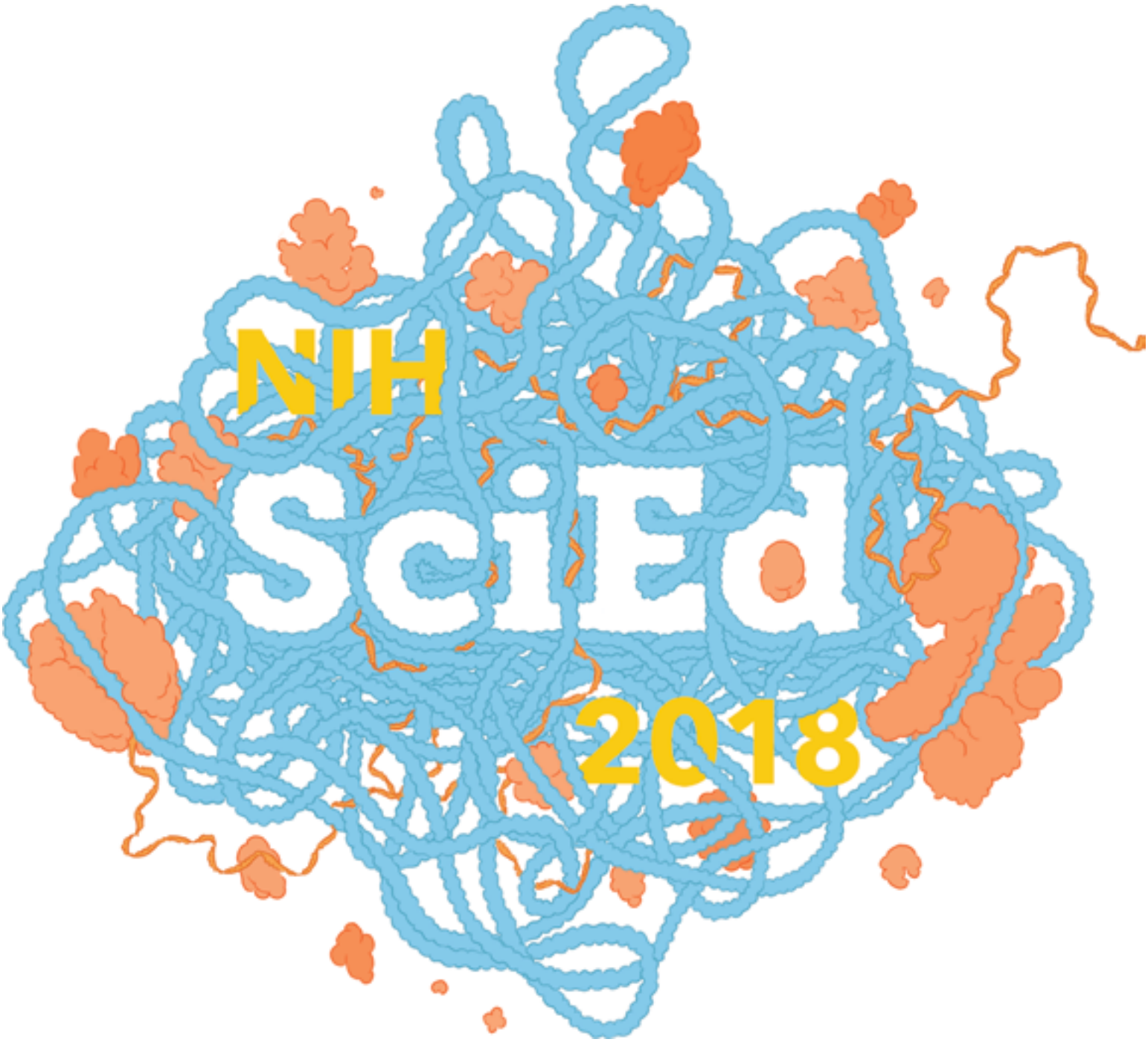
NIH
SciEd
2018

NIH SciEd 2018

Held May 29–June 1 in downtown Washington, D.C., NIH SciEd 2018 was the seventh NIH-wide conference for science education projects funded by the National Institutes of Health. The 74 projects represented at the conference were funded by the following programs:

- Science Education Partnership Award (SEPA), NIH National Institute of General Medical Sciences (NIGMS)
- NIH National Institute of Allergy and Infectious Diseases (NIAID)
- NIH National Institute on Drug Abuse (NIDA)
- National Science Foundation (NSF)

The 248 conference participants included 72 project PIs, 30 Co-PIs, 29 project managers, 43 project staff, 12 evaluators, 7 graduate students and post-doctoral fellows, 5 teachers, 34 other individuals, 33 NIH staff (NIGMS, NHGRI, NCI, NINDS, NCATS, Office of the Director, and Center for Scientific Review), and 13 staff from other federal agencies involved in science, technology, engineering, and mathematics (STEM) education at the pre-kindergarten–grade 12 (P–12) levels (National Science Foundation, U.S. Department of Education, the Smithsonian Institute, 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. He highlighted the synergies of the SEPA program with other biomedical research workforce development programs at NIGMS. In the next keynote address, Eric D. Green, MD, PhD, Director of NIH NHGRI, highlighted the "15 for 15" public education campaign (15 genomics discoveries that are changing the world, one featured each of the 15 days before National DNA Day on April 25) and discussed the development of NHGRI's next strategic plan. The second morning of the conference featured two additional keynote addresses. Miles O'Brien, Science Correspondent for the PBS NewsHour, spoke about the pressing need for accurate science journalism and science education. And Cristin Dorgelo, President and CEO of the Association of Science-Technology Center, spoke about the need to equitably engage people from all racial/ethnic/cultural/socio-economic communities in science and science education. Later that day, Norman Sharpless, MD, Director of NIH NCI, described some of the latest advances in cancer research as well as NCI's science education programs.

Breakout sessions addressed equity, diversity, and health disparities, informal science education, science teaching and learning, interactive multimedia for STEM learning, research and evaluation, funding opportunities, dissemination, and project administration. All projects were invited to present a poster about their work during one of two poster sessions. Participants reported that they returned home feeling energized after acquiring new ideas for evaluation and other project components, learning about STEM education priorities at the national level, networking, and forming new collaborations.

NIH SciEd 2018 Conference Organizing Committee

Kristin Bass, PhD, Rockman et al

Ann Chester, PhD, West Virginia University

Melani Duffrin, PhD, East Carolina University

Maurice Godfrey, PhD, University of Nebraska at Omaha Medical Center

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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

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Genetic Science Learning Center, University of Utah

Conference Schedule

Tuesday, May 30

5:30–7:30 Conference Check-in and Networking Reception
Poster Set-up

Wednesday, May 31

7:15–8:30 Breakfast

7:30–8:30 Late Conference Check-in and Poster Set-up

8:30–8:40 ***Welcome***
Louisa A. Stark, PhD
Chair, NIH SciEd 2017 Conference Organizing Committee, University of Utah

8:40–9:40 ***Keynote Address***
Jon R. Lorsch, Ph.D., Director, National Institute of General Medical Sciences (NIGMS), NIH

9:40–10:00 Break

10:00–11:00 ***Keynote Address:***
Enhancing Genomic Literacy: Rationale, Opportunities, and Challenges
Eric D. Green, M.D., Ph.D., Director, National Human Genome Research Institute (NHGRI), NIH

11:00–12:00 ***Update on the SEPA Program***
L. Tony Beck, PhD, Science Education Partnership Award (SEPA), Center for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH

Overview of the SEPA Process Evaluation
Jill Feldman, PhD, Westat Senior Study Director

12:00–1:30 Lunch

Mentor-Mentee groups meet for newly-funded SEPA projects
See list of assigned tables
Room: Franklin Square/McPherson Square

1:30–1:45 Poster set-up in breakout rooms – ONLY set session A posters on tables
Topic-oriented poster sessions will be held in breakout rooms

1:45–2:45 ***Poster Session A – even-numbered posters***

Authentic Research Experiences for Students & Teachers
Room: Independence F/G

Curriculum Development
Early STEM

Room: Farragut Square

Informal Science Education
Room: Lafayette Park

Student Science Enrichment
Rural STEM
Room: Franklin Square/McPherson Square

Teacher Professional Development
Room: Independence A – round tables

2:45–3:00 Take down even-numbered posters; set up odd-numbered posters

3:00–4:00 ***Poster Session B – odd-numbered posters***

Authentic Research Experiences for Students & Teachers
Room: Independence F/G

Curriculum Development
Early STEM
Room: Farragut Square

Informal Science Education
Room: Lafayette Park

Student Science Enrichment
Rural STEM
Room: Franklin Square/McPherson Square

Teacher Professional Development
Room: Independence A – round tables

4:00–4:15 Break; Return all posters to the tables in the plenary room

4:15–5:30 ***Concurrent Breakout Sessions***

Working With Populations Suspicious of Science
Strand: Equity, Diversity, and Health Disparities
Room: Lafayette Park

Understanding and Measuring STEM Career Development
Strand: Research and Evaluation
Room: Franklin Square/McPherson Square

But How Well Does it Work? Immersing High School Students in a Research-Design-Evaluate Cycle to Learn About Health Messaging
Strand: Science Teaching and Learning; Research and Evaluation
Room Farragut Square

Curriculum Development and the NGSS: Connecting Science Learning With the Lived World of Our Students
Strand: Science Teaching and Learning
Room: Independence F/G

Effective Professional Development Design and Implementation: What do Teachers Need and Want?
Strand: Teacher Professional Development
Room: Independence A

Resources Available from National Science Foundation STEM Education Resource Centers
Strand: Project Administration
Room: Independence I

Commercializing your SEPA
Strand: Project Administration
Room: Independence H

Dinner on your own

Thursday, June 1

7:15–8:30 Breakfast

Meeting for all new SEPA PIs
L. Tony Beck, PhD, Science Education Partnership Award (SEPA), Center for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH
Room: Franklin Square/McPherson Square

8:30–10:00 ***Assessment Workshop***
Joseph Krajcik, PhD, Lappan-Phillips Professor of Science Education; Director of CREATE for STEM Institute, Department of Teacher Education, Michigan State University

10:00–10:15 Break

10:15–10:35 ***NIHSEPA.org: A Website for the SEPA Community***
Nancy Moreno, PhD, Associate Provost for Faculty Development and Institutional Research; Professor, Allied Health Sciences and Family & Community Medicine, Baylor College of Medicine

10:35–11:00 ***The Trans-NIH Native American Research for Health Program***
Sheila A. Caldwell, PhD, Program Director, Center for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH

11:00–12:00 ***Keynote Address: Rigorous Design, Rigorous Research: Inventing the Future of Learning with Design-Based Research***
Christopher Hoadley, Ph.D., Associate Professor of Educational Communication and Technology, Program in Digital Media Design for Learning, and Program on Games for Learning. New York University

12:00–1:30 Lunch

1:30–2:45 ***Concurrent Breakout Sessions***

Discussion with Christopher Hoadley on Design-Based Research
Strands: Research and Evaluation; Informal Science Education

Room: Lafayette Park

Evaluating Teacher Professional Developments: Insights From Three SEPA Projects
Strand: Research and Evaluation
Room: Independence A

Establishing a Basic Genomic Literacy Framework for K-16 Students
(double session, 1:30–4:15)
Strand: Science Teaching and Learning
Room: Independence F/G

Planning Competitive National Science Foundation Proposals
Strand: Project Administration
Room: Independence I

Models for Building Relationships With Students and Communities That Support Science Learning and Success
Strand: Equity, Diversity, and Health Disparities
Room: Farragut Square

Science of Learning: How do SEPA Projects Incorporate Theories of Learning Into Curriculum?
Strand: Science Teaching and Learning
Room: Franklin Square/McPherson Square

Big Data in STEM Learning
Strand: Science Teaching and Learning
Room: Independence H

2:45–3:00 Break

3:00–4:15 ***Concurrent Breakout Sessions***

The Evolution of the "How We Role" Evaluation: Lessons Learned From Four Iterations of Learning Assessments
Strand: Research and Evaluation
Room: Lafayette Park

Establishing a Basic Genomic Literacy Framework for K-16 Students (double session, 1:30–4:15)
Strand: Science Teaching and Learning
Room: Independence F/G

Bilingual Exhibitions and Community Leader Dialogues in Rural Colorado Libraries
Strand: Informal Science Education
Room: Farragut Square

A Discussion of Science Identity Formation: Methods by Which Persons Find Their Space in STEM
Strand: Science Teaching and Learning
Room: Independence H

STEM Relationship Pipelines: A Core Component of Long-Term Impact
Strand: Equity, Diversity, and Health Disparities
Room: Independence A

Engaging a Pipeline from SEPA to IDeA Programs
Strand: Equity, Diversity, and Health Disparities
Room: Independence I

Connecting Current Research to the Next Generation Science Standards
Strand: Teacher Professional Development
Room: Franklin Square/McPherson Square

4:15–5:30 ***Networking Reception***

Demonstrations of Games, Apps and Technology-Based Educational Materials

Dinner on your own

Friday, June 2

7:15–8:30 Breakfast

8:30–9:45 ***Concurrent Breakout Sessions***

Tried and True Evaluation Instruments
Strand: Research and Evaluation
Room: Independence H/I

Best Practices in Professional Development: What SEPA Grantees Have Learned from K-12 Teachers and Students
Strand: Teacher Professional Development
Room: Franklin Square/McPherson Square

Stories from the Field: Institutional Challenges in IHE- ISE Partnerships
Strand: Informal Science Education
Room: Lafayette Park

Have a BLAST with DNA Subway's Blue Line
Strand: Science Teaching and Learning
Room: Independence A

Game-Based Learning 101: Introduction to Game Design, Formal Systems, and Rules
Strand: STEM Games for Learning
Room: Independence F/G

Personal Data Trackers in STEM Education
Strand: Science Teaching and Learning
Room: Farragut Square

9:45–10:00 Break

10:00–11:15 ***Concurrent Breakout Sessions***

Diabetes, Obesity, and Cardiovascular Disease (DOC) Working Group
Strand: Equity, Diversity, and Health Disparities
Room: Lafayette Park

Monitoring the Alignment of Program Objectives to Instruments: How to be an Evaluation Auto Mechanic
Strand: Research and Evaluation
Room: Independence F/G

Approaches to Evaluating Authentic Research Experiences
Strand: Research and Evaluation
Room: Independence A

Strategies for Integrating Disciplinary Literacy into Science and Health Curriculum
Strand: Science Teaching and Learning
Room: Franklin Square/McPherson Square

Student-Produced "Question-Framed Videos" and Science Identity Formation
Strand: Science Teaching and Learning
Room Farragut Square

Getting Started in STEM Games
Strand: STEM Games for Learning
Room: Independence H/I

11:15–11:45 ***Town Hall Discussion***
L. Tony Beck, PhD, Science Education Partnership Award (SEPA), Center for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH

Lunch on your own

Keynote Address
Wednesday, May 30, 2018: 8:45-9:45 A.M.

NIGMS Update

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

Reporter: **Barbara Hug, PhD,** *Teaching Associate Professor, College of Education, University of Illinois Urbana-Champaign*

Dr. Lorsch began his talk by providing an update on SEPA. In fiscal year 2017, SEPA moved to NIGMS; for the first time in eight years, the SEPA program will receive a budget increase.

Next Dr. Lorsch provided an overview of the 2018 NIGMS Director's Early-Career Investigator Lecture. This lecture and past lectures can be accessed using the following link, *https://www.nigms.nih.gov/News/meetings/ECI/*.

2018 NIGMS Director's Early-Career Investigator Lectures

- Jeramiah Smith, PhD, Ancient Bloodsuckers, Disposable Genes, and What It All Means *https://www.nigms.nih.gov/News/meetings/Pages/2018-NIGMS-Directors-Early-Career-Investigator-Lecture.aspx*.
  - Dr. Smith, using the context of sea lamprey, studies programmed genome rearrangement in order to begin to look at the possible function of different genes.
  - He and his group have shown that the lamprey "disposes" a large portion of its genome.
  - They compared the genome in somatic cells with the genome in germline cells.

This research has shown that a large number of the genes that it discards in somatic cells, when mutated, leads to cancer in humans.

Overview of the NIGMS Director's Early-Career Investigator Lecture Series

- This lecture series is a seminar series pitched to undergraduates.
- It includes 30-minute sessions, followed by a question and answer session.
  - Questions contributed by undergraduates
- There is often a full house with over 250 webcast views.
- Undergraduate students from Morgan State University 's BUILD, a NIGMS workforce development program, attended.
- The lectures are broadcast live. They are also recorded and accessible on the NIGMS website, *https://videocast.nih.gov/summary.asp?live=27347&bhcp=1*.

Dr. Lorsch next presented an update on the USA Science and Engineering Festival and discussed other outreach efforts.

USA Science and Engineering Festival

The NIGMS booth included

- A protein structure alphabet printer
- Virtual reality protein structures
- A student-led SEPA interactive health experiment: students from the West Virginia University SEPA project worked with the Oregon Health Sciences University team.
- A science themed selfie station called Cell-e-bration of Science that included "cell-fies"
- 365,000 attendees in 2018

Other Outreach

- Dr. Lorsch spoke with 4th grade elementary students at Rachel Carson Elementary about changes in science. The presentation was meant to be 40 minutes, but turned into a two-hour interaction.
- Senator Shelly Moore Capito (R,WV) attended the Health Science Technology Academy Graduation, a NIGMS SEPA-funded program. Her visit was prompted by one of her staff members who visited the NIGMS booth at the USA Science & Engineering Festival.

Dr. Lorsch spent the last part of his presentation discussing the new NIGMS website, IDeA States, faculty diversity, and other topics.

New NIGMS Website

- We are looking for ways to partner with the SEPA program and SEPA website; we want to make everyone aware of SEPA.
- We want to highlight and be able to replicate successful projects.
- We are seeking partners and SEPA projects to showcase on website.

IDeA States: Accelerate Commercialization of New Ideas and Technologies in IDeA

- We want to develop Regional Technology Transfer Accelerator hubs for IDeA states (new awards in FY18).
- We will use NIGMS STTR funds to award one Accelerator hub to each of the four IDeA Regions
- The goal is to provide training, mentoring, and consulting services focused on entrepreneurship, technology transfer, business skills, etc.
- Proposals have been reviewed; NIGMS will announce awards soon.

Diversity in Faculty in Life Sciences

- There has been a growth in URM life sciences PhD graduates; however, this has not translated into increased faculty diversity.
  - A nine-fold increase in student diversity has not translated into corresponding faculty diversity.
- Meyers LC, Brown AM, Moneta-Koehler L, Chalkley R (2018) Survey of checkpoints along the pathway to diverse biomedical research faculty. PLoS ONE 13(1): e0190606. *https://doi.org/10.1371/journal.pone.0190606*
- Request for information and strategies for enhancing postdoctoral career transitions to promote faculty diversity (NOT GM 18-034) have been released.

SEPA Program Updates

- Distribution: We would like to see one SEPA program in each IDeA state.
- Interaction: We would like to see increased interaction between SEPA and other programs, such as training and workforce development, graduate programs, INBRE, COBRE, and IDeA-CTR.

Development of an NIH Strategic Plan for Data Science

- A strategic plan has requested by Congress.
- The plan, which has a release date of May 30, focuses on
  - Modernizing the data resources' ecosystem to increase its utility for researchers and other stakeholders
  - Enhancing data sharing, access, and interoperability
  - Improving the ability to use electronic health records (HER) and clinical and observational data for research, while ensuring data confidentiality
  - Modernizing infrastructure and increasing capacity
    - Enhance the NIH workforce
    - Expand the national research workforce
    - Enhance quantitative and computational training for students and postdocs ("students" is meant to include K–12)
    - Engage a broader community (examples of coding outreach activities; citizen science)

Keynote Address
Wednesday, May 30, 2018 9:45–10:30 AM

Genomics and Genomic Literacy: Updates and Opportunities

Presenter: **Eric D. Green, MD, PhD,** *Director, National Human Genome Research Institute (NHGRI), NIH*

Reporter: **J. Michael Wyss, PhD,** *Professor of Cell, Developmental and Integrative Biology and Director, Center for Community OutReach Development, University of Alabama at Birmingham*

Dr. Green considered how the mission of SEPA fits into the developing science research mission of NHGRI. His initial comments considered the NHGRI GENOMIC LITERACY, EDUCATION, AND ENGAGEMENT (GLEE) Initiative. Part of this effort is the National Campaign for Genomic Literacy, which introduces genetics to the public, thus, greatly increasing understanding of genetics. GLEE is also focused on educating students and professionals in genetics. In part, this is funded by the Foundation for NIH. The 15/15 Celebration webpage, *https://www.genome.gov/27570876/15-for-15-celebration/*, contains information about how one genetics discovery is changing the world each day for 15 days to highlight the great progress being made in the field. National DNA Day, April 25 each year, is promoting genetics throughout the United States. Genome: Unlocking Life's Code, a genomics exhibit, has been developed and is touring the nation. Originally meant for a three-year tour, the exhibit is already oversubscribed well into a fourth year. This and other programs are being done in partnership with the Smithsonian Institute. Additionally, the Smithsonian, the History Channel, and 42 Degrees North Media partnered with NHGRI to develop a historical video catalogue featuring those involved in the Human Genome Project and in original gene discoveries of the 20th and 21st centuries. Dr. Green then showed a segment of one of the five new videos 42 Degrees North Media produced in partnership with NHGRI, which incorporated footage from the original historical video catalogue, some new footage, and some animations. All five of these videos are on available on YouTube at *https://www.genome.gov/27568323/nhgris-oral-history-collection/*.

In the second part of his talk, Dr. Green considered the development of NHGRI's 2020 strategic plan, which will be made public and final in 2020. It will identify and celebrate notable anniversaries, including February 16, 2018: the date that marked the 10,000th day since the official launch of the Human Genome Project. Dr. Green marveled at how much genomics has changed over the last approximately 10,000 days. Once a laboratory-based discipline mostly focused on genome mapping and sequencing, the field has expanded greatly over time and has blossomed into a robust discipline that now touches the full spectrum of research endeavors: basic, translational, and clinical. Details about the strategic planning process are available at *https://www.genome.gov/27570372/nhgri-strategic-planning-process-establishing-a-2020-vision-for-genomics/*.

In closing, Dr. Green noted that 2011–2018 was a time for advancing genomic science in order to advance genomic science in medicine; 2020 onward will be a time for genomics to improve healthcare effectiveness.

Wednesday, May 30, 2018: 10:45–11:00 AM

Update on the SEPA Program

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

Reporter: **Kristin Bass, PhD,** *Senior Research Associate, Rockman et al*

"I have the best job at the NIH," Dr. Beck declared as he greeted the audience. When the OMB consolidation of science education projects put SEPA's status at risk, the SEPA community rallied the House and Senate to get funding restored. Dr. Beck says that he continues to market the great things the SEPA community does. He thanked the Genetic Science Learning Center and the NIH SciEd 2018 Conference Organizing Committee for putting this meeting together.

In May 2016, SEPA moved to the National Institute of General Medical Sciences (NIGMS), also abbreviated as GM. That transition is nearly complete. SEPA is now part of a full portfolio of training, workforce development, and diversity programs for all ages and stages: K–12 (SEPA) through research careers. Collectively the programs are designed to develop a highly skilled, creative, and diverse biomedical workforce. SEPA is part of the Division for Research Capacity Building (DRCB) headed by Fred Taylor. The DRCB also includes the Institutional Development Award (IDeA) program: "It's great to be together again in the same division."

Dr. Beck gave a short history of the SEPA program. It was established in 1991 with coordination from the Association of Science-Technology Centers (ASTC), which needed more money for museum exhibits on health. IDeA followed two years later, in 1993. The first joint SEPA-IDeA program emerged in West Virginia in 1995.

From 1991 to 2010, SEPA was located within NIH's National Center for Research Resources (NCRR). In 2010, SEPA and the Office of Science Education moved to the Office of Research Infrastructure Programs (ORIP). The 2013 OMB consolidation jeopardized SEPA's future. The program survived because the SEPA community "established the value of the program to taxpayers"; it has the highest level of rigor on what works.

Since the move to NIGMS, it's been "smooth sailing." Dr. Beck says that SEPA has "landed safely" and has appreciated the support. He shared some program milestones since the last SciEd Meeting.

- July 2017 Congress moves SEPA to GM
- Aug 2017 SEPA Process Evaluation of the SEPA program, conducted by Westat
- Aug 2017 15 new SEPA awards
- Sep 2017 SEPA PAR–17–339 Funding Opportunity Announcement (FOA)
- Oct 2017 SEPA-related SBIR/STTR FOA
- Oct 2017 SEPA grants received new GM identification numbers
- Feb 2018 SEPA Grant Review Panel
- April 2018 SEPA-related SBIR/STTR Grant Review Panel

Last October saw the release of a SEPA-affiliated Small Business Innovation Research/ Small Business Technology Transfer (SBIR/ STTR) funding announcement on STEM games. Dr. Beck also highlighted an award to PBS NewsHour and Twin Cities Public Television that will share work with the public and develop resources for SEPA programs.

Dr. Beck announced two transitions in the community. Michael Lichtenstein, MD, at the University of Texas Health Science Center at San Antonio has been a part of SEPA since 1996. He has most recently served as the PI of the Voelcker Biosciences Teacher Academy SEPA program. He is leaving to concentrate on his medical practice with geriatric patients. Maureen Munn, PhD, at the University of Washington's Genome Sciences Education Outreach is retiring after 22 years of service. She received two rounds of SEPA funding for the Genes, the Environment, and Me (GEM) program, as well as grants from the National Science Foundation, the National Institute on Drug Abuse, the Howard Hughes Medical Institute, and many others.

Dr. Beck asked PIs "When you get your SEPA funding, how do you leverage your investment and get support from your college and schools?" He encouraged the audience to think strategically about how to sustain SEPA programs. He also noted that there are "a lot of programs across NIH supporting early STEM and workforce development" and that the "culture is changing to support pre-college STEM." He encouraged programs to share news with him, no matter how small. "Take the 'proud grandparent' approach!", he advised.

Finally, Dr. Beck reminded attendees "If you don't have at least two new collaborators, you can't get on the plane."

Wednesday, May 30, 2018: 11:00–11:15 AM

Journal of STEM Outreach

Presenters: **Ann Chester, PhD,** *Assistant VP for Health Sciences, West Virginia University*
Jennifer Ufnar, PhD, *Research Assistant Professor, Center for Science Outreach, Vanderbilt University*
Virginia Shepherd, PhD, *Research Professor and Director, Center for Science Outreach, Department of Teaching and Learning, Vanderbilt University*

Reporter: **Kristin Bass, PhD,** *Senior Research Associate, Rockman et al*

The Journal of STEM Outreach (JSO) (*https://www.jstemoutreach.org*) is the brainchild of Virginia Shepherd of Vanderbilt University. The journal emerged from challenges around publishing the great work of SEPA programs and frustration of resubmitting manuscripts to journals. Ann Chester and Virginia Shepherd are the Co-Editors. Five Associate Editors, a Journal Manager, and a 17-person Editorial Board round out the team.

JSO was created to offer a journal for researchers who develop and implement programs that connect formal and informal educators with practicing STEM professionals. The primary goal is to provide a journal that functions as a hybrid or bridge between the STEM and education worlds.

From the journal founders' own work and previous discussions at several past SEPA meetings, it became evident that SEPA-funded investigators were finding it difficult to publish their work, especially in two areas:

- Programmatic descriptions that could be incredibly important for replication
- Research and programmatic evaluation studies that show impacts on program participants, but are outside the scientific and educational research fields

JSO also provides an avenue to develop collaborations within the outreach community.

There are four types of articles appropriate for publication in JSO:

- Invited commentaries
- Descriptions of programs that might be of value to other researchers
- Research studies that support the replication of education or partnership models
- Case studies that exemplify a specific replicable aspect of a program that improves STEM instruction in K–12 schools

The following provides a logistical overview of the journal:

- The JSO is peer-reviewed by scientists and educators.
- The editorial board is made up of scientists and educators from the SEPA and NSF GK–12 communities.

- The JSO is published quarterly (Jan 15, April 15, July 15, Oct 15) with due dates approximately 45 days prior to publication.
- The JSO is published at Vanderbilt through Scholastica.

JSO is an open access journal, which increases its access to informal science educators, teachers, and parents. There is no cost to submit an article, but there are publishing fees:

- Research articles: $1000
- Case studies: $1000
- Programmatic articles: $1000
- Commentaries: $250

JSO is always interested in finding new reviewers. For more information, visit the JSO website *https://www.jstemoutreach.org/*.

Q & A

- What is the journal's impact factor? We are keeping analytics, but won't know the impact factor for two years.
- Where is the journal catalogued (e.g., PubMed)? We will find out.
- It's difficult to get quantifiable data for informal education programs. How does the ability to have a journal like this help with that issue?
  - The significance of the journal will carry weight once it gets beyond the SEPA program.
  - The JSO addresses the science of health education, which every previous journal has said belongs in another journal. Ann Chester's revolutionary study couldn't find a home before it appeared in JSO.
  - The JSO allows authors to write education articles for scientists; science educators, teachers, and clinicians are other possible audiences.
- Can people put page charges in their SEPA programs? Yes.

The speakers encouraged the audience to attend a breakout session on publishing later that afternoon where panelists would discuss other publication venues and the pros and cons of the venues.

Wednesday, May 30, 2018: 11:15–11:45 AM

NIGMS Programs to Enhance Diversity in the Biomedical Research Workforce

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

Reporter: **Ann Chester, PhD,** *Assistant VP for Health Sciences, West Virginia University*

Session Report

NIGMS historically administers programs from the undergraduate through post-doctoral space. The recent addition of SEPA extends the training pathway from pre-K–12 through post doc.

NIGMS supports

- R01: Research to understand and inform interventions, which can promote research careers for students in the biomedical sciences.
- U01: Research that employs a systems-based approach to understanding the underlying dynamics of the workforce and its trainees, examining strategies for retaining and advancing highly skilled independent investigators, and enhancing the diversity of the scientific workforce.
- TWD: Meetings to enhance diversity in the biomedical research workforce.

NIGMS is administering a Diversity Program Consortium, which takes a scientific approach to enhancing the diversity of the biomedical research workforce. It is focused to have

- Three levels of simultaneous impact: student, faculty, and institution.
- Integration of social science research and psychosocial interventions into the process of training and mentoring students and faculty.
- Rigorous assessment and evaluation of the training and mentoring interventions implemented across the program.

National Research Mentoring Network (NRMN) is opening a competition to encourage an infusion of new ideas regarding the science of mentoring and networking and to enhance the efficiency of the administrative structure.

A great deal is new, and more change is on the horizon. It has been asked that R25 (education research) codes for FOA's be changed to T (training) codes. Reorganization of programming is in place to reduce overlap, allow for evaluation that is more rigorous, and bring alignment of goals in funding approaches. Workforce development and diversity are the common thread. There is a distinct problem with recruiting minority PhD's from the post doc pool into medical school assistant professor positions. NIGMS hopes to address this and many other problems with the reorganization. NIGMS is asking for community input and will conduct extensive outreach to provide guidance while programs navigate the transition. Examples of change include

- NIGMS Biomedical Graduate Training PAR–17–341

- Medical Science Training Program: New Funding Announcement in Fall 2018
- Reorganization of the Initiative for Maximizing Student Development (IMSD) , Maximizing Access to Research Careers (MARC), Undergraduate Student Training in Academic Research (U-STAR) now called MARC U-STAR, and Research Initiative for Scientific Enhancement (RISE) programs

Wednesday, May 30, 2018: 11:45 AM–12:05 PM

NIGMS Grants Management: Budget and Allowable Expenses

Presenter: **Christy Leake,** *Grants Management Team Leader, National Institute of General Medical Sciences (NIGMS), NIH*

Reporter: **Louisa A. Stark, PhD,** *Professor of Human Genetics, University of Utah*

Ms. Leake provided important information about financial and other aspects of grant management about which PIs should be cognizant.

Grants Compliance and Oversight

Recipients of NIH grant funds must comply with federal statutes, regulations, policies (NIH Grants Policy Statement, and NIH Guide for Grants and Contracts), institutional requirements, and the Notice of Award (NoA).

The NoA is a legally binding document that contains award data and fiscal information, grant payment information, and terms and conditions. Grantees should carefully review Section IV, GM Special Terms and Condition. The grantee institution/organization indicates acceptance of the terms and conditions of the award by drawing down funds against the grant from the Payment Management System.

Cost Consideration

Direct costs are any costs that can be specifically identified with a particular project, program, or activity or that can be directly assigned to such activities relatively easily and with a high degree of accuracy. Direct costs include, but are not limited to, salaries, travel, equipment, and supplies that directly benefit the grant-supported project or activity.

Indirect costs are costs that are not readily identified with a specific project or organizational activity; they are incurred for the joint benefit of several projects and activities. Indirect costs are usually grouped into common pools and charged to benefiting objectives through an allocation process/ indirect cost rate.

Cost monitoring requires that actual expenses are periodically compared with the awarded budget, actual expenses are accurate (i.e., reasonable, allocable, allowable, and consistently charge), mischarges are corrected in a timely manner (i.e., via cost transfers), prior approvals are obtained when required, and subrecipient expenses are monitored (the main grantee/pass-through entity is responsible).

Allowable Costs (particularly related to SEPA awards)

- Incentive payments to volunteers or participants in grant-supported projects are allowable.
- Participants can be paid a reasonable amount as compensation for their participation in any grant activity.
- Honorariums are allowable as a speaker's fee.

Questionable Costs

- General supplies: only costs that are directly related to the grant and/or project are allowable as direct costs.
- Meals/Food: only allowable as part of a meeting that is necessary for disseminating information.
- Retreat: costs for retreat activities should be broken out individually so that each expense can be reviewed for admissibility.
- Poorly justified: costs that do not include adequate detail or use confusing terms in the budget justification narrative.

Unallowable Costs

- Entertainment: not allowable on NIH awards
- Gifts: not allowable on NIH awards
- Honorariums: not allowable when used to confer distinction on a speaker
- Scholarships: not allowable on NIH awards
- Stipends: only allowable on training grants

Prior Approvals

Prior Approval is always required for the following categories:

Change in Scope

A change in direction or other area that is significantly different from the aims, objectives, or purpose of the originally approved project. Actions likely to be considered as a change in scope include

- Changing the specific aims approved at the time of the award
- Substituting one animal model for another
- Changing, in any way, from the approved use of animals or human subjects
- Shifting the research emphasis from one disease area to another
- Applying a new technology; i.e., changing assays from those approved to a different type of assay
- Transferring performance of substantive programmatic work to a third party
- Changing key personnel
- Rebudgeting significantly due to a change in scope
- Purchasing a unit of equipment exceeding $25,000 due to a change in scope

Change in PI or Key Personnel (individuals who are specifically named in the NoA)

The grantee must notify NIH if the PI or other key personnel named in the NoA

- Withdraw from the project entirely
- Will be absent for 3 months or more
- Reduce their time devoted to the project by 25% or more

Significant Rebudgeting

Significant rebudgeting occurs when expenditures in a single, direct cost budget category increase or

decrease by more than 25% of the total costs awarded from the categorical commitment level that was established for the budget period. For example, if the award budget for total costs is $200,000, any rebudgeting that would result in an increase or decrease of more than $50,000 in a budget category is considered significant rebudgeting.

Who can submit requests for the changes listed above, which require Prior Approval?

Requests for actions related to the above categories must be submitted by the Authorized Organization Representative (AOR) to the NIGMS Grants Management Specialist and Program Officer no later than 30 days before the proposed change. Only the AOR or Signing Official (SO) has the authority to submit corrections or requests on behalf of a grantee organization or investigator.

Instances When Prior Approval is NOT Needed

Changes to the Budget

NIH Prior Approval is not required in order to rebudget funds for any direct cost item that the applicable cost principles identify as requiring the Federal awarding agency's Prior Approval, unless the incurrence of costs is associated with or is considered a change in scope.

- Incurring pre-award costs up to 90 days before the beginning date of the initial budget period of a competing or non-competing award.
- Initiating a one-time extension of the final budget period of a previously approved project period without additional funds (a.k.a. First No-Cost Extension).
- Rebudgeting that does not constitute a change of scope or significant rebudgeting, e.g., rebudget among budget categories, rebudget between direct and F&A costs.
- Adding, changing, or removing a domestic consortia site.
- Changing level of effort: the personnel are not named on the NoA or are not required to maintain a minimum level of effort; the departure or addition of personnel does not result in a change of scope.
- Direct charging of salaries of administrative and clerical staff. The salaries for these personnel should normally be treated as indirect (F&A) costs. Direct charging of these costs may be appropriate only if all of the following conditions are met:
  - Administrative or clerical services are integral to a project or activity.
  - Individuals involved can be specifically identified with the project or activity.
  - Such costs are explicitly included in the budget.
  - The costs are not also recovered as indirect costs.
  - The charges meet the criteria for allowable costs described in 45 CFR 75.403.

Post-Award Requirements

Annual Progress Reports

- All SNAP Progress Reports for SEPA awards must use the eRA Research Performance Progress Report (RPPR) Commons Module for submission (see *https://grants.nih.gov/grants/guide/notice-files/NOT-OD-15-014.html*).
- SNAP RPPRs are due 45 days before the anniversary start date for the award.

- Failure to submit complete and timely progress reports may affect future funding to the organization.
- The following link provides a searchable list to determine due dates for progress reports: *https://public.era.nih.gov/chl/public/search/progressReportByIpf.era*.

Unobligated Balances

- If an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget, in the annual RPPR a grantee must provide the estimated balance and a general description of how it is anticipated that the funds will be spent.
- Awards with excessive balances are subject to requests for additional information by NIGMS staff and subject to potential re-evaluation of duration and amount of provided support. When additional information is needed, the issuance of a NoA is subject to delay or deferral.

Deadlines for Required Grant Closeout Reports

- Recipients must submit final reports within 120 calendar days from the period of performance end date (i.e., end of the project period).
- Required Final Reports include
  - Final Progress Report (FPR)
  - Final Invention Statement and Certification (FIS)
  - Final Federal Financial Report (FFR): Recipients must ensure that there are no discrepancies between the final FFR expenditure data (in eRA Commons) and the Federal Cash Transaction Report (FCTR) in the Payment Management System (PMS).
- U.S. Department of Health and Human Services (HHS) policy requires NIH to initiate unilateral closeout procedures (i.e., closeout without receipt of acceptable reports) within 180 days of the period of performance end date if the grantee has not submitted an acceptable report for each required final report.

Resources

Online Resources

- FAQs, *http://grants.nih.gov/grants/frequent_questions.htm*
- Applying Electronically FAQs, *http://grants.nih.gov/grants/ElectronicReceipt/faq.htm*
  - Avoiding Common Errors, *http://grants.nih.gov/grants/ElectronicReceipt/avoiding_errors.htm#10check*
- Are You Using the Correct Forms For Your Application? *http://grants.nih.gov/grants/ElectronicReceipt/files/right_forms.pdf*

eRA Training: Video Tutorials, *https://era.nih.gov/era_training/era_videos.cfm*

- eRA Commons: Features and Functions You Need to Know
- Institution Registration and Account Creation
- Understanding Status
- For Reviewers: Navigating Internet Assisted Review (IAR)

Who to Contact

Before you contact NIH staff, review the following sources of information as they will likely contain the answers to the vast majority of questions you may have:

- The Terms and Conditions in the NoA for your grant.
- The specific program announcement that your application was submitted under.
- The NIH Grants Policy Statement at *https://grants.nih.gov/grants/policy/nihgps_2012/index.htm*.
- Your institution's grants and contracts office.

If you need additional assistance, contact the NIH grants management specialist (policy/budget issues) or the scientific program officer (policy/technical issues) listed in the last section of the NoA for your grant.

Breakout Sessions
Wednesday, May 30, 2018: 1:30–2:45 PM

Community Leader Dialogues to Engage Diverse Communities, Build New Partnerships, and Strengthen Existing Networks

Facilitators: Anne Holland, MS, *Community Engagement and Exhibits Manager, Space Science Institute*
Cynthia J. Armstrong, DPT, *Senior Instructor; Associate Director of Professional Programs, Colorado Area Health Education Center, University of Colorado Anschutz Medical Campus*
Robert Russell, PhD, *Program Director, National Science Foundation*
Reporter: Alexander Chang, PhD, *Seattle Children's Research Institute*

Resources

- Resources for Libraries: *www.starnetlibraries.org*
- Community Dialogue Guide: *www.nc4il.org/images/papers/Community-Dialogue-Guide052318.pdf*

What is a Community Dialogue?

- A Community Dialogue is a loosely facilitated discussion that provides the opportunity for venue staff and community leaders/members to discuss common, community-based challenges or aspirations.
- Think of it like a focus group, but instead of testing a product you are evaluating your community's opinions regarding your venue and the services your community needs.
- What about people who don't come through the door?
- Are there services they don't know about?
- Is there some reason they don't feel welcome?
- It provides opportunities to make new partners and cement your venue as a community hub.

How does Collective Impact play into a Community Dialogue?

- The Community Dialogue framework is an important piece that can contribute to collective impact.
- Collective Impact is a community that shares
  - A common agenda
  - Common progress measures (common goals)
  - Mutually reinforcing activities to allow everyone to participate
  - Communications
  - Backbone organization to manage collaborations

What do Community Dialogues look like?

- One to four hours

- Participation that represents
  - The community you live in.
    - Super important! You want representation that looks like your target audience.
  - People you already know AND people you don't.
    - Invite people who you don't normally talk to and whose opinions you don't normally hear.
  - The change makers.
- Most importantly, Community Dialogues should look relevant for the groups you're working with.
  - What is the key issue you're addressing?
  - What will your framework look like? Set up a framework.

What are some examples of Community Dialogue goals?

- Strengthen venue staff's roles in establishing a STEM Learning Environment.
- Identify underrepresented community groups.
- Pinpoint possible collaborations and partnerships within the community.
- Contribute to developing a flexible Community Dialogue model that all venues can use.

What are examples of Community Dialogue ground rules?

- Have a "kitchen table" conversation.
- Ensure everybody participates and no one dominates. This is not a lecture.
- Agree there are no "right answers".
- Draw on your own experiences, views, and beliefs. You do not need to be an expert.
- Keep an open mind.
- Listen carefully and try hard to understand the views of those who disagree with you.
  - Don't dominate just because it's your venue.
- Help keep the discussion on track.
- Stick to the questions; try not to ramble.
  - Keep discussion on track, turn comments into "how" or "why" questions.
- Agree to disagree, but don't be disagreeable.
- Respond to others how you want others to respond to you.
  - Hear them out. If you stop them, it may make it seem like their concerns don't matter to you.
- Have fun!

How can Community Dialogues help your venue?

- Expand your understanding of patrons' feelings about venue and programs, including programming related to STEM.
- Obtain meaningful feedback from the community on who visits your venue and why.
- Have a conversation about how your venue can better serve ethnically, economically, and geographically underserved and underrepresented audiences.

- Connect with local organizations and potential future partners that have shared interests with your venue and community.

What are the first steps in starting a Community Dialogue?

- Plan ahead.
- Invite the people you want to serve.
- Keep it to around 25–30 people.
- Consider a neutral location or go to them. Be flexible.
- Remember your role in these dialogues.
- Make it fun!

Community Dialogue Planning Guide

- Who is your target audience for this Dialogue event?
- Does your target audience already use your venue? If yes, are there different facilities/programs/resources you're trying to make sure they have access to?
- If your audience doesn't already use your venue, do you know the reasons why?
- What institutional barriers (real or perceived) may be preventing your target audience from using your venue?
- What services/resources do you plan to highlight to show this audience the value of your venue?
- What issues in your community do you feel your venue could be doing a better job at addressing? Are these disparities in income, race, or educational attainment based?
- What venues in your community do you see as leaders in facing these issues?
- What services do you provide that may address these issues? (Programming, resources, activities, etc.)
- What members of your community do you plan on inviting to your Dialogue? (Remember, this list should be a mix of community leaders who can "get things done" and community members who represent those you're trying to reach.)
- Do you plan on using the sample questions listed in the Community Dialogue Guide? If so, list the ones you think are relevant, and add potential follow up questions. If you think those questions aren't right for your Dialogue, create your own!
- What are your plans to follow up on the information learned in your Dialogue? Make sure you have a potential timetable ready so that those in attendance have goals to work toward. List some potential follow-up items.

Participants:

Ashlyn Sparrow, University of Chicago

Alexander Chang, Seattle Children's Research Institute

Crisianee Berry, Nerd Clutch

Emily Mathews, Northwestern University

Manetta Calinger, Center for Educational Technology

Rubin Baskir, NIH/OD/All of Us Research Program

Naomi Luban, Children's National Health System

Chris Doyle, Montana Tech

Alicia Santiago, TPT - Twin Cities PBS

Johnny Kung, Harvard University

Chandan Robbins, Georgia State University

Nicole Hines, NIH/NCI

Emily Kuehn, US Army Medical Research and Materiel Command

Alison Lin, NIH/NCI

Jenica Finnegan, University of Nevada, Reno

Establishing a 2020 Vision for Genomics: Society, Education, and Engagement

Facilitators: Elizabeth Tuck, MA, *Genomics Education Specialist, NIH, National Human Genome Research Institute*
Carla Easter, PhD, *Chief, Education and Community Involvement Branch, NIH, National Human Genome Research Institute*
David Kaufman, PhD, *Program Director, NIH, National Human Genome Research Institute*

Reporter: Amy J. Hawkins, PhD, *University of Utah*

Background

The National Human Genome Research Institute (NHGRI) has launched a new round of strategic planning that will establish a 2020 vision for genomics research aimed at accelerating scientific and medical breakthroughs. Five initial areas of strategic planning were identified to capture the initial input: (1) Basic Genomics and Genomic Technologies, (2) Genomics of Disease, (3) Genomic and Precision Medicine, (4) Genomic Data Science, and (5) Society, Education, and Engagement. The strategic planning can be explored in greater detail on the NHGRI website and by viewing a recorded presentation by Eric Green, M.D., PhD, "En Route to a 2020 Vision for Genomics: The Next Round of NHGRI Strategic Planning", from the 82nd meeting of the National Advisory Council for Human Genome Research. The presentation can be viewed using the following link: *https://www.genome.gov/genomics2020/*.

Elizabeth Tuck, Carla Easter, and David Kaufman each facilitated a small group discussion to gather input related to the fifth area of strategic planning: Society, Education, and Engagement. SciEd conference attendees served as stakeholders in science education and participated in strategic planning for the Genome Institute by identifying the current and future needs of K–12/undergraduate educators and healthcare providers to enhance genomic literacy in their students and patients, and by proposing opportunities to enhance the training of a diverse workforce in genomics. The session also served as an opportunity to highlight currently existing genomics educational resources that were collected, vetted, and organized by NHGRI to commemorate the 15th anniversary of the completion of the Human Genome Project in April 2018. These resources can be viewed at the '15 for 15' section of NHGRI website: *https://www.genome.gov/27570876/15-for-15-celebration/*.

SciEd Attendees Identified the Following Questions and Needs:

- How can we better communicate about results from genetic testing? Some patients are confused about what ancestry results mean and how risk for a genetic condition is different than ancestry testing. It's also difficult to communicate about uncertain results from genetic testing, such as letting patients know that a genetic test didn't provide any more information relevant to their condition.

- Patients are confused about privacy protections for their genetic data or lack thereof. How can we communicate about concerns for genetic privacy without fear mongering?
- The accessibility of genetic data and testing results may prove to be challenging. Patients already have enough trouble collecting their non-genetic medical records and passing them along to the appropriate health professionals. Can we expect that patients with genetic results or even their whole exome or genome will be any different?
- Some patients and families already have misplaced hopes about what we're currently capable of doing. For example, we're not currently capable of implementing CRISPR-based techniques to fix pathogenic genetic variants. How should we dial back expectations and continue to not oversell what genetic testing and eventually genetic therapy can do?
- There is a lack of credible, reliable, and free resources with information presented at varying levels of health literacy and complexity about genetics. Historically the Online Mendelian Inheritance in Man (OMIM) has served as a credible and freely available scholarly resource, but public funding for this resource may not continue.
- Who are the gatekeepers of genetic information? If new information comes to light about a variant that you have tested for, would you at some point in the future receive a push notification about that variant to your smartphone? Once people have had some genetic testing, how will they be able to opt out of knowing more information?
- We need better legal frameworks to guide decision-making about genetic information and to know how those frameworks vary on a state-by-state level. For example, in some states patients can opt out of newborn screening, while in other states they cannot.
- We need models of decision-making about genetic testing. What different narratives exist to validate some people's concerns and ultimately their decisions?
- We need to ensure that everyone realizes the benefits of genomic testing and personalized medicine. We need to take special care to avoid marginalizing groups of people who have been historically excluded or left behind. When considering equalizing access to genetic testing and genomics-based care, one participant related a suggestion from George Church: genetic information is so valuable that consumers ought to be compensated for their genetic information, rather than having consumers pay to obtain their genetic information.
- We need to pay special attention to the language we use to talk about genomics. It's easy to lapse into academic or fatalistic speech.
- We need to consider that genomics will have a different value to different people. For some, it may be a source of empowerment.
- We need to identify the components of a baseline of genomic literary; these would include concepts about numeracy, risk, and inheritance. What else should be included?

Participants:

Marisa Almonte, City of Hope

Abbey Thompson, Stanford University

Amy J. Hawkins, University of Utah

Andrea Panagakis, Salish Kootenai College

Mary Larson, Salish Kootenai College

Nicole Garneau, Denver Museum of Nature & Science

Helene Starks, University of Washington

Mary Kay Hickey, Cornell University

Donna, Sullivan, University of Mississippi Medical Center

Davie Micklos, Cold Spring Harbor Laboratory

Tim Herman, Milwaukee School of Engineering
Daniel Williams, Shelter Island High School
Marnie Gelbart, Harvard Medical School
Nancy Moreno, Baylor College of Medicine
Michele Shuster, New Mexico State University
Joann Mudge, National Center for Genome Resources
Ana Kaveh, Science Museum of Minnesota
Renee Bayer, Michigan State University
Idit Adler, Michigan State University
Julia Zichello, American Museum of Natural History
Sharon Pepenella, Cold Spring Harbor Laboratory
Stephen Koury, University at Buffalo
Charles Wray, The Jackson Laboratory
Eileen Dolan, University of Chicago
Michelle Ezeoke, Georgia State University
Maurice Godfrey, University of Nebraska Medical Center
Louisa Stark, University of Utah

Is Science Learning and Inquisition a One Way Street? Children Teaching Parents/Teachers: Lessons Learned When Teaching Roles Reverse—the Children become the Teachers!

Facilitators: Douglass Coleman, *Program Director, BOOST at Duke Medical School*
Brenda E. Armstrong, MD, Professor of Pediatrics/Pediatric Cardiovascular Medicine, Duke University School of Medicine
Reporters: Brenda E. Armstrong, MD, *Duke University School of Medicine*
Douglass Coleman, *Duke University School of Medicine*

Abstract

A component of the BOOST Program, a partnership between the Durham Public School System and Duke University School of Medicine, challenges the traditional rubric for teaching, where a "trained" teacher instructs students. At the conclusion of our Summer Science Immersion Week, during our year-end Science Symposium and throughout their research project build, lab visits, and field trips, BOOST scholars become the educators. We facilitate organized teaching by BOOST-scholar participants and formalize parent/guardian involvement as learners. This role reversal has had the unexpected benefit of providing parents and primary care givers the opportunity to navigate the traditionally-difficult task of "talking to teens" about crucial social topics, while communicating their excitement about developing an understanding/appreciation of science and technology concepts in an amazingly successful role-reversal. A model for the future!

Lessons Learned/Shared

- Understand that traditional teaching "turns off" even the brightest minds in the classroom, even with the most innovative programming; we need to develop techniques to get around traditional "one-way teaching"[teacher to student]. This means acknowledging that "kids DO have more knowledge" than they are given credit for.
- Use the evolving relationships with adults to dismantle the notion that "schools are a threat" and not a refuge for learning.
- Develop a curriculum to address "how things work".
- Consider multi-skill/age level programs to foster scaffold mentoring among the kids.
- Allow the kids to be "irreverent" in their vocalizing fear of science concepts.
- Involve parents/guardians in the development of thematic topics; aim for identifying best practice(s) development for teaching concepts.
- Engage parents as "another set of teachers": train the parents/guardians.
- Use creative strategies to engage parents in identifying the "science" in life processes to make science logical and "fun".
- Acknowledge that kids DO have understanding of and can identify science in every day processes to develop mutual communication.
- Engage parents in the development of projects "outside of the classroom".
- Scaffold mentoring to engage children at multiple developmental stages, promote leadership, and

reinforce concepts of role models at multiple stages.

- Have Scholars present selected topics that explain natural scientific phenomena relevant to everyday life.
- Emphasize "education through relevant dialogue". Have Scholars select topics that allow parents and Scholars to discuss science TOGETHER.
- Introduce and create relevant science/tech curriculum with practical application in the Scholars' environment as a vehicle for common discussion with parents.
- Develop the concept of "near peers" to bring slightly older and more advanced students in science/tech to participate in graduated science concepts to reinforce standard curriculum.
- Consider including parents as part of an advisory group to leverage efforts to increase capacity of programs at multiple levels; train parents as spokespersons for the programs.
- Create "TOUGH TALK" spaces using effective conversations. Start with trust building among parents and emerging adolescents through "talking science", for example how do we do "education" AND dialogue? Are they one and the same?
- Develop kits using parents/guardian TOGETHER for science/tech units.
- Create non-traditional resources to recruit new students to programs. Couple individuals without identified parents/guardians with others who are willing to mentor students without traditional parental supports
- Involve teachers in teams with parents/children.
- Develop inquiry-based curricula and integrate with traditionally taught curricula.
- Create "summer camp" experiences with significant parental involvement and visibility, especially when field trips are central to programming.
- Train everyone in the program; develop standard training modules that can be replicated.
- Incentivize teacher involvement.
- Identify areas where there are traditional "taboos" for under-exposed/represented/resourced families and immerse these families in the program during summer and school breaks, e.g., spring break, fall break, etc.
- Develop content-based kits created JOINTLY by children, parents, and counselors.
- TRAIN all facilitators, counselors, and teachers.
- Evaluate regularly using ALL participants and a facilitator; give families, especially the children, the ability to evaluate the program and curriculum and to suggest improvements.
- Incorporate "tough talks" as part of programs.
- Create rewards using an "Idea forum".
- Involve local news outlets to highlight the benefits of participation and highlight program accomplishments.
- Create Summer Scholars programs: "naming" participants, e.g. "Scholars"/"Emerging Scientists", "Science Stars", "Innovators", etc.
- NAME the Program PARTICIPANTS, e.g., Banneker Scholars, and "brand" their program gear.
- Include the parents/guardians/teachers/counselors in all publicity about the program.

Participants:

Duke University School of Medicine: BOOST (Building Overtures and Opportunities in Science and Technology

Baylor University: NASA Project

University of Texas at San Antonio

Wheeling Jesuit University, West Virginia

Seattle Children's Institute

Georgia State University

Flint Community College/Michigan State University Collaboration: Health in Our Hands

University of Texas/Austin

Boston Afterschool Programs

Rocky Mount NC/STEM/Health Outreach

Ohio State/Young Scientists Advancing Teachers

Maximize Mentoring: Examining the Mentor Side of Mentoring

Facilitator: **Kelley Withy, MD,** *Professor of Family Medicine and Community Health; Director, Hawaii/Pacific Basin Area Health Education Center (AHEC), John A. Burns School of Medicine, University of Hawaii*

Panelists: **Kelley Withy, MD,** *University of Hawaii*
Loran Carleton Parker, PhD, *Associate Director and Senior Evaluation and Research Associate, Evaluation and Research Learning Center, Purdue University*
Lindley McDavid, PhD, *Evaluation and Research Associate, Evaluation and Research Learning Center, Purdue University*
Gwendolyn M. Stoval, PhD, *Clinical Assistant Professor, Freshman Research Initiative Director, High School Research Initiative, University of Texas at Austin*
Liliana Bronner, MHSA, MBA, *Assistant Professor and Clinical Education Manager, UNMC SEPA Program, Department of Family Medicine, University of Nebraska Medical Center*
Adrianne Fisch, *Engagement Program Manager, Purdue University College of Veterinary Medicine*

Reporter: **Alicia Boards,** *University of Cincinnati*

Effective Mentoring

Mentors should give ownership to the students and allow them to manage their mentoring. For example, the University of Nebraska's mentoring program began with a free lunch session for students in order to gain a better understanding of students' knowledge of mentoring. Many students did not understand the value they could receive from a mentor in their academic learning spaces. Furthermore, minority students did not have a clear idea of the benefits a faculty mentor, in their own field, could offer them. From this meeting, students went on to create their own mentoring program. Students sought out community resources on mentoring programs, services, and outreach efforts offered to young people. They used the resources to create their own application and recruit faculty to mentor students. The newly developed mentoring program was promoted through news and video stories, which were disseminated across the college. Students wanted both formal and informal mentoring; therefore, figuring out ways to have a structured program was necessary. Along with having a contract between a mentor and a mentee, the faculty needed training and resources on how to mentor students that were outside their department. The biggest challenge that the University of Nebraska has faced is that people don't know when the relationship ends. Most of the faculty members involved are junior faculty members; incentives for participation include the college counting faculty participation toward their promotion and tenure and providing letters to include in their promotion packet. The sense of student agency, which was created by the student-driven initiative to build the mentorship program, is a key aspect to the success of this young program.

Faculty Training Process

- Lasts 40–45 minutes long
- Defines mentorship
- Describes different mentoring relationships
- Provides overview of what mentoring is and what happens in this relationship
- Occurs over the lunch hour to get as many faculty as possible
- Offers separate meetings for faculty who do not make the training session

Follow Up

- Template of contract and faculty training will be sent to session attendees via email.
- Highly recommend having a mentoring training session on age-specific ways to mentor for next year.

Mentoring Program Evaluation

The main purpose of the mentoring program at Purdue University is to train and support doctoral veterinary medicine students to deliver a science education curriculum at a local community center located in an under-resourced neighborhood. The evaluation of this SEPA grant-funded program was to examine how the experience of becoming mentors/role models for K–5 students might change perspectives or engage the doctoral students to grow as incoming veterinarians. The curiosity to evaluate came from an observation of how students are initially timid, but by the end of the program, the students are inserting more of who they are. The evaluation was framed in evaluation theory around social context and emphasized support and growth for youth well being. The hope is that students can grow certain capacities and will seek out future community opportunities once they are practicing veterinarian medicine. The evaluation of this program was focused on exploring how students feel about engaging in a community that looks different from them and how likely as a science professional are they to engage in the community afterwards. The program also allows the students to gain skills that will enable them to better engage with a diverse range of clients.

Evaluation Methods and Results

Cohorts are usually 10–15 students; the total number of students included in this evaluation was N=33. Students were surveyed in the beginning of the program and at the last curriculum session. Students also participated in two 90-minute focus groups.

The survey data did not change much between the first and second survey. The focus group data gave contradicting results. In the focus groups, students were given the opportunity to share their narratives and give rich descriptions of their experiences. From the focus groups, researchers uncovered three themes:

- Perceptions and understanding.
- Growth as a future veterinarian. The students gained skills, including increased understanding of how to deal with emotional needs and how to deliver sensitive information. They practiced these skills with little risk.
- Personal growth. The students recognized and empathized with other people. They learned to interact in a positive manner with others who may not act or look like them, to self-regulate implicit biases, and to recognize the value of being integrated in the community.

Summary

The sample size was small; therefore, survey/quantitative data may not be too telling. Next time, they would do a retrospective design instead of pre and post surveys. This was the first time they included mentor voices in the evaluation. Recommendations for doing evaluations of programs such as this mentoring program are to integrate theoretical-based principles to support well-being, persistence, and retention. Make sure programs emphasize organization, support student success and failures, encourage students to apply their strengths, and provide knowledge and training necessary to help in new environments, cultures, and contexts.

Follow Up

- Training that the vet students go through will be shared via email.
- Training includes
  - Online
  - Finish at their own time in 2.5–3 hours
  - Short assignments to submit
  - Content includes materials around being culturally responsive in a classroom and basics, such as how to your answer questions and scenarios
  - Reflection to allow students to think about their own background
  - Exercises to help students think about where they came from

Recruiting, Training, and Rewarding Mentors: Lessons Learned

This program consists of approximately 30 undergraduate student mentors that help lead a biochemistry course at the University of Texas at Austin. All the mentors have previously taken the course and use more of a near-peer model approach. To recruit, it's important to leverage the benefits.

Benefits include:

- Course credit
- Leadership role
- Payment
- Requirement for advanced researchers
- Volunteer experience
- Outreach opportunities

To incorporate leadership opportunities, there are positions that students can carry out in both lab and class (i.e., coordinator, team leader, senior tech manager, ambassador, safety officer). Each mentor signs up for an elective course titled "Peer Teaching"; having a class associated with becoming a mentor is the best way to recruit and retain mentors. Programs such as this build a culture of mentorship in the classroom and lab and have a "menu" of options for mentors to mentor; students can always start small then "grow out" the program through the assigned leadership roles. The culture/atmosphere being created through the opportunities to interact and engage assists in creating a "family" of mentors.

What are the key ingredients of a trained mentor?

- Make it relevant; it must make sense. Put it in context.
- "Feathers in the cap"- at least one step ahead of students by having time to gain more technical and advanced skills. This gives confidence and breadth to engage in different mentoring relationships.
- Training must be continuous.

Weekly meetings consist of

- Review day-to-day components.
- Make announcements: what students will be doing.
- Advance their own skill set through practice and develop technical skills.
- Give mentors quizzes; the score does not count toward a grade. The goal is for them to figure out where they are in the learning process and what areas they need to focus on in their technical training so they can identify the resources and skills they most need.
- Work on some sort of mentor soft skill (case studies).

What is a mentor? A mentor provides psychosocial support, technical expertise, and connection to resources.

Reward of Mentorship

- It's "INTRISICALLY AWESOME!"
- Feedback from students help the mentors grow
- Mentor security (asked to come back)
- Option of choice and getting leadership roles
- Recommendation letters
- Social events

Participants:

Shaunna Garner, North East Independent School District
Maureen Munn, University of Washington
Erin Hardin, University of Tennessee
Donna Cassidy-Hanley, Cornell University
David Holben, University of Mississippi
Isela Rodriguez-Bussey, Georgia State University
Adrianne Fisch, Purdue University
Loran Parker, Purdue University
Behrous Davani, NIH/NCI
David Clayton, University City Science Center
Michael Kennedy, Northwestern University
Lisa Harlan-Williams, University of Kansas Cancer Center
Emily McMains, Dana-Farber/Harvard Cancer Center
Patrice Saab, University of Miami
Cherilynn Shadding, Washington University
Carol Merchant, NIH/NCATS
Timothy Indahl, Mayo Clinic
Charlie Geach, American Physiological Society
Margaret Sheben, American Physiological Society
Mike McKernan, The Jackson Laboratory
Steven Azeka, New York University
R**enee Hesselbach,** University of Wisconsin Milwaukee
Alicia Boards, University of Cincinnati
Kelley Withy, University of Hawaii
J**ennifer Wiles,** NIH/NIGMS
Leah Clapman, PBS NewsHour
Lindley McDavid, Purdue University
Gwendolyn Stovall, University of Texas at Austin
Rosemary Riggs, University of Texas Health Science Center at San Antonio

Measuring Students' Self-Identification with Research Using a Novel Researcher Identity Instrument

Facilitators: Ben Koo, PhD, *Program Coordinator, Science & Health Education Partnership, University of California, San Francisco*
Shruti Bathia, *Doctoral Student, University of California, Berkeley*
Reporter: Shruti Bathia, *University of California, Berkeley*

In this session, we learned about the San Francisco Health Investigators' SEPA project at the University of California, San Francisco that engages students in health-related research. Currently in its third year, this SEPA project has developed curriculum around research in infectious diseases, antibiotic resistance, and cancer.

As part of a project, the evaluators are interested in understanding whether the researcher identity of a student increases because of taking part in this program. It is important and difficult to measure the researcher identity of students engaging in research. One can use the four-stage Bear Assessment System, developed by Professor Mark Wilson at University of California, Berkeley, which includes (a) construct mapping, (b) item design, (c) outcome space, and (d) measurement model.

In the first phase, construct modeling, it is important to determine what are we trying to measure and how many dimensions of it exists. For example, the Researcher Identity instrument was determined to have four dimensions:

- Self: The extent to which a student identifies himself/herself as a researcher.
- Fit: The extent to which a career in research fits into a student's future goals.
- Community: The extent to which a student feels a part of the research community as a whole.
- Agency: The extent to which a student feels ownership and is empowered to be able to use his/her research to bring about a change in the society.

In the second phase, item design, we determine the type of items (Open Response, Likert Type, Guttman) that would best represent what we are trying to measure. The most common form of instrument being used in social science research is surveys; however, the scope of possible instruments includes interviews, observations, focus groups, and other methods of data collection.

In the third phase, outcome space, we determine the numerical value of each response. We are assigning numbers to student responses, which will be used later for data analysis. It is very difficult to assign numbers to open responses; therefore, it is important to use the construct map that was developed in the first phase as a scoring guide.

In the fourth phase, the measurement model, we analyze the data to provide useful inferences from the numbers that we came up with in the third phase. Our data analysis largely depends on the type of question(s) we are asking.

In the pilot stage of instrument development, it is important to keep testing items and reiterate the four-stage process till we are completely confident with our instrument.

One also has to check for reliability and validity and then the instrument is ready for use.

Participants:

Sharolyn Kawakami-Schulz, NIH/NIGMS

Anja Scholze, The Tech Museum of Innovation

Rayelynn Brandl, Montana Tech

Amanda Jones, Seattle Children's Research Institute

Karin Chang, University of Kansas

Ruchita Patel, Rockman et al

Anne Westbrook, BSCS Science Learning

Holly Brown, US Army Medical Research and Materiel Command

Madison Spier, Texas A&M Health Science Center

J Michael Wyss, University of Alabama at Birmingham

Jill Rhoden, University of Texas at Austin

Christopher Villa, Helix Solutions

Tania Jarosewich, Censeo Group

Grace Stallworth, University of Nebraska-Lincoln

Ido Davidesco, New York University

Bret Hassel, University of Maryland School of Medicine

Christopher Pierret, Mayo Clinic

Using Self-Acquired Fitness and Performance Data to Motivate STEM and Health Literacy

Facilitator: **Donald DeRosa, EdD,** *CityLab Director and Clinical Associate Professor, Boston University*

Panelists: **Carla Romney, DSC,** *Associate Dean: STEM and Director of Pre-Health Education, Fordham University*

Carl Franzblau, PhD, *Professor, Boston University School of Medicine*

Reporter: **John Halloran,** *Connetquot High School*

Initial Program Goals

- Engage students in data analysis in a manner consistent with the Next Generation Science Standards.
- Capitalize on the popularity of fitness trackers as a means to engage students in science research.
- Increase interest in STEM fields and careers in underrepresented minorities in an urban area.
- Develop a partnership with SEA, a program with a shared goal of increasing urban minority enrollment in college programs.

Pilot One: The program was designed to have students use Polar Gofits during Squash practice.

Key Points

- Few fitness trackers offer anonymous data collection, which is imperative for use with student health data.
- Initial student reaction was positive and raised awareness of impact of stress on heart rate.
- Student interest waned because of a lack of connection to Squash performance.

Pilot Two: After consulting with coaches and trainers, the program was changed to employ the Fitlight trainer system. The new system was demonstrated, and videos of students using it were presented.

Key Points

- Student found the data had a greater correlation with their Squash training.
- Investigations should be designed with both teacher and coach goals in mind to increase program success.

Workshop Summary

The Fitlight Training system offers a unique opportunity to engage students in authentic research and data analysis by incorporating their passion for sports with authentic science research. By developing investigations that look at reaction times and physiology of students as they practice their preferred sport, the students become more invested in the subsequent data analysis. Investigators should be thorough in the investigation of devices they employ, as many fitness trackers on the market do not guarantee health data confidentiality.

Participants:

Wendy Suzuki, New York University
Stephanie Tammen, Tufts Medical School
Nathan Berger, Case Western Reserve University
John Halloran, Connetquot High School
Cathy Morton, West Virginia University
William Folk, University of Missouri
Sarah Henes, Georgia State University
Joan Griswold, University of Washington
Lori Kudlak, Wheeling Jesuit University
Jackie Shia, Wheeling Jesuit University
Elizabeth Danter, New Knowledge Organization Ltd.
Alison Kieffer, The Jackson Laboratory
Carl Franzblau, Boston University
Carla Romney, Fordham University
Donald DeRosa, Boston University
Where to Publish SEPA Outcomes

Where to Publish SEPA Outcomes

Facilitators: **Virginia Shepherd, PhD,** *Research Professor and Director, Center for Science Outreach, Department of Teaching and Learning, Vanderbilt University*
Jennifer Ufnar, PhD, *Research Assistant Professor of Teaching and Learning, Vanderbilt University*

Panelists: **Kristin Bass, PhD,** *Senior Research Associate, Rockman et al*
Ann Chester, PhD, *Assistant VP for Health Sciences, West Virginia University*
Mary Jo Koroly, PhD, *Research Associate Professor of Biochemistry and Molecular Biology, and Director, Center for Pre-Collegiate Education and Training, University of Florida*
Peter Lindemann, *National Science Teachers Association*
Marsha Matyas, PhD, *Director of Education Programs, American Physiological Society*
Julia McQuillan, PhD, *Department Chair and Professor of Sociology, University of Nebraska-Lincoln*

Each panelist reported on a specific journal or journals in which SEPA projects might publish their work. They discussed topics such as type of articles accepted, time to publication, review process, costs, number of issues per year, etc. The following is a list of journals that were discussed:

- Academic Medicine
- Advances in Physiology Education
- CBE-Life Sciences Education
- Electronic Journal of Science Education
- Elementary School Journal
- Journal of Clinical and Translational Science
- Journal of College Science Teaching (NSTA; college level)
- Journal of Higher Education Outreach and Engagement
- Journal of Science Education and Technology
- Journal of Science Teacher Education
- Journal of STEM Outreach
- Professional Development in Education
- School Science and Mathematics
- Science and Children (NSTA; elementary school)
- Science Scope (NSTA; middle school)
- The American Biology Teacher

- The Science Teacher (NSTA; high school)

The panelists provided additional recommendations to those pursuing project publication:

- Get involved in how and where to publish by volunteering to review for journals that you think might be a good fit for your work.
- Consider your audience when you select a journal: teachers, scientists, educators, etc.
- Know the journal. Although Advances in Physiology Education has "physiology" in its name, it publishes any area of science and all levels. The American Physiological Society also has a digital library that researchers can contribute to.
- Read articles that have been published in a journal that you are considering before you decide to submit to that journal.
- Write to the editor and ask if he/she thinks that your abstract/article idea would be a good fit for that journal.
- Think of your manuscript as a story or narrative and write it in a way that you would like to read.
- Avoid journals that do not have a good track record in terms of publication times or do not have a good impact factor. With respect to the Journal of STEM Outreach (JSO), there will not be an impact factor for a while. You can help increase the impact by citing previous articles from the JSO.
- Take notice of the time involved in getting published. NSTA journals are peer reviewed and often have a long lead time to publication: i.e., the high school journal may take >9 months from submission to publication.
- Write publication fees into SEPA and other grants.

Participants:

Virginia Shepherd, Vanderbilt University

Jennifer Ufnar, Vanderbilt University

Ann Chester, West Virginia University

Marsha Matyas, American Physiological Society

Julia McQuillan, University of Nebraska-Lincoln

Kristin Bass, Rockman et al

Mary Jo Koroly, University of Florida

Rob Rockhold, University of Mississippi Medical Center

Krishan Arora, NIH/NIGMS

Anna Gossin, University at Buffalo

Marie Barnard, University of Mississippi

Margery Anderson, US Army Medical Research and Materiel Command

Kim Soper, University of Nebraska Medical Center

Alana Newell, Baylor College of Medicine

Melani Duffrin, East Carolina University

Virginia Stage, East Carolina University

Tracy McCarty, La Red Hispana

Barbara Hug, University of Illinois at Urbana-Champaign

Brenda Koester, University of Illinois at Urbana-Champaign

Megan Mekinda, University of Chicago

Jeanne Chowning, Fred Hutchinson Cancer Research Center

Keynote Address
Thursday, May 31, 2018: 8:30–9:30 AM

Teachable Moments: The Pressing Need for Science Journalism

Speaker: **Miles O'Brien,** *Science Correspondent, PBS News Hour*
Facilitator: **Ann Chester, PhD,** *Assistant VP for Health Sciences, West Virginia University*
Reporter: **Melani Duffrin, PhD,** *East Carolina University*

Miles O'Brien, PBS News Hour science correspondent, discussed the importance of responsible scientific journalism. Consumer market demands for responsible scientific journalism has decreased over the past few decades, resulting in an increase of public misunderstanding of science and a decrease in science reporting.

Now more than ever, consumers of scientific media have to be careful in interpreting and understanding scientific reporting because there is a lack of knowledgeable reporters. In addition to the lack of knowledgeable reporters, more information is appearing on the web from unreliable sources. Often, individuals have an agenda to misinform the public.

Post session questions thematically addressed the issues related to the concern of irresponsible reporting of scientific information. Mr. O'Brien emphasized the importance of continued advocacy for the public understanding of science and shared that his live internet coverage, as well as his PBS show, help to address these issues.

He encouraged the audience to continue to support PBS because it is one of the few media outlets that promotes quality scientific journalism.

Keynote Address
Thursday, May 31, 2018: 9:45–10:45 AM

Science in Society: The Role of Informal Science Education and Community Collaboration

Speaker: **Cristin Dorgelo,** *President and CEO, Association of Science-Technology Centers*
Facilitator: **Kristin Bass, PhD,** *Senior Research Associate, Rockman et al*
Reporter: **Melani Duffrin, PhD,** *East Carolina University*

Cristin Dorgelo is an experienced executive with nearly 20 years of success in leading technology and public policy organizations. Cristin most recently served as Chief of Staff at the *White House Office of Science and Technology Policy* (OSTP) from July 2014 to January 2017. As Chief of Staff to the President's Science Advisor and the U.S. Chief Technology Officer, Cristin facilitated policy development and implementation across a broad spectrum of science and technology issues.

Her talk highlighted six areas of importance to science education in America. She discussed issues related to Emerging Technologies, Data Science, Eco System is Evolving, Partnerships and Networks, Community Engagement and Participatory Science, and Place and Community. It is her professional opinion that each of these areas are of significant importance to discussions when designing public policy related to science education and advancing scientific discovery.

Cristin concluded her talk with key questions related to her six emerging themes. She asked how might we

- Shape the evolving nature of the STEM learning ecosystem
- Reach beyond the wall to collaborate with others
- Fund and scale promising models
- Foster teams that reflect the diversity of the communities we serve and develop rewarding career paths
- Source new ideas, tools, and approaches from peers within the field and form other sources
- Understand the implications of new scientific research and keep our eye on the horizon
- Build equity into our future systems and counter bias
- Put community aspirations and hopes at the forefront of our work

These concepts were presented to prompt the audience to generate ideas in these areas.

At the conclusion of the presentation, the audience asked questions that expanded discussions on the aforementioned concepts.

Breakout Sessions
Thursday, May 31, 2018: 11:00 AM–12:15 PM

Addressing Successes and Challenges in Implementing Rigorous Evaluation Designs

Presenters: **Dina Drits-Esser, PhD,** *Senior Research Associate, Genetic Science Learning Center, University of Utah*
Marie Barnard, PhD, *Assistant Professor of Pharmacy Administration and Research Assistant Professor, Research Institute of Pharmaceutical Sciences, University of Mississippi*
Kristin Bass, PhD, *Senior Research Associate, Rockman et al*
Reporter: **Jenica Finnegan, MA,** *University of Nevada, Reno*

Session Report

This session focused on topics related to rigorous evaluation, project design, and unforeseen challenges in implementation. Participants in this session had the opportunity to look at several case-based scenarios to develop a deeper understanding of some of the challenges of conducting an RCT and QED. The following provides a summary of the topics that were discussed:

1. Considerations in planning: Proactive planning can reduce challenges that may arise later on. Session participants and presenters agreed that conducting a needs assessment to collect information about major variables that affect the project (i.e., teacher and student access to technology) is a critical step to undertake prior to attempting treatment implementation. Involving teachers in the study's design and using a participatory design are effective ways for researchers to understand barriers participants may face.
2. Minimizing participant attrition: Attrition is a common challenge for many SEPA researchers. To minimize it, attendees suggested giving participants a detailed overview of what is required of them. Once the overview is presented, avoid adding any additional obligations to the agreement. This helps build trust and ensures that clear expectations are set from the beginning. Programs have also been successful in reducing attrition by tying a signed agreement to participant compensation.
3. Working with an external assessment partner: Facilitators noted that there is great value in working with a psychometrician because so many outcomes depend on the quality of measures. Depending on the data sources available, there are sophisticated models such as Rasch modeling and Item Response Theory (IRT) that can be used. Session participants were encouraged to read an article, "A Primer for Developing Measures of Science Content Knowledge for Small-Scale Research and Instructional Use" (Bass, Drits-Esser & Stark, 2016) to learn more about the advantages. Cost was the biggest challenge mentioned in collaborating with external evaluators.
4. Randomized controlled trials: Session attendees posed a couple of questions: (1) Do we need RCTs or can we do a well-matched comparison instead? (2) In a social science context, whom does an RCT serve at an environmental level? Facilitators suggested that RCTs are the ideal because if researchers start with an RCT and it does not work out researchers can still have a rigorous study

design. However, the reality is that for many projects it is pragmatically unmanageable. Evaluations are very project driven, and evaluators should look at the end goal of a project to determine what it is they are trying to accomplish; in many cases, an RCT is not appropriate. Researchers are encouraged to create the most robust design possible for their proposed projects, while keeping within their allocated evaluation budget.

5. Publications: Writing papers aimed at science teachers gives visibility to SEPA programs and shares our data. Session attendees advised pre-post or program model publications are possible without conducting an RCT. Attendees noted that several journals accept different kinds of papers. With other program obligations and time issues, can SEPA researchers increase the number of publications in these kinds of journals?
6. Other designs: In situations where school districts' resources vary significantly, a waitlist comparison can be an effective technique. Participants serve as their own control and then become enrolled in the active treatment the following year. Robust case studies are also an option when there are many variables to consider in the context in order to step down the design ladder. Ethnographic studies offer a wealth of information, but are not as common now. SEPA researchers are reminded that we are testing hypotheses, and qualitative work usually does not do that. Additionally, robust qualitative studies are challenging due to budget restrictions; external funding may be required. However, graduate students may be able to assist in collecting data by conducting in-depth interviews.

Participants:

Elizabeth Danter, New Knowledge Organization Ltd.
Manetta Calinger, Wheeling Jesuit University
Debbie Sullivan, Wheeling Jesuit University
Jenica Finnegan, University of Mississippi Medical Center
David Clayton, University City Science Center
Kevin D. Phelan, University of Arkansas for Medical Sciences
Steven Azeka, New York University
Amanda Jones, Seattle Children's Research Institute
David Holben, University of Mississippi
Ruchita Patel, Rockman et al
Andrea Panagakis, Salish Kootenai College
Virginia Stage, East Carolina University
Cindy Armstrong, University of Colorado
Julia Zichello, American Museum of Natural History
Marsha Matyas, American Physiological Society
Margaret Sheben, American Physiological Society
Lynne Holden, Mentoring in Medicine, Inc
Christopher Villa, Helix Solutions
Megan MeKinda, University of Chicago
Emily McMains, Dana-Farber/Harvard Cancer Center
Emily Mathews, Northwestern University
Michael Kennedy, Northwestern University
David Micklos, Cold Spring Harbor Laboratory
Carmela Amato-Wierda, University of New Hampshire
Helene Starks, University of Washington

Best Practices for Digital Technology in STEM Learning

Facilitator: **Paulette Jones, MRE,** *President and CEO Meadowlark Science and Education, LLC*

Panelists: **Andrij Holian, PhD,** *Director, Center for Environmental Health Sciences, University of Montana*

Georgia Hodges, PhD, *Assistant Research Scientist and Mat Coordinator, Department of Mathematics and Science Education, University of Georgia*

Reporter: **John Halloran,** *Connetquot High School*

Introduction

Video games are highly engaging and are played by a majority of school-age children. Incorporating video games as a tool for science learning would seem like a natural fit. This breakout session was divided into three sections. A panelist who had video-game development experience led each session; each panelist focused on some of the challenges and key lessons learned from their game development experience.

1. Dr. Holian: The focus of the University of Montana's interactive video game project is to develop a game that simulates authentic science research using an asbestos mitigation project as the storyline.

   Key Points

   - Engage students in the alpha and beta testing.
   - Create options at each step to allow for replay and increased performance.
   - Collaborate with teachers to ensure materials and subject matter match student's development and teacher goals.

2. Paulette Jones: Ms. Jones led a Q&A session that engaged audience members to share their experiences in video game development, specifically focusing on the basic principles of story development and how that pertains to the process of building a video game.

   Key Points

   - Highlighted the importance of involving the target audience in the development process.
   - Encouraged the use of backward design with the NGSS standard as the goal because that is what teachers are more likely to be focused on.
   - Pointed out that the use of characters often depends on the students' age; younger kids prefer cartoons and older students identify more with life-like characters.

3. Dr. Hodges: Dr. Hodges, a former biology teacher, presented her experiences as she moved from the classroom to educational video game programmer; she shared lessons learned from both sides of the equation. The most recent game she developed focuses on teaching students in grades 3–5 about human body systems using simulations and animations.

   Key Points

   - Student engagement can be increased by giving students the opportunity to create their own avatar.

- Games should be tested in schools on school hardware in order to troubleshoot technical issues before deployment.
- Teacher input is critical at all stages of development.
- Developers need to recognize teacher's strengths lie in their knowledge of pedagogy; this is an asset in game development.

Lessons Learned

Most school-age children have a natural attraction to video games. By involving teachers and students in the development process, video games can be successfully developed to be both an engaging and impactful tool used to teach students about the process of science research.

Participants:

Crisianee Berry, Nerd Clutch

Madison Spier, Texas A&M Health Science Center

Grace Stallworth, University of Nebraska-Lincoln

Brinley Kantorski, The Partnership in Education

Sarah Henes, Georgia State University

David Micklos, Cold Spring Harbor Laboratory

John Halloran, Connetquot High School

Wendy Suzuki, New York University

Jackie Shia, Wheeling Jesuit University

Rita Karl, Twin Cities PBS

Holly Brown, US Army Medical Research and Materiel Command

Juli Rose, NIH/NIGMS

Stephanie Older, NIH/NIGMS

Stephanie Tammen, Tufts Medical School

Ashlyn Sparrow, University of Chicago

Paulette T. Jones, Meadowlark Science and Education, LLC

Andrij Holian, University of Montana

Georgia Hodges, University of Georgia

EmilyKate McDonough, Tufts Medical School

It's Less About Content Than We Think: Centering Community Rituals and Relationships as Core Science Education Practices

Panelists: **Katherine Richardson Bruna, PhD,** *Associate Professor, Iowa State University (via satellite)*
Ann Chester, PhD, *Assistant VP for Health Sciences, West Virginia University*
Marlys Witte, MD, *Professor of Surgery, University of Arizona College of Medicine Maurice Godfrey, PhD, Professor, University of Nebraska at Omaha Medical Center*
Kelley Withy, MD, PhD, *Professor of Family Medicine and Community Health, Director of the Hawaii/Pacific Basin Area Health Education Center, University of Hawaii, John A. Burns Schools of Medicine*

Reporter: **Shaunna Garner, M.Ed.,** *Teacher Enrichment Initiatives, UT Health San Antonio, NorthEast Independent School District, San Antonio, Texas*

Dr. Bruna: Harambee Beginning Ritual

Dr. Bruna started the session by leading all of the participants in a beginning ritual she calls Harambee. All participants stood in a circle and sang along with her Harambee chant, which she performs each day with the kids at her Young Scientists: Mosquitoes and Me Summer Camp. The purpose of the ritual is to break down barriers and should allow students to form relationships with one another before engaging in the hands-on activities. Following the Harambee chant, students share recognitions or celebrations within the group and have the option of demonstrating a special talent that demonstrates their personality. This ritual allows students to be who they while in a safe place. After the ritual, Dr. Bruna shared aspects of her Young Scientists summer camp activities, such as developing mosquito traps using authentic science tools. The focus of her camp is for the students to feel like scientists while having fun creating and doing hands-on, innovative learning. Students also have the opportunity to discuss the ecology and epidemiology of mosquitoes.

Dr. Withy: Health Careers Mentorship Program

Dr. Withy spoke about the mentorship program she has implemented in Hawaii with middle school students and students in a gap year of college. There is not a standard schedule; the program is all about structure, not form. She works with roughly 26 students in health career schools, who engage in quarterly social events and celebrations (i.e., smoothie/ice cream social and formal celebration with family). Family buy-in plays an important role in the overall success of the mentorship program. Awards and certificates are handed out at the formal celebrations. Newsletters are sent out relaying the successes and accomplishments of the program, as well as individual student's successes. Dr. Withy's goal is to portray the various avenues of health careers students can become involved with so students incorporate research in program activities and gain specific skills needed in health career settings, such as OSHA and CPR trainings.

Dr. Chester: Intrinsic Motivation

Dr. Chester has approximately 750 kids in her program. The students must keep their grades up to stay

in the program; this isn't a problem because students keep coming back due to intrinsic motivation. Dr. Chester attributes student's interest to the fact they are learning so many new things; not only are they learning about content, but they are also engaging with an array of people and making new friends. These students get to do things they don't normally get to do in a structured environment. Dr. Chester believes in building an environment that incorporates fun and friends and where there is freedom to engage in their curiosity; when that happens, the content doesn't matter.

Dr. Godfrey: Health and Science Education in Native Communities

Dr. Godfrey's focus is on native communities in Nebraska and South Dakota. This is an area with 500 tribes, 500 languages and 500 cultures. His lesson learned is that innate trust doesn't exist; it needs to be built and nurtured. His challenge was how to work together to build the relationships simply by being present, and the answer was to make learning fun. In one particular community, you can have similar interests but diverse culture. His team would go to a community and do activities for various age groups; this brought everyone together. The participants were encouraged to come in pairs or groups of three so they would not be alone. The activities performed helped hone skills that would be useful in their specific communities and would enable participants be productive citizens in their society.

Dr. Witte: Inquiry on Ignorance

In her program, over 700 high school students will be followed over a course of 30 years. The main focus is on students not being afraid to ask questions; students are to have a goal of asking three questions a day and should not be afraid to show their ignorance. The diversity of questions is one way to evaluate the success of the program. Curiosity is the passion that explores the unknown. The hungry mind vs. the problem-solving mind is the one that asks the questions and helps define the path of life.

Dr. Bruna: Ending Ritual

After the panelists spoke and the breakout sessions concluded, Dr. Bruna shared her ending ritual: the creation of clay art that you can bake and wear as beads. Her students are rewarded with a bead after answering questions based on what they learned or are still wondering about. The bonding beads are placed in a jar. At the end, students have the opportunity of making their own bracelet or necklace to remind them of their experience.

Professional and Executive Coaching in STEM Careers: When is a Good Time to Start Professional Coaching?

Presenter: **Christopher Sistrunk, PhD,** *Director of STEM Training and Education Program, City of Hope*
Marisa Bowers, PhD, *Assistant Director of STEM Training and Education Program, City of Hope*

There is a misunderstanding about coaching in the program under "Project Administration, dissemination, etc."

- Professional Coaching = $400/hour

Mentoring vs. Coaching

Mentoring

- Engages a senior colleague as a role model
- Uses specific personal and content experience to create a road map

Coaching

- Used to improve performance
- Focuses on current timeframe
- Is a professional relationship using tools to assist professional growth & development

Professional coaching is more common in other fields; STEM fields lack coaches. It is often the case that STEM professionals get coaching as they reach the pinnacle of their careers. Many discussion participants concurred that the field lacks good coaches.

A good coach will have the following skills:

- Active listening and reflective questioning
- Empathy
- Ability to identify the "driver" of the person being coached
  - Contributing/helping
  - Personal success
  - Foe, family, relationships
  - Achievement and notoriety
  - Play, creativity, entertainment
  - Belief in potential of all

Good listening is an important skill to master for any coach. The speaker presented the idea of one channel listening vs. two channel listening.

One channel listening

- Listening to give examples

- Becoming distracted by mentor/coach's personal experience

Two channel listening

- Listening to learn about subject
- Being empathic without projecting
- Paying attention to body language

Mentoring and coaching are not exclusive; an individual can play both roles.

The speaker presented the acronym SMIRC as a way to remember skills to use when mentoring or coaching.

- Stop, look and listen
- Motive: Understand the motive
- Impact: Consider the impact
- Respectful
- Candid

Participants:

Lisa Harlan-Williams, University of Kansas Cancer Center

Carla Romney, Fordham University

Emily Kuehn, US Army Medical Research and Materiel Command

Cherilynn Shadding, Washington University

Berri Jacque, Tufts Medical School

Douglass Coleman, Duke University

Lorna Gitari-Mugambi, Georgia State University

Mary Jo Koroly, University of Florida

Reading, Writing, Speaking, and Listening as a Scientist: Using Language to Introduce the Culture of Science

Presenters: **Nancy P. Moreno, PhD,** *Professor and Associate Provost, Baylor College of Medicine, Center for Educational Outreach*
Alana Newell, PhD, *Assistant Professor, Center for Educational Outreach, Baylor College of Medicine*
Sarah Aguirre, M.Ed., *Field Specialist, Center for the Inquiry of Transformative Literacies, College of Education and Human Development, University of Texas at San Antonio*
Gregory Vogt, EdD, *Assistant Professor, Center for Educational Outreach, Baylor College of Medicine*
Reporter: **Stephanie Elder, M.Ed.,** *Flint Community Schools*

In previous projects, the Baylor group created guides with science inquiry activities and matched fiction reading materials, which were often taught at a separate time. Although focused on literacy materials, the ELA and science content were offered in parallel, rather than in a fully integrated manner.

This current project bridges NGSS and ELA Common Core standards to engage 2nd grade students with nonfiction text to read, write, and speak as scientists. The premise of the project is that scientists belong to a community of practice (CoP) in which members talk, act, and think alike, and teachers help students understand "what we do as scientists"—the secret of the discipline.

The project's mini-lessons help teachers model how scientists speak (e.g., specific sentence stems) and behave, and then let students engage and lead discussions in cooperative groups. The student inquiry circles model research groups. For example, one student takes on the role of a PI. Students study famous scientists, recognize science in their world, read and write scientific texts, and create products like a scientist.

The work applies a method of literacy education to science literacy that is familiar to teachers, specifically the format of teaching text-to-self (science-to-self), text-to-text (science-to-science), and text-to-world (science-to-world). Students learn and apply specialized literacy practices and text features specific to science (e.g., figures, charts, and illustrations) to learn the language and tools used by science experts.

Project assessments gather evidence of students using science-specific approaches in their interactions with text including science vocabulary (science specific words), science concepts, scientific processes and tools, and reading strategies (How did you use reading strategies during science this week?). Students are asked to identify the language of scientists (For example, which of the following sentence stems might a scientist use before doing an experiment?), read text to answer specific questions, make connections between new and existing information, and recognize themselves as a part of the science community (How were you a scientist this week?).

The project website, BioEd Online, includes the fiction materials from the previous project and will include pilot products from this project.

Participants:

Alison Kieffer, The Jackson Laboratory
Naomi Luban, Children's National Health System
Mary Kay Hickey, Cornell University
Joann Mudge, National Center for Genome Resources
Michele Shuster, New Mexico State University
Chanelle Case Borden, NIH/NCI
Maureen Munn, University of Washington
Lori Kudlak, Wheeling Jesuit University
Chris Doyle, Montana Tech
Daniel Williams, Shelter Island High School
Abbey Thompson, Stanford University
Kim Soper, University of Nebraska Medical Center
Aaron Kyle, Columbia University
Karina Meiri, Tufts Medical School
Stephanie Messina, Ochsner Health System
Ana Kaveh, Science Museum of Minnesota
Christopher Pierret, Mayo Clinic
Timothy Indahl, Mayo Clinic
Renee Hesselbach, University of Wisconsin-Milwaukee

Sometimes It Takes More Than Two to Tango: Successes and Challenges of Partnerships for Curriculum Development, Enactment, and Dissemination

Facilitators: **Idit Adler, PhD,** *Research Associate, CREATE for STEM Institute, Michigan State University*
Renee Bayer, *Associate Director for Engagement, CREATE for STEM Institute, Michigan State University*
Stephanie Elder, Flint Community Schools
Barbara Hug, PhD, *Teaching Associate Professor, College of Education, University of Illinois Urbana-Champaign*
Louisa A. Stark, PhD, *Professor of Human Genetics and Director, Genetic Science Learning Center, University of Utah*

Reporter: **Idit Adler, PhD,** *Michigan State University*

The workshop provided a platform for participants to engage in personal and collective reflection about partners and partnerships in their SEPA-funded projects and triggered lively discussions between the participants about the successes and challenges of collaborations. It began with an activity in which the participants were asked to detail questions about partnerships in their projects. Participants' questions addressed various aspects of partnerships, including the process or steps required to establish partnerships, how to develop a shared agenda and goals, ways to sustain ongoing productive and sometimes distant collaborations, and how to navigate collaborations with various types of partners in one project.

Then each of the speakers discussed the types of partnerships in their own project:

- Louisa Stark described a partnership with scientists and teachers during the process of developing learning materials. Her project brings together teachers from all over the country to provide their expertise and develop curricular materials. This ongoing partnership between the Genetic Science Learning Center at the University of Utah and teachers is very successful; there is a growing

community of teachers that are willing to participate in the development and testing of innovative curricular materials and activities.

- Barbara Hug described her partnership with scientists at University of Illinois Urbana-Champaign to develop curricular materials. Consequently, the materials are linked to research on campus and bring cutting-edge science into the classrooms. Barbara also noted the tension between the scientific and the educational frameworks and emphasized the importance of understanding that these types of relationships take time to establish.
- Renee Bayer, Stephanie Elder, and Idit Adler described the ongoing partnership between their project, Health in Our Hands, and the Flint community and district. They detailed how the support of the community and the superintendent led to a district-wide enactment of the curriculum in all 6th grade classes in Flint. They also noted the challenges of partnerships with district and communities, such as involving parents in students' learning, being in a vulnerable situation between the district and teachers who have not volunteered to participate in the project, and dealing with less successful partnerships with additional districts.

The participants shared the various partnerships and roles in their projects, revealing interesting partners and roles, such as teachers, administrators, larger educational facilities, state-wide associations, federal groups, media organizations, business groups, outreach programs, scientists, and policy and state organizations. It was clear that networking, partnerships, and good collaborations are major goals for many of the projects. Participants also noticed the lack of potential collaborators, such as philanthropic organizations, libraries, museums, clinical partners, state legislators, students, and the media.

In the last activity, the participants were asked to grade their partnerships and share the reasons for the grades. Participants used various criteria in judging their partnerships and discussed strategies that worked for them to effectively engage partners in collaborations, including assigning mentors to work with new teachers, meeting face-to-face on a periodic basis, developing trust, allocating time to the process, compensating students and teachers, celebrating successes, aligning goals, and participating in practitioner-based meetings and conferences.

Participants:

Joan Griswold, University of Washington
Sharolyn Kawakami-Schulz, NIH/NIGMS
Debra Yourick, Walter Reed Military Medical Center
Charlie Geach, American Physiological Society
Patrick Goertz, St. Dominic Savio Catholic High School
B**ehrous Davani,** NIH/NCI
Michael Carapezza, Columbia University
Leah Clapman, PBS NewsHour
Ruben Dagda, University of Nevada, Reno
Ido Davidesco, New York University
Carol Merchant, NIH/NCATS
Bret Hassel, University of Maryland School of Medicine
Tim Herman, Milwaukee School of Engineering
Brenda Koester, University of Illinois at Urbana-Champaign
Anissa Brown, NIH
Kelley Bushheister, University of Nebraska-Lincoln
Donna Cassidy-Hanley, Cornell University
Sharon Pepenella, Cold Spring Harbor Laboratory
Rebecca Carter, Seattle Children's Research Institute
Jacqueline Krikorian, University of Maryland, Baltimore County
Patrice Saab, University of Miami

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

Facilitator: **Martin Weiss, PhD,** *Senior Scientist, New York Hall of Science*
Panelists: **Julia McQuillan, PhD,** *Department Chair and Professor of Sociology, University of Nebraska-Lincoln*
Geralyn Abinader, MSC, *Creative Producer, New York Hall of Science*
Reporter: **Laycca Umer,** *New York Hall of Science*

Overview

This session included a discussion and activities about two overlapping projects focused on introducing and creating comic books to help students understand science and science concepts. The focus is on middle school students, ages 10–14. In this panel/workshop, we discussed why we chose comics, the different kinds of comics out there, what students say about them, and what research has shown about comics, science capital, and science literacy. Attendees engaged in a hands-on activity creating their own comic based on a story about animal evolution.

Why Comics

Based on a library visit, librarians mentioned that kids want things that are graphic; they want comics. Comics naturally engage kids, who are fluent in how to read and use them. Students are familiar with how humor is used and characters are portrayed in comics. Characters can be designed to resonate with the intended audience. Accompanying materials can expand on science concepts and misconceptions, thereby helping students to better understand the complex world around them. Comics have also been shown to be good for students with developmental disabilities as well as English Language Learners.

Exploring Different Comics, Genres, and Topics

Comics come in many forms and explore a wide variety of scientific subjects such as vaccines, rocket science, disease transmission, etc. Some comics anthropomorphize non-human elements, such as cells, viruses, animals, and organelles, portraying them as intentional, emotional beings. Other comics tend to be more heavily text based, and some are more informational and shy away from fantastical comic conventions, such as superheroes and costumes.

Research About Comics

Research says that comics work. Julia McQuillan et al. did a study at the University of Nebraska-Lincoln in which 800 students in a biology class received either a comic or an essay. The students who received the comics didn't want to give them back. The researchers found that the students who identified as having a low science identity and who got a comic expressed a desire to keep reading the material at a similar rate to the students who identified as high science identity who had received the essay. So, we can make a difference just by offering comics.

Part of the research also looked at how students currently get their science materials. McQuillan et al. measured how many books students have in their house (under 10, 10–99, 100+) against other activities, such as watching science/nature shows, visiting a science museum, visiting a zoo, visiting a library, and reading comics. They found that there was a gradient with each of the activities. If a person had

less than 10 books in their house, they were generally less likely to do certain activities than students with 100+ books in their house. It has also been shown that the friends of students who participate in afterschool science clubs also benefit more than kids who don't have friends in after school science clubs. Science capital is so important for participating in society and making decisions.

Considerations When Creating a Comic

- Audience: We chose middle school students. We adjusted our story, based on the 1999 West Nile Virus Epidemic, to be more contemporary, so kids could relate to it through things like use of cell phones, the internet, and blogs/vlogs.
- Platform: Some digital comics use iOS, Android, or HTML5. We decided to use HTML5, so our comic can be used on browsers and will be available to the widest breadth of audience possible. This choice does limit the complexity of the interactive elements we could use.
- Curriculum: You must consider how this fits into what students in your target audience are actually learning about. For us, evolution and homology are not really talked about during middle school, so we focused on understanding and collecting evidence.
- Community Engagement: You want to be sure that your comic book is actually relevant and responsive to your community. For ours, we canvassed the neighborhood and took pictures that we sent to the artist. We also chose characters with diverse backgrounds to make sure we were being representative of our local community.
- Interactivity: How will you engage students in an interactive experience? We have features throughout the narrative that engage the reader in exploring science concepts as well as evidence such as popup pages that give the reader facts about real people. Additionally, we included infographics that explain things like how mosquitoes spread infection. We also included games that teach concepts, for example, a reader is a virus travelling through different vector hosts with a goal to spread infection.
- History: What is the historical context of the information you are trying to communicate? We integrated this throughout the narrative in the ways mentioned previously.

Activity and Attendee Comments

Attendees were given a story about the evolution of cheetahs. Cheetahs used to be fast and slow, some with large, heavy bones. Over time, natural selection refined these traits to cheetahs as we know them now, fast with lightweight bones. Attendees are invited to create their own comic book based on this story, share their comic books, and engage in a discussion.

- Attendee 1: Created a comic from the perspective of a herd of antelope. The antelopes get a history lesson on "look where your family comes from" so you can see how some of the ancient antelopes may or may not have passed on their genes. "I like being able to bring humor and fun into the classroom through science concepts. When you put that element of humor and illustration into the classroom...the kids smile, have fun, and learn."
- Attendee 2: "I thought about it from the perspective of wild animals, because I am a cancer researcher and a sex educator. I like the de-stigmatization of difficult subject matter."
- Attendee 3: "I thought about this from the perspective of being a mom and created this for my son. The cheetahs are sad because they didn't catch any antelope and one of them says that his bones

are very heavy. Another cheetah, that did catch an antelope, is smaller and lighter. Years later the faster cheetah will have two fast kids and one slow kid."

- Attendee 4: "I thought a lot about the different ways to anthropomorphize and how the way you do it can mean so many different things. The collaboration factor of creating comics is so interesting because the same group of kids can come at it from so many different ways."

Participants:

Cathy Morton, West Virginia University

Max Kelly, University of Utah

Alison Lin, NIH/NCI

Speaker
Thursday, May 31, 2018: 1:15–1:30 PM

NIHSEPA.org: A Website for the SEPA Community

Presenter: **Nancy Moreno, PhD,** *Associate Provost for Faculty Development and Institutional Research; Professor, Allied Health Sciences and Family & Community Medicine, Baylor College of Medicine*

Reporter: **Kristin Bass, PhD,** *Senior Research Associate, Rockman et al*

The SEPA website serves multiple functions:

- It promotes awareness for the unique roles of SEPA and other NIH-funded science and health education partnerships.
- It facilitates communication and collaboration through an enhanced user experience, project news, and editing tools.
- It disseminates SEPA and related NIH-funded resources, programs, and tools through multimedia and links to home websites.

Website developers added some new functions in 2016, including the ability to search using multiple keywords and to search by state. The site also contains pages from past and current SEPA projects, although these are only as accurate as the SEPA community makes them. The website team uploads the abstract submitted with each proposal. Those affiliated with each project need to provide additional details.

Dr. Moreno asked audience members to register on the website and update their project information. There are five steps in this process:

- Contributor registration
- Contributor profile page
- Dashboard
- Project information editing
- Annual impacts

Dr. Moreno also highlighted a new SEPA newsletter that will be populated with contributions made to the site. Dr. Moreno encouraged, "The contents depend on you!" Past editions of the newsletter will be archived on the site.

Action Items

- Register on NIHSEPA.org using the key Join@SEPA.
- Update your publications and project resources.
- Complete the Impact Survey by July 1, 2018.

Breakout Sessions
Thursday, May 31, 2018: 1:30–2:30 PM

NCI Support for Science Education

Speaker: **Norman E. Sharpless, MD,** *Director, National Cancer Institute, NIH*
Reporter: **Gwendolyn M. Stovall, PhD,** *University of Texas at Austin*

Session Report

Dr. Sharpless became the Director of NCI in 2017, and upon completing a "Look and Listening" tour, has a recent review of the NCI and the institute's focus. Dr. Sharpless described the NCI personnel and highlighted their positive effects on patients as well as their positive accomplishments. The NCI is large; it leads the National Cancer Program (e.g., Bethesda, MD, Frederick, MD, NCI-designated cancer centers, and national clinical trials network), and large financial supporters of cancer-related programs. The NCI's "process is complex" (e.g., "bypass budget," "RPG pool," etc.).

There are four areas of focus for the NCI:

- Workforce Development: Support the cancer research enterprise by focusing on the workforce of cancer investigators.
- Basic Science: Reaffirm our commitment to basic science to drive novel approaches and technologies (e.g., literately thousands of drugs in clinical trials).
- Big data: Increase data aggregation and interpretation to speed our work across the cancer enterprise (e.g., story of a young patient with brain cancer and his treatment determined by a clinical trial of just 22 people and data aggregation failure story of mutations determining the effectiveness of leukemia drugs).
- Clinical Trials: Realize in full the power of clinical trials through innovative design, administration, and analysis. One challenge is that the cost per patient has recently increased four-fold because treatments and trials have become genome sequence-specific, and the IRB approval process is complicated.

NCI has focused on tumor and patient heterogeneity, which has made treatment more effective; despite the research and trails being more complicated, the results have been promising. The "TCGA's analysis of six major types of adult soft tissue sarcomas reveals frequent copy number alterations, low mutational loads, and a diverse array of underlying molecular mechanisms," and is a wonderful dataset, but there are still limitations (i.e., larger sample size needed, etc.). Researchers have realized the tumor's microenvironment is immensely important in the host response, cancer metastasis, etc. There has been recent work to determine why cancers go to certain areas. Additionally, cancer immunotherapy provides a new therapeutic approach (e.g., lung cancer and gene therapy; myeloma treated with BCMA-targeted CAR T cells). Steven Rosenberg, MD targets the KRASG12D Neoantigen, a person-specific neoantigen, to treat cancer (NEJM 2016); other checkpoint inhibitors have been very promising. A new library of cancer images and results is available for mining.

NCI supports the workforce by investing in scientists at every career stage. Continuing Umbrella of Research Experiences (CURE) seeks to increase the size of the talent pool, emphasize scientific

areas of greatest need, and expand and extend the period of training. CURE builds an ecosystem of support; for example, R25 Youth Enjoy Science program provides early intervention and support for underrepresented students and teachers, and Intramural CURE is a new program. The new Partnerships to Advance Cancer Health Equity (PACE) fosters and supports collaborations among institutions serving underserved health disparity populations and NCI-designated cancer centers (i.e. U54 and P20).

Questions from the audience and corresponding answers:

- What information do we want to provide emerging, young researchers? Personalized medicine is coming, think entrepreneurially, and think early on about the data science at an early age (e.g., Are young students getting the right math?).
- Is there a way to provide a model to increasing diversity and addressing disparity? Cancer centers' evaluation of their approach to addressing disparity and education in the area is improving.

Breakout Sessions
Thursday, May 31, 2018: 2:45–4:00 PM

Dis...tance Research, Opportunities WE Can Create

Panelists: **Kelley Withy, MD, PhD,** *Professor of Family Medicine and Community Health, Director of the Hawaii/Pacific Basin Area Health Education Center, University of Hawaii John A. Burns School of Medicine*
Chris Pierret, PhD, *Assistant Professor, Director/Founder InSciEd Out, Mayo Clinic*

Reporter: **John Halloran,** *Connetquot High School*

Obstacles to Students Conducting Research

For many high school students finding a suitable mentor is often the most difficult obstacle to overcome in their research projects. For Dr. Withy, this problem is exacerbated for the students she works with who are living on the Pacific Islands of Hawaii, Guam, and American Samoa. Faced with few practical solutions she has partnered with Dr. Pierret, and they have explored various technologies that help foster long distance mentoring relationships.

Video Conferencing

Participates were paired off and tasked with communicating using a video conferencing program or web app. First-hand experience with the technology enabled participants to discuss the pros and cons of the different technologies as they may apply to a classroom setting. Problems ranging from multiple conference sessions occurring a single room, school firewalls and bandwidth issues, and video conferencing using multiple platforms were discussed.

Asynchronous vs. Synchronous

Different time zones or conflicting schedules mean that students and mentors are not always able to communicate in real time. The second session explored the benefits and drawbacks of asynchronous and synchronous communications, and highlighted two programs that can be employed by students and teachers. Dr Pierret introduced FlipGrid and Edmodo and discussed his use of these technologies as a means of fostering both class wide and small group discussions. The benefits of each program, in particular, the administrative tools offered to teachers, were discussed. The session concluded with session participants posting videos to a shared FlipGrid. This program offers teachers the opportunity to post questions that students can respond to using a short video asynchronously.

Participants:

Gwendolyn Stovall, University of Texas at Austin

Charlie Geach, American Physiological Society

Margery Anderson, US Army Medical Research and Materiel Command

Donna Cassidy-Hanley, Cornell University

Mary Kay Hickey, Cornell University

John Halloran, Connetquot High School

Opportunities and Challenges in Preparing a Competitive SEPA Grant Proposal

Presenters: **J. Michael Wyss, PhD,** *Professor of Cell, Developmental, and Integrative Biology, Center for Community OutReach Development, University of Alabama at Birmingham*
Nancy P. Moreno, PhD, *Associate Provost for Faculty Development and Institutional Research; Professor of Allied Health Sciences and Family & Community Medicine, Baylor College of Medicine*
Dina G. Markowitz, PhD, *Professor, Life Sciences Learning Center, University of Rochester*
Tony Beck, PhD, *Program Director, Science Education Partnership Award (SEPA), Division for Research Capacity Building, National Institute of General Medical Sciences, NIH*

Reporter: **Kristin Bass, PhD,** *Senior Researcher, Rockman et al*

This session considered the top elements needed for a successful SEPA grant application. The session included three successful SEPA PIs and the SEPA Program Officer. All four participants discussed the challenges and opportunities in planning and writing a grant proposal.

Tony Beck, PhD, National Institutes of Health

Dr. Beck began the session by noting that the moment you receive your first SEPA award, you need to start planning for the next one. Proposals can address any subject matter that NIH funds. To receive a priority score, proposers need to successfully address the five review criteria:

- Significance
- Investigators
- Innovation
- Approach (including evaluation and dissemination plans)
- Environment

The SEPA review panel is "the best example of peer review in the federal government." Jonathan Arias assembles a strong panel every year. About one-third of the group served on the previous year's panel; this provides continuity. Everyone on the panel is an expert in SEPA, which generates a very open discussion.

Dr. Beck offered a variety of suggestions for preparing and submitting a competitive proposal.

General Suggestions

- Make the proposal easy for reviewers to read. Each proposal is assigned to three reviewers. Some panelists may read additional proposals that are in their interest areas. Not every proposal gets discussed, so you want to make sure you communicate your ideas clearly and compellingly. You really want reviewers to say that your grant was "a pleasurable read."
- Start submitting early. Make sure that you have an eRA Commons account long before the proposal

deadline.

- Complete all sections of the proposal. This includes the plan for recruitment and retention of minorities and the training on responsible conduct of research. IRB approval may also be necessary if the evaluation is rigorous.
- Avoid appendices. Reviewers are not required to read anything in an appendix. Dr. Moreno said that appendices "make reviewers cranky." Dr. Beck suggested contacting Jonathan Arias if you really want to add an appendix.
- Ask questions. Drs. Beck and Arias are available to answer questions about proposal logistics (*beckl@mail.nih.gov*, *ariasj@csr.nih.gov*). Budget inquiries, including options for compensating teachers, can be directed to your institution's budget office or to Christy Leake, the Grants Management Team Leader at NIGMS (*cleake@mail.nih.gov*).

Proposal Content

- Include three specific aims.
- Provide evidence that your approach works, especially if you are proposing work that you have been doing for a while.
- Be hypothesis-driven! There are very few novel approaches in education. You need to frame your project around the existing background research. Tell reviewers what's already known, what you'll test, and what you hope to know by the end of the project.
- Use Gantt charts with color to illustrate what you plan to do.

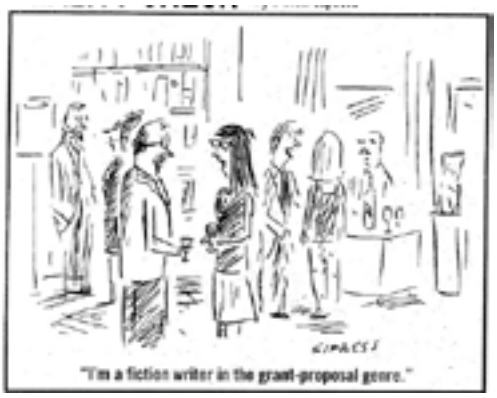
Evaluation

Dr. Beck explained, "Evaluation saved the SEPA program," when the program's funding was threatened in 2013. Most NIH projects don't require evaluation or have the funding for it. He gave advice on how to make the most of this opportunity.

- Make sure your evaluator is independent and listed as Key Personnel. A PI should understand evaluation, but cannot do the work. Schools of Education and independent evaluation firms are options. A team can also have internal and external evaluators; the former individual will have an understanding of the day-to-day project efforts, while the external evaluator will provide an outside perspective on the project's activities and outcomes.
- Work with evaluators from the start of your project.
- Use common instruments across program sites. This will provide evidence of replication and allows you to sustain your work.
- Consider how you will use evaluation findings. "It's important in a proposal to have plenty of room to change course."

Nancy P. Moreno, PhD, Baylor College of Medicine

Dr. Moreno is an experienced SEPA PI and reviewer. She provided general tips for preparing a proposal.



Be realistic! Think carefully about your scope of work, timeline, budget, and number of participants. Align your work with SEPA guidelines and provide citations to document the project's need.

Be clear and feasible. Dr. Moreno repeated Dr. Beck's advice to make your proposal readable. This includes

- Focused, achievable goals and expectations
- Ideas expressed in clear language
- A narrative framed in theory, but explicit about what will be accomplished
- Evaluation plans matched to objectives

Weave together resources for sustainability. Dr. Moreno recommended taking a hard look at your work to ensure that you're still applying the latest best practices. She described the evolution of SEPA programs at Baylor's Center for Educational Outreach. In 1993, the Center produced fictional science adventure stories. Its current SEPA program addresses science disciplinary literacy. This shift has been possible because the Center's team has leveraged its core resources (e.g., BioEd Online website, community relationships, institutional support, a curriculum development and evaluation model, and its internal evaluation and research capacity) while incorporating new community partners and needs, the latest biomedical research, and current educational research and practices.

Dina G. Markowitz, PhD, University of Rochester

Dr. Markowitz shared her experience disseminating and sustaining her SEPA program's curriculum materials with funding from a Small Business Innovation Research (SBIR) grant. Science Take-Out is a University of Rochester start-up company that develops, manufactures, and sells hands-on science kits based on SEPA curriculum materials. The kits use common household chemicals and simulated "chemicals," making them safe to use in non-lab settings such as home schools, science clubs, and teacher professional development workshops. Science Take-Out kits have been used in over 3,100 schools and with more than 5,000 teachers. Funding from SEPA, SEDAPA, Blueprint for Neuroscience Research, SBIR, and STTR made this program possible and helped it become self-sustaining.

J. Michael Wyss, PhD, University of Alabama at Birmingham (UAB)

Finally, Dr. Wyss gave advice on sustaining SEPA programs. He explained that SEPA PIs need to conduct research to determine what strategies work best for nurturing learning. It's important to sustain successful programs to show reviewers the return on NIH's investment and to build trusting, long-term relationships with school and community partners.

Dr. Wyss offered five suggestions for program sustainability:

- Think about sustainability early in the process and talk to your partners about it.
  - Just like in the renewal consideration, year 4–5 of a grant are not the time to consider sustainability.
- Be thinking about alternative funding streams. National Science Foundation's Noyce, ITEST, and CSforAll grants fund teachers, STEM workforce development, and computational thinking, respectively. At UAB, these grants have complemented each other. For example, Noyce-funded student teachers facilitate SEPA summer camps, while the CSforAll grant has helped K–12 students learn computer science skills they then apply to SEPA projects.
- Decide what is worth sustaining in your early formative assessment. Not all good ideas merit sustaining.
- Think about cost effective ways to partner with others (districts, state boards, NSF, companies, etc.).
- Get your partners to have skin in the game.

Dr. Wyss also recommended collaborating with other SEPA PIs to see if a program can be replicated at new sites. He has tested a School of Science and Math (Virginia Shepherd, Vanderbilt) and a SEPA science careers video (Marilyn Winkleby, Stanford) and learned a great deal from the experience. Dr. Beck supported this approach, noting that it generates the evidence of program effectiveness needed to secure additional federal funding.

Revisiting Tried and True Evaluation Instruments

Facilitator: Alana Newell, PhD, Assistant Professor, Baylor College of Medicine
Reporter: Shruti Bathia, University of California, Berkeley

In the field of science education, there is a lot of focus on measuring a student's cognitive and non-cognitive abilities. When educators and measurement experts seek to measure these abilities, such as science identity, student engagement, literacy, self-efficacy, knowledge, etc., it becomes clear that these abilities can be bucketed into larger subgroups:

- Science and Health Literacy
- Psychosocial
- STEM Interest
- Science Identity
- Behavior
- Knowledge
- Self-efficacy of Kids
- Self-efficacy of Teachers
- Attitudes

We realize that the majority of the science educators are measuring attitudes and knowledge about science and health literacy.

The scientific process of building a sound instrument and evaluating students' abilities requires decisions in three key areas.

1. Evaluation Design: There is no preferred evaluation design; the decision is left to the evaluator. An evaluator should consider these questions:
   - What type of data is required? A pre-post design and a retrospective design can both yield very different results.
   - Do the participants change throughout the study or remain constant?
   - Is there a need for anonymous evaluation or a non-anonymous evaluation?
2. Managing Relationships: It has been identified that stronger relationships lead to better data, thus better results. It is essential to have an open and clear conversation with participants regarding a range of issues:
   - What is the study about?
   - Why is it so important?
   - What is in it for them?

Science educators or evaluators often have to involve teachers in their study design, and sometimes, in order to elevate their interest, it is important to treat them as peers, involve them in publications, and use their expertise. They can also incentivize students in many creative ways, such as donating a dollar to a charity that they are involved in for every survey that they take, donating to their prom night, etc.

3. Items & Instrument Design: Since most of the non-cognitive studies are self-reported, it is essential that the evaluator ask questions that are task or performance specific. It is useful to adapt instruments from previous work; however, validity and reliability checks should be performed to understand if the instrument would work for their target audience. Sometimes creating your own instrument is more ideal; researchers should make this decision based on availability of resources. It is useful to involve experts, such as teachers, researchers, and evaluators. One challenge is when items are designed for elementary school children it is difficult to go beyond a three-point scale. Therefore, it is useful to use different types of instruments, for example slider bars, to ask the same question.

In the end it is important to spend time doing literature review and brainstorming with subject experts to improve your study design and your own knowledge about things in general.

Participants:

Christopher Villa, Helix Solutions
Michael Boyd, Iowa State University
Kevin D. Phelan, University of Arkansas for Medical Sciences
Dina Drits-Esser, University of Utah
Patrick Goertz, St. Dominic Savior Catholic High School
Stephanie Tammen, Tufts Medical School
Karina Meiri, Tufts Medical School
Shruti Bathia, University of California, Berkeley
Carol Merchant, NIH/NCATS
Madison Spier, Texas A&M Health Science Center
Rebecca Carter, Seattle Children's Research Institute
Alex Chang, Seattle Children's Research Institute
Amanda Jones, Seattle Children's Research Institute
Daniel Williams, Shelter Island High School
Ido Davidesco, New York University
Mary Larson, Salish Kootenai College
Debbie Tyrrell, Wheeling Jesuit University
Marie Barnard, University of Mississippi
Karin Chang, University of Kansas

Scaffolding STEM to Engage Young Learners, Parents, and Caregivers

Facilitator: **William Folk, PhD,** *Professor of Biochemistry, University of Missouri*
Panelists: **Carol O'Donnell, PhD,** *Director, Smithsonian Science Education Center*
Loran Carleton Parker, PhD, *Associate Director & Senior Evaluation and Research Associate, Evaluation and Learning Research Center, Purdue University*
Victoria Coats, *Manager of Exhibits Research, Oregon Museum of Science and Industry*
Rachel Smilow, *Program Manager, Children's National Research Institute*
Reporter: **Stephanie Elder, M.Ed.,** *Flint Community Schools*

STEM experiences during early childhood serve as a foundation for future learning. Projects targeting young audiences focus on parent and community engagement, professional learning for teachers, strategic planning for schools and districts, experiential curriculum, and the importance of leveled content literacy.

Smithsonian Science Education Center seeks to increase knowledge through research and to transform the teaching and learning of science for students and teachers K–12 across the globe by creating more experiential learning and bringing interactive, object-driven learning into classrooms. The curriculum uses engaging phenomenon-anchored lessons related to real world results. The team is currently working with 16 districts and 125 study schools in three states. Annually, the study includes 60,000 diverse students and 1900 teachers; the majority of the students are Hispanic. Over the course of five years, participants are supported in implementing the five components of The LASER Model (2017). The five components are as follows:

- Research-based curriculum: inquiry centered
- Professional development: competent teachers
- Assessment
- Materials support
- Administrative and community support (i.e., university, local museum, etc.)

Students who receive support show they are able to work in teams to solve real science problems and show higher math and reading scores at the state level. School-based studies have proven to be complicated due to forced clustering in schools, classrooms, and districts.

Purdue University College of Veterinary Medicine provides STEM experiences to disadvantaged K–4 students in order to diversify the veterinarian-scientist workforce. The focus is on engaging young students in STEM and biomedical careers by training inspirational biomedical professionals to deliver the curriculum and serve as role models for the children. Curriculum is delivered in an after-school setting along with traveling exhibits, which mirror the topics presented in the curriculum. Lessons are experiential, object-driven, and related to children's experiences with a focus on clinical trials on pets and treatments for disease such as diabetes. The connection to animals creates an emotional connection with the children, and the issues related to health lead to relevant connections in children's

lives. A challenge has been providing role models with the tools needed to deal with children with diminished resilience and those dealing with trauma. There is a need to boost the cultural competence of facilitators. Identifying reciprocal partnerships and developing these relationships organically over time is also key component to scaling the project.

The Oregon Museum of Science and Industry is working to engage parents and caregivers in understanding neurodevelopment so that they can then enrich development in their own children. They do so with a traveling exhibit that explores early brain development, including interactive family learning, a website, bilingual take-home guides for parents/caregivers, and programs and materials. Focus groups including low-income parents, Head Start educators, and OMSI members that have young children that come to the museum space have discussed play and brain development. Parents indicated that they want to learn more about categories of play, learning styles, child development, and stages rather than ages. More specifically, parents wanted to know how to interact with their children, how to engage children without toys, questions to ask children, and ideas and video examples that can be used at home.

Children's National Research Institute has built on their previous SEPA project, "Being Me", by looking into informal and after or out of school settings such as libraries. This project is not concerned with standards, but rather designed to deliver short, five-minute drop-in programs. Children spend a week at the hospital as part of the Summer Science Experience, exploring STEM careers, talking to doctors and nurses, and viewing surgeries.

The University of Missouri supports middle school science and health education for diverse learners by linking grade-level reading of complex texts and inquiry. Most texts are not sufficiently complex to prepare students for college, and college texts are not sufficiently complex for students preparing to go into science and engineering. Teachers indicated that they did not use text because reading levels varied widely within the classroom. This study attempts to improve science literacy, address the deficit of appropriate reading materials, and build a strong base of knowledge through leveled, content-rich text sets. Using text sets with appropriately complex anchor texts, teachers can work with groups of students at different levels of difficulty on the same topic with the ultimate goal for all students to be able to read and understand the anchor text. Text sets will be linked with existing inquiry activities. Pilots will include PD for five teachers and increase to 10 teachers over the next three years. The goal of the project is to develop 10 text sets, which address some of the core ideas in NGSS over the course of five years, support teachers through professional learning workshops, and assess changes in teacher practice and student interest in science.

Participants:

Julia Miller, Children's National Health System
Sarah Henes, Georgia State University
Cecilia Nguyen, Oregon Museum of Science & Industry
Anja Scholze, The Tech Museum of Innovation
Abbey Thompson, Stanford University
Lindley McDavid, Purdue University
Adrianne Fisch, Purdue University
Sarah Aguirres, University of Texas at San Antonio
Stephanie Elder, Flint Schools
Rubin Baskir, NIH/OD/All of Us Research Program
Victoria Coats, Oregon Museum of Science & Industry
Carol O'Donnell, Smithsonian Science Education Center
Loran Parker, Purdue University
Rachel Smilow, Children's National Research Institute
William Folk, University of Missouri

The 7 R's of Retaining Diversity in the STEM Pipeline

Facilitator: Ann Chester, PhD, ***Assistant VP for Health Sciences, West Virginia University***

Reporter: Alicia Boards, ***University of Cincinnati***

This session focused on a Health Science and Technology Academy (HSTA) program in West Virginia; the purpose was to discuss things that work for keeping kids in the pipeline from diverse backgrounds. West Virginia's program is for grades 9–12 and is a yearly program that consists of summer camps and meeting once a week for two hours after school during the academic year. Each year, the kids embark on their own research project and explore a topic that is important to them. This program is important because it is asset based; it's not just about having an impact on graduation, but also an impact when they are in their communities. As soon as a student is accepted into HSTA, the student is made to feel special, and the bar is set high. Graduates from this program are going back into their under-resourced communities and working in health care.

About HSTA

- Students work on a research project of their choice and get connected to a scientist, if their project allows.
- At the end of the year students present project in front of judges, peers, and teachers.
- Students do 75 hours of community service.
- Each year students attend camp and each grade has a different focus: forensic camp (10th grade), biomed camp (11th grade), and statistics (12th grade, including three units of college credit).
- If a student completes the program, they get a tuition and fee waiver for health majors at any WV university. They can get tuition and fee waiver for undergraduate, graduate, and professional degrees. (Only one degree at each level and 8 semesters of UG education.)
- The program is supported by the WV legislature; it even has its own state line item.
- Applicants are chosen by need (underrepresented minority, financially disadvantaged, first generation, rural, etc.). A 2.5 GPA is required for acceptance, but students have to raise it to a 3.0 by their first semester.
- The student ratio is 10 kids per one teacher.

Summer Camps

- Fun
- Hands-on experiences
- Good exposure to a college campus (how to work and act on a college campus)
- Formal dinner
- Quality teacher training

Community Ownership

- A local governing board is made up of volunteers.
- The board includes nine members of the community (member of education, health care, HSTA

families, and HSTA kids).

- The local governing board gets to hire the person who runs that region. They find the teachers, help get applicants for that region, and present them to the governing board.
- There are 14 different regions across the state. They have local volunteer governing boards with no University members and a joint governing board that comes together once a month.
- Community buy-in and ownership builds trust and relationships.

The Seven R's

- Reward: Lifting some financial burden.
- Recreation: Going to college for the first time is fun at the summer camps. Lots of interaction, low stakes, entertainment, and down time to feel comfortable on a college campus.
- Relationships: Building friendships with people they've never seen before. Go from seeing kids in their own pods to intermingling across schools. They build relationships with kids that may be different, but share the same dream.
- Research: Having fun, friends, and funding, then comes the research. The research has to be important to them, which is why they pick their own projects. Participation in the research process also incorporates college prep skills. For example, they learn how to do arithmetic, engage in problem solving, synthesize information, and develop communication skills. After doing that for four years, they are more equipped to use those skills to navigate the college experience.
- Relevance: Ensuring the research is relevant helps them push through the hard stuff.
- Rigor: Identifying rigor as a trait of high importance from the beginning. They must meet certain levels of expectations; a rubric is provided for each project (i.e., Did they cite references? Is the question testable? Did they do statistics?).
- Repetition: Learning takes time in order to overcome deficits.

References

The LASER Model. (2017, February 15). Retrieved from *https://ssec.si.edu/laser-model*

Using Media Creation to Engage Students in Learning and Building Health Careers

Presenters: **Leah Clapman, BA,** *Managing Editor, Education, PBS NewsHour*
Cindy Armstrong, *Associate Director, Colorado AHEC Program Office, University of Colorado, Anschutz Medical Campus*
Angie Millan, PhD, MSN, RNP, *National Association of Hispanic Nurses*
Alicia Santiago, *Cultural Diversity Consultant, Twin Cities Public Television*
Robert Russell, PhD, *Program Director, National Science Foundation*
Reporter: **Jenica Finnegan, MA,** *University of Nevada, Reno*

Session Report

Several SEPA programs are successfully using media creation to engage students in learning and build interest in STEM careers. Panelists shared their experiences and showed video products from their projects to encourage other programs to use media to engage participants and communities.

CerebroEDU / BrainEDU

Rita Karl, Senior Managing Director, Twin Cities Public Television
Alicia Santiago, Cultural Diversity Consultant, Twin Cities Public Television

CerebroEDU, or BrainEDU, is a newly funded SEPA program that leverages the network from a NSF-funded project, Sci Girls, to focus on brain function and careers in neuroscience. The media component will include videos and interviews, which show what it is like to be a neuroscientist or mental health professional. Role models in the videos will discuss diverse pathways to careers, challenges students may face, and insights into how professionals overcame similar challenges. BrainEDU will work with partners from 18 sites around the country.

Hispanic Role Models in Healthcare

Angie Millan, PhD, MSN, RNP, National Association of Hispanic Nurses
Paul Castro, Hispanic Communications Network, National Association of Hispanic Nurses

Hispanic Role Models in Healthcare aims to increase the number of Hispanics attending nursing school nationwide through media and radio campaigns. Researchers interviewed Hispanic nursing school students and produced videos and radio spots in Spanish and English. These efforts inspire bilingual and bicultural students to study science and math and pursue careers in nursing. Media products are integrated into a toolkit, published on social media sites, and played on the radio throughout the United States via the Hispanic Communication Network (HCN). When students indicate they are interested in a career in nursing, they can easily connect with an experienced mentor through an online database.

Discover Health / Descubre la Salud

Robert Russell, PhD, Self-Reliance Foundation

Discover Health or Descubre la Salud is a Spanish-English bilingual traveling exhibit on diabetes,

obesity, and cardiovascular disease. The exhibits, targeted to Hispanics in rural areas, focus on understanding bodies, healthy eating habits, exercise, and positive body images. Researchers use local media partners, such as Telemundo, to circulate the videos, and they also publish in print magazines and on social media. The goal is to surround audiences with positive health messages every week and in turn encourage them to act on the messages and visit the exhibits.

Student Reporting Labs (SRL)

Leah Clapman, BA, Managing Editor, Education, PBS NewsHour

Student Reporting Labs (SRL) use media creation as a learning tool by engaging students in discussions about real-world news events. SRL consider the next generation of news reporters and news literacy by giving students the opportunity to go out into the field, conduct interviews, and create their own news stories told in their own voice. The stories air nationally on the NewsHour as well as on local PBS stations. Student impacts include increasing confidence, learning to work in teams, acquiring journalistic and scientific skills, and gaining experience in researching and fact checking; these are all skills students need in order to be successful in college.

Challenges

- Media organizations are often for-profit and companies charge a lot to post videos or information.
- If you fail to catch the attention of the audience in the first eight seconds of a video, consumers will click off and move on; the beginning of a video is very important.
- Partnerships with individuals take time; you must build trust in order to have a functioning relationship.
- It is difficult to evaluate and measure the success of using media to engage students.

Overcoming Challenges

- Researchers are encouraged to build trust by working with families and participants in a comfortable setting for the participants; consider different locations, formats and structures.
- Programs should be aware of Hispanic values and that "Hispanics" are not a single audience; this group includes a number of sub ethnicities, so it is not a 'one size fits all' group.
- Videos should include subtitles: keep them short and know your audience and the media platforms they use (SnapChat and YouTube).

Evaluation efforts for these projects included tracking data about the number of plays videos achieved and surveying participants about how they found out about the program and/or video.

Participants:

Stephanie Messina, Ochsner Health System
Emily Mathews, Northwestern University
Debra Yourick, Walter Reed Military Medical Center
Joan Griswold, University of Washington
Rashada Alexander, NIH/NIGMS
Renee Hesselbach, University of Wisconsin-Milwaukee
Cindy Armstrong, Colorado Area Health Education Center
Anne Holland, Space Science Institute
Elizabeth Danter, New Knowledge Organization Ltd.
Beth Tuck, NIH/NHGRI
EmilyKate Mcdonough, Tufts Medical School
Ben Koo, University of California, San Francisco
Elizabeth Ozer, University of California, San Francisco
Johnny Kung, Harvard University
Stephanie Older, NIH/NIGMS
Juli Rose, NIH/NIGMS

Youth Enjoy Science (YES): a National Cancer Institute Initiative to Broaden the Biomedical Research Workforce Diversity from Middle School to Graduate Education

Facilitator: **Maurice Godfrey, PhD,** *Professor, University of Nebraska Medical Center*

Panelists: **Alison Lin, PhD,** *Program Officer, National Cancer Institute, NIH*

Nathan Berger, MD, *Hanna-Payne Professor of Experimental Medicine and Director of the Center for Science, Health and Society and Professor of Medicine, Biochemistry and Oncology, Case Western Reserve University*

Jeanne Ting Chowning, *Director, Science Education Partnership, Fred Hutchison Cancer Research Center*

M. Eileen Dolan, PhD, *Professor of Medicine, University of Chicago*

Reporter: **Shaunna Garner, M.Ed.,** *Teacher Enrichment Initiatives, UT Health San Antonio, NorthEast Independent School District, San Antonio, TX*

Purpose of the Youth Enjoy Science Program

The purpose of the Youth Enjoy Science (YES) NCI initiative is to help show students there is a pathway to become a cancer researcher. If the students cannot envision it, they may never pursue it. Some students may think of work as a 'job' and not as a 'career'. The program focuses on engaging students from diverse backgrounds, including teachers, in the field of cancer research. By allowing students into an active cancer research environment, students can receive hands-on preparation for a career in biomedical research.

Program Requirements

The YES Research Education Programs are open to students and teachers in grades 6–12, as well undergraduate students and faculty. The students must be from an underrepresented background as defined by the eligibility criteria. The hosts of YES programs can be higher education institutions, government, nonprofits, or for-profit organizations. The host organization's application requirements include history of the organization's research experiences, curriculum or methods development, and outreach efforts. In addition, the program outline cannot overlap with goals and objectives of a program already in implementation status. Participants must commit to at least two consecutive years and be open to evaluation and tracking so researchers can obtain data as it pertains to program objectives.

Summary of Current Programs

There were some common threads between the programs the various panelists discussed. All programs worked to create diversity in the cancer research workforce and focused on underrepresented communities. The program designs all sought to enhance student's understanding of the significance of cancer research, strengthen their career skills, and educate the family and community on biomedical research. The programs discovered that mentorship, peer networking, and community involvement play an important role in maintaining student engagement. Some of the programs incorporated curriculum development, which allowed students and teachers to take the tools

learned during the program into the classroom setting. The duration of all programs was a minimum of two years and three months, with some being longer. Family inclusion was evident in some of the programs; for example, the Dana-Farber program hosted family orientations and a summer BBQ. Recurrent challenges included diversity of applicants and teacher retention.

Participants:

Lisa Harlan-Williams, University of Kansas Cancer Center
Michael McKernan, The Jackson Laboratory
Nathan Berger, Case Western Reserve University
Marisa Almonte, City of Hope
Theresa W. Gillespie, Emory University
David Micklos, Cold Spring Harbor Laboratory
Tim Herman, Milwaukee School of Engineering
Megan Mekinda, University of Chicago
Brenda Koester, University of Illinois at Urbana-Champaign
Paulette T. Jones, Meadowlark Science and Education, LLC.
Kim Soper, University of Nebraska Medical Center
Mary Jo Koroly, University of Florida
Marsha Matyas, American Physiological Society
David Holben, University of Mississippi
Melani Duffrin, East Carolina University
Gregory Vogt, Baylor College of Medicine
Robert Sege, Tufts Medical Center
Christopher Sistrunk, City of Hope
Maureen Munn, University of Washington
Louisa Stark, University of Utah
Shaunna Garner, North East Independent School District
Jennifer Wiles, NIH/NCI
Maurice Godfrey, University of Nebraska Medical Center
Behrous Davani, NIH/NCI
Jeanne Chowning, Fred Hutchinson Cancer Research Center
Eileen Dolan, University of Chicago
Emily McMains, Dana-Farber/Harvard Cancer Center
Alison Lin, NIH/NCI

Breakout Sessions
Friday, June 1, 2018: 8:30–9:45 AM

Citizen Science: Role & Best Practices in Science Education

Facilitator: **Teresa W. Gillespie, PhD,** *Professor, Emory University*

Panelists: **Jennifer Couch, PhD,** *Chief, Structural Biology and Molecular Applications Branch, NIH National Cancer Institute*
Katrina Theisz, *Program Analyst, Structural Biology and Molecular Applications Branch, NIH National Cancer Institute*
David Miller, PhD, *Program Director, Division of Cancer Biology, NIH National Cancer Institute*
David Mickolas, MS, *Executive Director, Dolan DNA Learning Center, Cold Spring Harbor Laboratory*
Nicole Garneau, PhD, *Curator and Department Chair, Health Sciences, Denver Museum of Nature and Science*

Reporter: **Shaunna Garner, M.Ed.,** *Teacher Enrichment Initiatives, UT Health San Antonio, NorthEast Independent School District, San Antonio, TX*

Citizen Science Defined

Public participation in any part of the scientific process is defined as citizen science. Citizen science helps you recruit people into science. Not everyone has an understanding that everything is tied to science. Take the scientific method for example, almost daily, citizens are making a hypothesis, solving a problem (most through trial and error), making observations, and interpreting/gathering data to help identify basic needs. There can be bias in citizen science, and it is helpful to keep this in mind when evaluating information that comes from citizen science projects. However, citizen science is important because when you are interacting with the community you are fostering a stronger community. Your community is becoming stronger because you are tackling a lot of big problems that members of that community are facing. We must take the information that results from citizen science and think about it in a scientifically literate manner.

During the session, there was much discussion on what could be constituted as citizen science. It was determined that science means you are utilizing the scientific method, forming a hypothesis, and designing an experiment to solve a problem; if these things are not being answered, then we are not sure you can call it citizen science.

Citizen Science and Curiosity: The Smartfin

A participant made a comment that it is okay to be curious. Citizen science allows the general population to engage in science because they are curious. If a citizen is curious, it is likely they have an interest in the results of the data collection and can help guide the implementation of a community effort based on the data analysis. Citizen science is not just about educating the public on science, and you do not always have to elicit a behavior change, but it allows citizens to be curious and engaged in real-life science application. A great example of citizen involvement due to curiosity was the

implementation of the Smartfin. In an effort to gather information about the changing ocean chemistry, scientists and engineers developed a tool, called the Smartfin, to assist in data collection. The Smartfin is a sensor-ridden fin that attaches to a surfboard and collects information such as temperature, location, and wave characteristics. Future sensors on the Smartfin will measure pH levels, dissolved oxygen concentration, and chlorophyll content. All of these information points piqued the interest of area surfers; the Smartfin is being put to use by the local surfers in San Diego. That is citizen science at work!

Rigor and Reproducibility of Citizen Science

In regards to collecting information, a scientist likely collects information much differently than a citizen of the general population. Scientists have passion and professionalism and have been trained in defining limits and the application of rigor. It is important to collect data with rigor, as it is necessary for our data to be reproducible. Often the rigor depends on the size of the cohort collecting the data. In most projects, there is a larger chance for the data to be skewed if you have a smaller cohort. On the flip side, if you have a larger cohort there is less of a chance of the data being skewed due to a larger data compilation. A big question to ask is, "Do we know if citizens are using the same rigor as scientists would in a laboratory setting?"

Participants:

Shaunna Garner, North East Independent School District

Teresa Evans, North East Independent School District

Behrous Davani, NIH/NCI

Paulette T. Jones, Meadowlark Science and Education, LLC

Chuck Wood, Wheeling Jesuit University

Leah Clapman, PBS NewsHour

Helene Starks, University of Washington

EmilyKate Mcdonough, Tufts Medical School

Barbara Baumstark, Georgia State University

Michelle Ezeoke, Georgia State University

Donna Sullivan, University of Mississippi Medical Center

Holly Brown, US Army Medical Research and Materiel Command

Laurie Jo Wallace, Health Resources in Action

Michael Boyd, Iowa State University

Berri Jacque, Tufts Medical School

Johnny Kung, Harvard University

Alison Kieffer, The Jackson Laboratory

Wendy Suzuki, New York University

Stephanie Messina, Ochsner Health System

Jasmine Miller-Kleinhenz, Emory University

Rashada Alexander, NIH/NIGMS

Christopher Sistrunk, City of Hope

Marisa Almonte, City of Hope

Anja Scholze, The Tech Museum of Innovation

Naomi Luban, Children's National Health System

Rachel Smilow, Children's National Health System

Rubin Baskit, NIH/All of Us Research Program

Rosemary Riggs, University of Texas Health Science Center at San Antonio

Cindy Armstrong, University of Colorado

Evaluation and Assessment "Unconference" Session

Facilitators: Alana Newell, PhD, *Assistant Professor, Baylor College of Medicine*
Dina Drits-Esser, PhD, Senior Researcher, University of Utah
Reporter: Shruti Bathia, *University of California, Berkeley*

The discussion focused on the following key topics related to evaluation and assessment:

- Research implementation in evaluation practices in SEPA projects
- Curriculum evaluation
- The value of ethnographic studies in a SEPA project

Research Implementation in Evaluation Practices in SEPA Projects

Session participants noted that unlike evaluation, research has more room for flexibility. Evaluation is very client driven. One of the challenges of incorporating research in evaluation is the fact that even if it is an important element in the evaluation, it is not billable by the company. Therefore, the evaluator ends up wearing multiple hats. An ideal scenario is when there is a synergy between an internal evaluator and an educational researcher. There are times when a SEPA proposal is written without prior research because the PI doesn't have the time to delve into past research. Fluffy evaluation reports are built without research, which leads one to wonder, "Do people read those reports?" Another question that the session participants pondered was, "How can we drive PIs to publish?"

In summary, it is important to indoctrinate best evaluation practices across all SEPA projects, create stronger networks of evaluators, and build a common repository of evaluation tools that can be reused in multiple SEPA projects. There is repository on the SEPA website, but implementation needs to improve.

Curriculum Evaluation

It was noted that it takes time to assess the effectiveness of a curriculum. One can measure behavioral, cognitive, and emotional changes in the student as they take part in the curriculum; for example, student engagement can be measured. Allowing students to reflect on their learning can also provide useful insights because it gives students a platform to collect their thoughts. The Lawrence Hall of Science has done commendable work on "activated learning". However, it is still very hard to measure learning because so much is covered in such a short time.

The Value of Ethnographic Studies in a SEPA Project

There is a lot of value in doing ethnographic studies in SEPA projects. It is essential in order to better understand teacher thought processes, which cannot be captured by RCTs or other quantitative processes. It is important to understand what is going on in their minds. Ethnographic studies can be useful when we are trying to answer questions about individuals in a system; for example, answering the question, "How do they develop identity?" Some ways of conducting ethnographic studies include journaling, interviews and video conversations. When the number of participants in a study is small, qualitative studies can yield better results. It is always good to keep in mind that people are more attracted to stories than to data.

Participants:

Carol Merchant, NIH/NCATS

Marie Barnard, University of Mississippi

Debra Tyrrell, Center for Educational Technology

Loran Parker, Purdue University

Dina Markowitz, University of Rochester

Danielle Alcena, University of Rochester

Margaret Stieben, American Physiological Society

Carmela Amato-Wierda, University of New Hampshire

Elizabeth Danter, New Knowledge Organization Ltd.

Shruti Bathia, University of California Berkeley

Christopher Villa, Helix Solutions

Kristin Bass, Rockman et al

Emily McMains, Dana-Farber/Harvard Cancer Center

Lindley McDavid, Purdue University

Rita Karl, Twin Cities PBS

Dina Drits-Esser, University of Utah

Ruchita Patel, Rockman et al

IDeA State and SEPA Collaborative Experiences

Facilitator: **Krishan K. Arora, PhD,** *Program Director, Division of Research Capacity Building, NIH NIGMS*

Panelists: **Rob Rockhold, PhD,** *Deputy Chief Academic Officer, University of Mississippi Medical Center*

Ann Chester, PhD, *Assistant VP Health Sciences, West Virginia University*

Rayelynn Brandi, MS, *Program Director, Clark Ford Watershed Education Program, Montana Tech*

Maurice Godfrey, PhD, *Professor, Munroe-Meyer Institute, University of Nebraska*

Reporter: **Donna Sullivan, PhD,** *University of Mississippi Medical Center*

Collaborations between SEPA investigators and investigators from Institutional Development Award (IDeA) states involved in IDeA Networks of Biomedical Research Excellence (INBRE), Centers of Biomedical Research Excellence (COBRE), and IDeA Program Infrastructure for Clinical and Translational Research (IDeA-CTR) programs were explored from a number of different perspectives. Dr. Arora provided an initial overview of the NIH's NIGMS-supported programs, including IDeA, Support of Competitive Research Program (SCORE), Native American Research Centers for Health (NARCH), and SEPA. The goal of these programs is to provide support to undergraduate institutions in under-represented regions of the United States. The long-term goal is to provide a pipeline of a trained, skilled workforce for the biomedical community. This session focused on aligning the goals of SEPA and IDeA programs in producing such an outcome.

Several collaborations were presented, from newly formed partnerships to well established ongoing collaborations. In Mississippi, the SEPA-funded Science Teaching Excites Medical Interest (STEMI) program at the University of Mississippi Medical Center has begun a partnership with the INBRE program at the University of Southern Mississippi. The common goals are to share resources, enhance K–12 STEM curricula, and enhance and expand the student population entering STEM fields. The STEMI program has a strong record of training high school teachers in the preparation of small grants to support their curriculum. INBRE has begun to accept and fund small grants from these high school teachers with the help of members of the STEMI team. Many of the high school teachers in the group have ties to local community colleges and offer dual enrollment courses, thus providing additional contacts for INBRE. Furthermore, high school students are introduced to experiences in IDeA/INBRE-funded labs. Student interactions are encouraged through participation in scientific sessions at the annual Mississippi Academy of Sciences.

The nine-year West Virginia experience of SEPA/INBRE has produced over 90 high school interns working in biomedical research in INBRE-funded laboratories. The collaboration included 46 high school teachers and over 125 contacts at meetings and workshops. The keys to the success of the interactions were the use of a dedicated SEPA/INBRE coordinator, a community research liaison translator, and a tracking system for both projects. A clearinghouse-type database was established to document student/investigator collaborations as well as contact information for follow-up purposes. The joint effort resulted in a shared Biomedical Scientists Leadership group and included SEPA-

required research experiences.

The Bringing Research Into the Classroom (BRIC) program has had funding from NIH (INBRE), NSF (Eager), colleges, and businesses. Students interested in careers in the natural sciences, engineering, medical, or veterinary were targeted for participation. The program included a phage discovery component to introduce high school students to hands-on laboratory experiences. BRIC students were funneled into undergraduate programs at participating institutions, including Montana Tech, Montana State University, Rocky Mountain College, Carroll College, University of Montana, and Flathead Community College. Participants were eligible for financial support for college expenses.

The Accelerating Access project is a SEPA/INBRE collaboration that crosses two states, Nebraska and South Dakota. Emphasis is placed on Native American high school students; the program works with three tribal colleges in an effort to establish ties between SEPA teachers and INBRE researchers. An important aspect of the project is the inclusion of community outreach to students' families and tribal elders. The idea of building trust as an absolute prerequisite for a successful collaboration was stressed. Currently, three INBRE principal investigators are actively involved with high school students and teachers.

In conclusion, the session participants exchanged ideas about the need for publishing results and collecting data on students impacted by SEPA/INBRE programs. It was noted that data must reflect the multifaceted success of these programs to include more than the number of MDs and PhDs produced. The entry of students into research positions at academic and commercial institutions should be documented. Furthermore, other fields in biomedicine (medical technology, nursing, physician assistants, etc.), natural science (wildlife/fisheries, environmental science, water quality assessment), and engineering should be included in data collections in order to more accurately reflect the success rates of SEPA/IDeA/INBRE collaborations.

Participants:

Maurice Godfrey, University of Nebraska Medical Center
Rayelynn Brandl, Montana Tech
Chris Doyle, Montana Tech
Ruben Dagda, University of Nevada, Reno
Margaret Stieben, American Physiological Society
Behrous Davani, NIH/NCI
Sheila Caldwell, NIH/NIGMS
Rashada Alexander, NIH/NIGMS
Andrij Holian, University of Montana
Donna Sullivan, University of Mississippi Medical Center
Rob Rockhold, University of Mississippi Medical Center

Introducing Bioinformatics in K–12 Programs: Challenges and Best Practices

Facilitator and Panelist: Charles Wray, PhD, *Director, Courses and Conferences, The Jackson Laboratory*

Reporter: Amy J. Hawkins, PhD, *University of Utah*

Background

A range of SEPA-funded efforts integrate bioinformatics into K–12 classrooms and other educational programs. This session focused on both successful efforts and the challenges that programs face in designing and implementing K–12 bioinformatics curricula and teacher professional development programs. The following panelists introduced their SEPA projects and shared their experiences with bioinformatics education.

Michele Shuster, PhD, Associate Professor of Biology, New Mexico State University

The overall goal of Science Tools in the Classroom is to diversify and broaden participation in the scientific workforce by developing and disseminating culturally relevant DNA-based activities for elementary and middle school students in populations with high Hispanic representation. The project employed a partnership model in which K–8 teachers engaged in a seven-day professional development experience. The teachers refreshed and expanded their knowledge about life science content related to DNA and then worked collaboratively with scientists and pedagogy experts to design bioinformatics-based units. Teachers then field-tested the units in their classrooms, which are freely available at the project's website, *http://www.stcnm.org*. Notably, the materials were tailored to the local community in New Mexico and include instructions and student handouts in both English and Spanish. Students learn and practice how to use BLAST, an open-access online program that compares DNA sequences (e.g., unknown sequences) to all sequences in the genetic database, finding matches to identify species or individual genes.

Andrea Panagakis, Program Coordinator, Salish Kootenai College STEM Academy

Biomedical STEM Transitions through Outreach, Research, and Model Education (BioSTORM) is a STEM Academy designed to increase the number of American Indian high school graduates who are prepared to enter college in academic majors aligned with biomedical and biobehavioral research. The project enrolls American Indian junior and senior high school students in afternoon classes at a small tribal college campus for two consecutive academic years and provides culturally congruent education, rigorous coursework, mentoring, and an extended research experience. Acceptance into the Academy is competitive and free of cost to students who are chosen to attend. More details can be found on the Academy's website, *http://stemacademy.skc.edu/*.

In 2017, the STEM Academy began participating in the HHMI Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science (SEA-PHAGES) program. Students isolate, purify, sequence, and then annotate the genome of phages from local soil samples. More details about the program can be found at its website, *https://seaphages.org*. While enrolling the first student cohort at the BioSTORM STEM Academy, instructors found it challenging to adapt or frame the SEA-PHAGES curriculum so that their students would view it as relevant to their own cultural experiences. Instructors have also discovered that grading gene annotation can be quite time consuming.

Charles Wray, PhD, Director, Courses and Conferences, The Jackson Laboratory

The Jackson Laboratory (JAX) project Teaching the Genome Generation provides high school teachers the content knowledge, teaching strategies, and resources needed to enhance student learning in genomics, bioinformatics, and bioethics. The short courses and the high school classroom implementation of the program are divided into three major topics, which are interwoven with the Next Generation Science Standards. The topics are (1) the methods involved in isolating, amplifying and detecting DNA from human saliva, (2) the computational methods utilized in analyzing DNA, RNA, or amino acid sequences, and (3) the ethics involved in DNA testing (both in the classroom and in the community). The program has thus far reached 101 students and will be in its third year of the project in 2018. Details on the program and current summer course offerings can be found on the JAX website, *https://www.jax.org/education-and-learning/high-school-students-and-undergraduates/teaching-the-genome-generation*

The five original bioinformatics lessons were

- Introduction to the NCBI
- BLAST and Clustal
- Basic DNA sequence alignments
- Ensembl and UCSC browsers
- Human SNPs exploration

While manipulating a DNA sequence file and aligning it may not fit the traditional definition of bioinformatics, the JAX team has found that these are appropriately difficult activities for high school students. One of the challenges the JAX team found in testing the bioinformatics curriculum is that they discovered their underlying assumption—that students would act as "digital natives" and use web and genome browsers somewhat intuitively—hasn't held true. This observation particularly resonated with the other panelists in the room. Additionally, the JAX team had comparatively low rates of bioinformatics lesson implementation (46%) compared to the molecular assays (>90%) in the curriculum. Teachers reported difficulty in finding an appropriate place in their biology classroom curriculum for bioinformatics lessons.

Ralph Imondi, PhD, Executive Director, Coastal Marine Biolabs

To meet the challenge of having students meaningfully partake in the practices of proper annotation and analytics in sharing data with professional research communities, the NeuroLab M3 program designed customized student interfaces for existing professional databases. For example, rather than directly accessing the *Barcode of Life Data (BOLD) System's online digital interface*, *a data repository for the international DNA barcoding community,* NeuroLab students and instructors can use the BOLD Student Data Portal to upload, manage, and analyze DNA barcode data in a user-friendly and worry-free environment. The BOLD Student Data Portal can be accessed at *http://www.studentdnabarcoding.org/resources/technology/BOLD.html*. A similar student-friendly interface was designed to interact with the VISTA Enhancer Browser, a database designed to track distant-acting transcriptional enhancers in the human and mouse genomes. In addition to the challenges named above, Dr. Imondi shared that students had difficulty understanding and applying professional community standards to annotating and contributing their own data to these online data repositories. Further details on NeuroLab can be found on the program's website, *http://www.neurolabsepa.org*.

Stephen Koury, PhD, Research Associate Professor of Biotechnical and Clinical Laboratory Sciences, University at Buffalo

The Western New York Genetics in Research and Health Care Partnership was designed to annually engage with 20 biology teachers from schools that serve underrepresented or disadvantaged students across a 14–county region in western New York. Partnering teachers attend a two-week summer workshop at the University at Buffalo where they receive training in the use of the Guiding Education through Novel Investigation Academic Collaboration Toolkit (GENI-ACT; *https://geni-act.org*), a toolkit that permits students to annotate bacterial genes that previously have only been automatically annotated by a computer. When students complete annotating a gene, an instructor can approve their work and submit it to the database. Dr. Koury has developed a lab manual to accompany the GENI-ACT tools. It and other teaching resources can freely downloaded using Dropbox on following link, *http://geni-act.blogspot.com/p/welcome-to-geni-act-teaching-resources.html*. Dr. Koury related that it could be challenging to keep any educational guides that pair with publicly available databases up to date for its users. For example, any time the database user's interfaces change in appearance, the screenshot of the database within a user manual will need to be updated or users may become too discouraged to continue.

Sharon Pepenella, PhD, Dolan DNA Learning Center, Cold Spring Harbor Laboratory

Barcode Long Island (BLI) challenges student research teams to use DNA barcoding to explore, document, and track biodiversity on and around Long Island, New York. Through yearlong research projects, BLI aims for students to gain an intuitive understanding of the crucial interdependence between humans and the natural environment. Participating science teacher mentors attend weeklong professional workshops to learn about DNA barcoding, experimental design, and laboratory and bioinformatics methods. During the following school year, students prepare samples, isolate and amplify DNA, or analyze their results at open lab sessions at a BLI-associated facility or at their school using a footlocker containing all equipment and reagents needed to conduct the wet lab steps of DNA extraction, PCR, and gel electrophoresis. Once amplified, samples are sent for sequencing, and sequences are automatically uploaded to the DNA Subway website for analysis. DNA Subway ties together key bioinformatics tools and databases to assemble gene models, investigate genomes, work with phylogenetic trees, and analyze DNA barcodes. Further details about BLI can be found at the program's website, *https://www.dnabarcoding101.org/programs/bli/* or at the DNA Subway website, *https://dnasubway.cyverse.org*.

Participants:

Mary Larson, Salish Kootenai College
Amy J. Hawkins, University of Utah
Sharolyn Kawakami-Schulz, NIH/NIGMS
Krista Glazewski, Indiana University
Lori Kudlak, Wheeling Jesuit University
Jackie Shia, Wheeling Jesuit University
Isela Rodriguez-Bussey, Georgia State University
Daniel Williams, Shelter Island High School
Anna Gossin, University at Buffalo
Grace Stallworth, University of Nebraska-Lincoln
Cherilynn Shadding, Washington University
Nathan Berger, Case Western Reserve University
Karina Meiri, Tufts Medical School
Marlys Witte, University of Arizona
Abbey Thompson, Stanford University
William Folk, University of Missouri
Stephen Koury, University at Buffalo
Sharon Pepenella, Cold Spring Harbor Laboratory
Ralph Imondi, Coastal Marine Biolabs
Michele Shuster, New Mexico State University
Andrea Panagakis, Salish Kootenai College
Charles Wray, The Jackson Laboratory
Nancy Moreno, Baylor College of Medicine
Louisa Stark, University of Utah

Open-Inquiry Research Class: Is it Possible (or necessary) to Control the Chaos of Independent Research in a High School Classroom Environment

Presenters: **Patrick Goertz, MA,** *University of Texas High School Research Initiative Teacher and Department Chair, St. Dominic Savio Catholic School*
Jill Rhoden, PhD, *Outreach Program Coordinator, University of Texas at Austin*
Gwen Stovall, PhD, *High School Research Initiative Director, University of Texas at Austin*
Reporter: **Alicia Boards,** *University of Cincinnati*

This interactive session allowed attendees to participate in classroom experiments and engage in dialogue regarding their observations and how they could utilize the different modes of inquiry. Participants were engaged as both students and teachers. During the session, conversations between attendees and presenters took place regarding tools and resources they could use to help students develop their own research questions. While students may choose to explore questions that have already been researched, the most important aspect is that it is new to them, and they should be encouraged to explore things they are curious about. The session also included information regarding the SEPA-funded program, High School Research Initiative, that is a collaborative effort between a community of University of Texas at Austin students and faculty and local high schools.

Balloon Activity

Session attendees were given different balloons. They were instructed to blow up the balloons and then pop them. They were to record their observations on paper. Each table reported their observations to the entire group. This activity can be used with younger students to help them generate questions and then later parse out independent and dependent variables.

Tips for Teachers

- Reach out to other people in their department if students have disciplines different from their own
- Be creative
- Work around project components

Why Do This?

- Increase science exposure and knowledge, which builds ownership and independence that leads to persistence.
- Encourage curiosity through fun. Make them start to think about the world in a scientific way.
- Build long-term retention of content through project-based learning .
- Improve collaboration, team building, and problem solving.

Freshmen Research Initiative

- Students can see the merits of inquiry-based science.

- Students get a hands-on experience.
- 30–40 students participate in an ongoing research project in which each has their own part to invest ownership in.
- A dual enrollment research course is taught at high school campuses. (High schools, teachers, and districts are talking and are interested in these types of programs.)
- High school students collaborate with undergraduate students and faculty on university-level projects in their high school.
- Students learn how to ask research questions.
- There are two different inquiries:
  - First semester: participates in a science fair project
  - Second semester: takes high school class and matching first-year undergraduate research initiative class and develops dual mutual research objectives.

Challenges

- Having high school teachers supervise 15 individual research projects, especially when the projects can vary in discipline, timeframe, interests, various material needs, etc., is difficult. (Teachers attend three weeks of training in the summer to assist them in learning how to supervise and manage projects.)
- Takes some getting used to because it's not a traditional lecture style, and students don't like the lack of direction and concreteness.

How Students are Assessed

- Teachers assess through observations and interviews.
- Pre and post surveys are administered, which look at attitudes toward science and measure the likelihood of students continuing science in their future and going to college.
- Students receive a different grade at the high school level than they do at the undergraduate level. Teachers can include different assignments to match their needs.

Participants:

Stephanie Elder, Flint Schools

Idit Adler, Michigan State University

Ido Davidesco, New York University

Michael McKernan, The Jackson Laboratory

Megan Mekinda, University of Chicago

Manetta Calinger, Center for Educational Technology

Alicia Boards, University of Cincinnati

Debra Yourick, Walter Reed Military Medical Center

Margery Anderson, US Army Medical Research and Materiel Command

Jenica Finnegan, University of Nevada, Reno

Karin Chang, University of Kansas

David Petering, University of Wisconsin-Milwaukee

Bret Hassel, University of Maryland School of Medicine

Emily Kuehn, US Army Medical Research and Materiel Command

John Halloran, Connetquot High School

Planning Competitive National Science Foundation Proposals

Presenter: Robert Russell, PhD, ***Program Director, National Science Foundation***

The following topics were presented during this session:

- Identifying potential project ideas
- Selected funding programs and NSF priorities
- Linking project ideas to programs
- Knowing your audience: the review process
- What to say in 15 pages
- Critiquing excerpts from successful proposals
- Avoiding fatal flaws

ECR Program

ECR supports basic research. It invites researchers to conduct research on basic questions in order to advance STEM learning in general or to address specific challenges of great importance in four general areas:

- STEM learning
- STEM learning environments
- Workforce development
- Participation in STEM expansion

Core Research Proposals: Study of a foundational research with the question/issue designed to inform the transformation of STEM learning and education.

- maximum five years with up to $5 million

Capacity Building Proposals: Support groundwork necessary for advancing research within the four core areas.

- maximum three years with up to $500,000

Synthesis/Workshop

- typically $25,000–$100,000

DRK–12

The Discovery Research K–12 program (DRK–12) seeks to significantly enhance the learning and teaching of Science, Technology, Engineering and Mathematics (STEM) by preK–12 students, teachers, administrators, and parents in school settings. All DRK–12 projects should be framed around a research question or hypothesis that addresses an important need or topic in formal Pre K–12 STEM education.

DRK–12's Three Strands

- Assessment Strand: Projects that develop and study valid and reliable assessments of student and teacher knowledge, skills, and practices.
- Learning Strand: Projects that develop and study resources, models, and tools to support all

students' STEM learning, enhance their knowledge and abilities, and build their interest in STEM fields.

- Teaching Strand: Projects that develop and study resources, models, and tools to help pre- and in-service teachers provide high quality STEM education for all students.

DRK–12 Proposal Types

- Exploratory Studies
- Design and Development Studies (Early Stage or Late Stage)
- Impact Studies
- Implementation and Improvement Studies
- Conferences and Syntheses

Maximum Awards and Durations

- Funding Level 1: Up to $450,000 for a maximum duration of three years.
- Funding Level 2: Up to $3,000,000 for a maximum duration of four years.
- Funding level 3: Up to $5,000,000 for a maximum duration of five years.

ITEST (Innovative Technology Experiences for Students and Teachers) Program

Ensure a high-quality STEM workforce by supporting projects that

- Increase student awareness of career opportunities in STEM and cognate fields.
- Motivate students to pursue appropriate educational pathways to STEM-related careers.
- Provide technology-rich experiences that develop disciplinary knowledge, practices, and non-cognitive skills needed in STEM fields.
- Incorporate applied research in learning.

Three Primary Types of Projects Supported

- Exploratory projects that advance theory and generate evidence for revised or new practices.
  - Awards up to $450,000 for up to two years.
- Strategies projects that address the creation and implementation of innovative workforce-related activities or programs.
  - Awards up to $1.2M for projects lasting up to three years.
- SPrEaD (Successful Project Expansion and Dissemination) projects that support the wider and broader dissemination and examination of innovative strategies.
  - Awards up to $2M for projects lasting three to five years.

Conference proposals may be submitted at any time, but talk with a Program Director first.

Project Notes

Strategies projects must address one or more of the questions listed in the solicitation.

- Experiences that foster student competency
- Instructional and Curricular Models

- Roles of business and workforce members in education
- Roles of business and industry in preparing teachers
- Strategies for parents, mentors, & caregivers
- Strategies for principals, counselors, & other school administrators
  - Strategies for engaging diverse, underrepresented populations

SPrEaD proposals must

- Describe the innovation and the contexts and conditions for broadening and scaling

STEM+C Program

The STEM+C program supports research and development proposals related to new approaches to pre-K–12 STEM teaching and learning related to Harnessing the Data Revolution, Convergence Research, and the Future of Work at the Human-Technology Frontier.

Robert Russell went through many different slides defining and explaining different type of NSF proposals and what PIs should consider when applying for funding. He was very detailed regarding how to look at the application, what to consider when writing, and why you need to be clear and concise about what your group needs and how it will benefit from NSF funding. He also noted that it was important to use a reviewer-friendly format. The easier it is for a reviewer to get through your proposal, the higher chance you have of scoring well.

Participants:

Kevin D. Phelan, University of Arkansas for Medical Sciences
Gregory Vogt, Baylor College of Medicine
Angie Millan, National Association of Hispanic Nurses
Maurice Godfrey, University of Nebraska Medical Center
Victoria Coats, Oregon Museum of Science & Industry
Erin Hardin, University of Tennessee
Lorna Gitari-Mugambi, Georgia State University
Nicole Hines, National Cancer Institute, NIH
Rayelynn Brandi, Montana Tech
Christopher Doyle, Montana Tech
Lynne Holden, Mentoring in Medicine, Inc
Mary Jo Koroly, University of Florida
Carla Romney, Fordham University
Barbara Hug, University of Illinois at Urban-Champaign
Kim Soper, University of Nebraska Medical Center

Breakout Sessions
Friday June 1, 2018: 10:00–11:15 AM

Diabetes, Obesity, and Cardiovascular Disease (DOC) Group

Facilitators: Ann Chester, PhD, *Assistant VP for Health Sciences, West Virginia University*
Melani Duffrin, PhD, *Professor of Nutrition Science, East Carolina University*

The Diabetes, Obesity, and Cardiovascular Disease (DOC) group brings together NIH SEPA projects that address issues related to diabetes, obesity, and cardiovascular disease. The purpose of the group is to discuss common interests, best practices, and evaluation tools across the variety of DOC programs.

In the past, the DOC group has worked on supplemental funding ideas related to evaluation. DOC members continue to be interested in common evaluation tools. This year, the DOC group continued discussions on measures for Attitude Toward Science and discussed the potential use for a new tool called the Veggie Meter.

Four key ideas for the future of the DOC group were generated in the session:

- Explore inviting cancer-focused projects into the group and rename the group DOCC or DOC2: Diabetes, Obesity, Cardiovascular Disease, and Cancer.
- Continue to work on improving tools for measuring attitudes toward science.
- Explore and share information about the use of the Veggie Meter in studies.
- Explore the idea of DOC group projects answering the question: "Can science education programs impact health outcomes?"

Over the course of the next academic year, the DOC group will continue to work together to facilitate continued collaborative work to address the aforementioned ideas.

Participants:

Renee Bayer, Michigan State University

Ann Chester, West Virginia University

Melani Duffrin, East Carolina University

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

Joan Griswold, University of Washington

Sarah Henes, Georgia State University

Gorgia Hodges, University of Georgia

David Holben, University of Mississippi

Allender Lynch, East Carolina University

Maureen Munn, University of Washington

Patrice Saab, University of Miami

Virginia Stage, East Carolina University

Finding Their Voice: Empowering K–12 STEM Teachers through a Teacher Academy

Facilitator: **Rosemary Riggs, MA,** *Educational Development Specialist, University of Texas Health Science Center at San Antonio*

Panelists: **Teresa Evans, PhD,** *Assistant Professor of Pharmacology, University of Texas Health Science Center at San Antonio*

Reporter: **Stephanie Elder, M.Ed.,** *Flint Community Schools*

The University of Texas Health Science Center at San Antonio developed a teacher-driven academy called Voelcker Biosciences Teacher Academy (VBTA). The project was devised as a way to build beneficial relationships between teachers and scientists in order to deepen teacher content knowledge, provide links to current science research, and connect teachers to science careers. In addition, the project helps researchers improve their pedagogy, engage in outreach, and learn to better share information with the non-science community.

This project is focused around the belief that STEM begins in the classroom and the way in which it is delivered is just as important as the content. This project's goals focus on both teachers and students:

Teachers

- Improve self-efficacy
- Reduce anxiety
- Improve classroom management
- Improve motivation
- Improve social-emotional support for students

Students

- Increase achievement
- Increase engagement

The VBTA provides support to teachers by providing teacher-led mentorship opportunities, grant writing support, and community science night planning.

Mentorship Opportunities

Many teachers leave the profession within the first three years; there is a need to focus on mentorship in order to increase teacher retention. The mentoring program is grounded in educational theories and adult learning theories such as Transformative Learning Theory and Constructive Developmental Theory, which help teachers identify how they give and receive feedback. Mentoring provides opportunities for teachers to engage in high-quality professional learning and network and collaborate with trusted colleagues. Throughout the program, teacher leaders are empowered to research, plan, and develop a responsive mentor-training program with a focus on reflective practices for both mentors and mentees. Mentor teachers are given opportunities to present at conferences and workshops.

Grant Writing Support

Teachers often have the perception that writing a grant is very difficult. This program coaches teachers on how to capitalize on grant funds to secure resources by writing grants. Training is geared specifically toward teachers, and it targets awards between $500–$5,000. Teachers in the program have a 71% success rate of obtaining grants; over $35,000 in grant funds have been awarded since 2014.

Community Science Night Planning

The goal of this aspect of the program is to empower teachers to plan and hold a science night at their school. Teachers are trained using specific guidelines for organizing such an activity that will engage community and positively change school culture. The training includes science content and the development of 10-minute activities. Teachers are supported in writing grants to cover the cost of the science night activities. An evaluation tool checklist is used to provide data to teachers on the effectiveness of the activities, and data is also used to communicate with the school principal to encourage future endeavors.

Participants:

Charles Wray, The Jackson Laboratory
Stephanie Elder, Flint Schools
Jill Rhoden, University of Texas at Austin
Gwen Stovall, University of Texas at Austin
Michael Boyd, Iowa State University
Joann Mudge, National Center for Genome Resources
Megan Mekinda, University of Chicago
Ruchita Patel, Rockman et al
Greogy Vogt, Baylor College of Medicine
D**ouglas Coleman,** Duke University
Lorna Gitari-Mugambi, Georgia State University
Michelle Ezeoke, Georgia State University

From the Outside In: Understanding the Impacts of a Youth Science Education Partnership Program by Examining the Perspective of the Community It Serves

Facilitator: **Loran Carleton Parker, PhD,** *Associate Director, Evaluation and Learning Research Center, Purdue University*

Presenters: **Lindley McDavid, PhD,** *Evaluation Associate, Evaluation and Learning Research Center, Purdue University*

Wilella Burgess, MS, *Director, Evaluation and Learning Research Center, Purdue University*

Adrianne Fisch, BS, *Engagement Program Manager, College of Veterinary Medicine, Purdue University*

Sandra San Miguel, DVM, PhD, *Associate Dean for Engagement, College of Veterinary Medicine, Purdue University*

Reporter: **Jenica Finnegan, MA,** *University of Nevada, Reno*

Session Report

SEPA program researchers are especially mindful of the program's impact on participants and heavily focused on evaluation efforts on young learners or educators. In this session, Dr. Parker challenged attendees to consider who may be missing from SEPA program evaluations. The Purdue University, College of Veterinary Medicine program This is How We Role solicits participation and feedback from the community and parents of the enrolled participants, whose perspectives are often underrepresented. By engaging parents and community members in a "Family Fun Night" that celebrates the partnership between the project and community and inviting parents and stakeholders to participate in concurrent focus groups over dinner, This is How We Role staff was able to gather and report key findings about the benefits and challenges to examining these voices.

Benefits

- Parents and guardians appreciated being included in the University community and valued the exposure to science, which improved student engagement.
- Upper leadership, e.g., deans, was able to begin an open and communicative relationship with community members.
- There was an increase of understanding of cultural competency and the importance of training role models on cross-cultural intelligence.
- Project staff were able to strengthen relationships with community partners through trust building.
- Researchers were able to communicate a more complete picture about the impact of the program to funding agencies by examining the perspective of those in the community.
- Community stakeholders were able to suggest ideas for improvements that project staff could implement. These perspectives added value and generated unanticipated impacts for the project.

Challenges

- Qualitative data is often undervalued; some researchers with hard science backgrounds may not be interested in this type of data.
- Efforts to evaluate community members may be considered outside the immediate scope of the project's impacts.
- This type of interaction requires cultural competence and knowledge about the community served; it can be challenging to build trust in these communities.
- It is logistically challenging and resource intensive to collect data; this requires increased effort and funding.

Discussion

This evaluation led to unexpected opportunities and outcomes. For example, families felt welcome and were willing to engage in the research. Researchers from This is How We Roll are trying to understand how this model can be used in the process of scaling up to help partners be successful. In addition to getting letters of commitment, is it possible to go a step further and use the stakeholder/community partner lens to improve the scaling process and model?

Participants:

Cindy Armstrong, University of Colorado
Anne Holland, Space Science Institute
Nathan Berger, Case Western Reserve University
Ben Koo, University of California, San Francisco
Shruti Bathia, University of California, Berkeley
Carol Merchant, NIH/NCATS
Alicia Santiago, Twin Cities Public TV
Angie Millan, National Association of Hispanic Nurses
Erin Harden, University of Tennessee
Jennifer Wiles, NIH/NCI
J**ohnny Kung,** Harvard University
Andrea Panagakis, Salish Kootenai College
Renee Bayer, Michigan State University
Idit Adler, Michigan State University
Rubin Baskir, NIH/OD/All of Us Research Program
Christopher Villa, Helix Solutions
Jenica Finnegan, University of Nevada, Reno
David Holben, University of Mississippi
Mary Larson, Salish Kootenai College
Julia Miller, Children's National Health System
Mary Jo Koroly, University of Florida
Rita Karl, Twin Cities PBS
Laurie Jo Wallace, Health Resources in Action
Barbara Baumstark, Georgia State University

Living Organisms and STEM: Using Flatworms to Teach the Science of Drug Addiction in K–12 Classrooms

Presenters: **Judy Cameron, PhD,** *Professor of Psychiatry, University of Pittsburgh*
Chris Tallarida, BA, *Laboratory Manager, Temple University School of Medicine*
Scott Rawls, PhD, *Professor of Pharmacology, Temple University School of Medicine*
Reporter: **Amy J. Hawkins, PhD,** *University of Utah*

The Science Education Against Drug Abuse Partnership (SEADAP) is an educational program designed to teach students in grades 4–12 about how commonly available drugs (e.g., caffeine, sugar, alcohol, nicotine) can produce addiction. Unlike past drug abuse programs, such as DARE and Life Skills, the SEADAP curriculum is designed around using inexpensive live animals for experimentation in the classroom. Planarians, simple, scientifically relevant flatworms, are an excellent invertebrate-model organism for engaging K–12 classrooms or SciEd workshops! Planarians are macroscopic, which allows multiple students, teachers, or workshop attendees to observe the same flatworms simultaneously; this fosters an ideal environment for social learning. Teachers can also choose to display flatworms to a whole classroom by using a Petri dish on a document camera or overhead projector. Planarians display mammalian-like responses to addictive substances: by monitoring their C-shaped movements, motility, or preference for light or dark locations in a Petri dish, researchers have observed and quantified behavioral changes consistent with drug dependence, withdrawal, drug-seeking, and anxiety. Using the SEADAP curriculum, students perform experiments to generate their own data about the effects of drugs on living organisms. Students draw their own conclusions about how these drugs may act to produce similar behavioral changes in people.

Workshop presenters showed that students who were taught with the SEADAP curriculum showed significant learning gains in knowledge about the science of drug addiction when comparing pre and post-test scores; these learning gains were achieved in students from distinctly different communities: urban, suburban, and rural. To gain firsthand experience with the SEADAP curriculum, workshop participants engaged in hands-on experimentation with the planarians. Each group of participants received Petri dishes containing planarians in spring water and two different concentrations of nicotine in solution. Participants observed obvious behavioral differences in the planarians and quickly began brainstorming ways in which the planarian's behavior could be quantified, for example, by placing the Petri dish on top of graph paper and tracking when a planarian moved from one quadrant of the dish to another in a given span of time. The potential for planarians as an excellent model organism for student-driven inquiry at scalable levels of experimental complexity rapidly became evident to workshop participants. SEADAP curriculum materials, lesson plans, and instructional videos are all freely available on the program's website, Planarian Party: *http://planarianparty.com/*

Participants:

Amy J. Hawkins, University of Utah

Sharolyn Kawakami-Schulz, Office of Intramural Education, NIH

Anja Scholze, The Tech Museum of Innovation

EmilyKate McDonough, Tufts University

Alison Kieffer, The Jackson Laboratory

Bret Hassel, University of Maryland School of Medicine

Holly Brown, Walter Reed Military Medical Center

Debra Yourick, Walter Reed Military Medical Center
Emily Kuehn, Walter Reed Military Medical Center
David Petering, University of Wisconsin-Milwaukee
Daniel Williams, Shelter Island Union Free School District
John Holloran, Connetquot High School
Michael Wyss, University of Alabama at Birmingham

Funding Opportunities for Interactive Digital Media Resources for Learning Science

Presenters: **Georgia Hodges, PhD,** *Assistant Research Scientist and Mat Coordinator, Department of Mathematics and Science Education, University of Georgia*
Tony Beck, PhD, Program Director, Science Education Partnership Award, NIH/NIGMS
Edward Metz, PhD, *Education Research Analyst, Institute of Education Sciences, US Department of Education*
Rajesh Mehta, PhD, *Program Director for Educational Technologies and Applications, Small Business Innovation Research (SBIR) Program, NSF*
David Miller, PhD, *Program Director, Division of Cancer Biology, NIH National Cancer Institute*

This session focused on three main points:

- Identify and examine possible funding mechanisms for future projects
- Understand the common pitfalls that program officers have identified
- Provide an opportunity to ask program officers questions

The presenters highlighted various developed technologies that did the following:

- Increased student learning of difficult science concepts
- Led to approximately $6 million in state & federal funding for Clarke County
- Created 16 jobs in the private sector with an average salary of $65,000, plus healthcare
- Funded graduate students in science education

The research findings discussed included the following:

- Transformation of gameplay data into formative assessment for classroom use
- Framework developed for teacher/professional use of novel learning technologies
- Novel methodologies developed for teaching fundamental biological concepts
- Students' mindsets shift

Using an Interrupted Case Study Approach with Primary Scientific Literature to Engage Students in Authentic Science Practice

Presenters: Berri Jacque, PhD, *Assistant Professor of Medical Education, Tufts Medical School*
Karina Meiri, PhD, *Professor, Tufts Medical School*
Revati Masilamani, PhD, *Research Associate, Tufts Medical School*

The presenter discussed the importance of incorporating biomedical science education in high school science curriculum. However, there are many challenges to bringing authentic science to the high school classroom. Challenges include

- Relevant equipment
- Teaching expertise
- Class period length
- Teacher-to-student ratio
- Curriculum and testing compatibility
- Adequate time for prep & clean up for the lab

Considering these challenges, how do we make biomedical science learning accessible to all?

The presenter then moved on to a discussion of case studies.

What is a case study? A case study is a problem that you seek an explanation for; it is formatted as a study.

- An interrupted case study is delivered in piecemeal. It resembles the flow of the scientific process.
- The challenges of using this approach is training the teachers, serving the right papers, and keeping it simple.

The presenter then moved on to a case study example.

Question: Is obesity an infectious disease?

Case Study #1

- From the graph, it is concluded that "antibiotics cause weight gain."
- Students are then presented with background information.

Activity 2 is presented.

- What conclusions do you draw from the graph?
- Methods are limited, and students are asked to find a pattern in the data.
- Based on what they have concluded, students are asked to draw a predicted graph.
- Based on observations, students are asked if obesity is considered an infectious disease.

Finally, there was a discussion on correlation vs. causation: *www.tylervigen.com/spurious-correlations.*

A researcher needs to run an experiment to determine correlation vs. causation.

- As part of the training, teachers are encouraged to NOT provide the answers to the students.
- Most notably, students will gain a capacity to interpret data.
- It is key for teachers to have buy-in and have the knowledge to implement.
- Some are moving to an online model where feedback will depend on the student's prediction.

Participants:

Abbey Thompson, Stanford University
Michael McKernan, The Jackson Laboratory
Stephanie Messina, Ochsner Health System
Margery Anderson, Walter Reed Military Medical Center
Patrick Goertz, St. Dominic Savio Catholic High School
Barbara Hug, University of Illinois at Urban-Champaign
Manetta Calinger, Center for Educational Technology
Karina Meiri, Tufts Medical School
Carla Romney, Fordham University
Donald DeRosa, Boston University

Posters and Interactive Media Abstracts

Poster and interactive media abstracts are listed alphabetically by title within the following topic areas:

- *Informal Science Education*
- *Teacher Professional Development*
- *Rural STEM*
- *Student Science Enrichment*
- *Authentic Research Experiences for Students & Teachers*
- *Early STEM (PK–3)*
- *Curriculum Development*

Informal Science Education

1. **Biohealth Learning Lab and Makerspace for the Community**
   The Tech Museum of Innovation, Anja Scholze

   The Tech Museum of Innovation and Stanford University Department of Genetics have partnered to develop and activate a novel type of museum space for engaging the public in life sciences: a community bio-makerspace with a repertoire of custom hands-on experiences at the intersection of biology, design, genetics, and technology. We plan to develop both open ended bio-making activities and more scaffolded ones that, together, start to do for biotech and living systems what today's makerspaces have done for engineering. We will report on the first two activities in development (Bio Inks and CRISPR in Yeast) and our initial evaluation results.

2. **Biology of Human**
   University of Nebraska, Judy Diamond, Charlie Wood, and Julia McQuillan

   In partnership with biomedical researchers, science writers, and artists, the Biology of Human team creates integrated packages of outreach media, resources for educators and youth, and teacher professional development, all grounded in social science research. Our key objectives are 1) synthesize innovations in public science education to create resources and deliverables on current topics in biomedicine, 2) work with diverse youth to positively impact their understanding of and attitudes toward research in biomedicine, and 3) conduct social science-based research on the factors that influence how youth develop science identities.

3. **BRAINedu: A Window into the Brain/Una Ventana al Cerebro**
   Twin Cities PBS, Rita Karl, Alicia Santiago, and Kristin Pederson

   BRAINedu: A Window into the Brain/Una Ventana al Cerebro is a national bilingual informal STEM education project providing culturally responsive programming about the brain's structure and

function to Hispanic middle school students and their families. The goals are to empower educators to provide culturally responsive neuroscience education programs, demonstrate neuroscience careers and reduce mental health stigma, increasing help-seeking behavior. The hypothesis is that participants will be able to explain how the brain works and describe specific brain disorders; demonstrate interest in neuroscience and mental health careers and be more willing to seek support for brain disorders and mental health conditions.

4. **Can an Interactive Comic Help Develop STEM Skills? Transmissions: Gone Viral, an Online, Interactive Comic**
   New York Hall of Science, Martin Weiss

   This eBook supports children's understanding of scientific inquiry skills via the use of evidence. Three children try to solve the mystery of dying crows in their neighborhood, with the help of scientific specialists. As they gather evidence, readers are challenged to find patterns in the evidence using interactive games embedded in the narrative. The readers also learn about homology, zoonotic diseases, and disease transmission. The poster highlights key takeaways about how to support science inquiry and content knowledge development using this medium, and shares the challenges of conceptualizing, designing, and testing an interactive comic book in an informal learning environment.

   Transmissions: Gone Viral
   Type: e-Book
   Audience: Middle School (Grade 6–8); Public/Family
   Access: Only available locally

5. **Citizen Science Health & Diversity**
   Emory University, Theresa W. Gillespie and Adam Marcus

   The Citizen Science Health & Diversity (CSHD) Program of Emory University is an NIH SEPA-funded initiative that targets middle school students at Title I schools in urban and rural areas of Georgia. CSHD has four main components that build on citizen science with a focus on health and under-represented students in STEM: 1) After-school STEM enrichment program; 2) Summer Big Data camp for middle school girls; 3) Community outreach through schools and organized events (e.g. Atlanta Science Festival); and 4) Web-based Citizen Science.

6. **Discover Health/Descubre la Salud**
   University of Colorado Denver, Cynthia Armstrong and Paul Dusenbery

   The University of Colorado's Area Health Education Center (AHEC) in collaboration with the STAR Library Network (STAR Net) team, and CLACE developed Discover Health/Descubre la Salud (DH/DS), a bi-lingual informal education program funded by the National Institutes of Health/Science Education Partnership Award. This Colorado based traveling exhibition is hosted by nine Colorado public libraries throughout the state. It includes programs, associated media and evaluation, which addresses the nation's most serious public health issues (diabetes, obesity, and cardiovascular health), especially among underserved and rural populations. It also encourages youth, especially those from at-risk communities to pursue careers in health care professions.

7. **Hexacago Health Academy**
The University of Chicago, Melissa Gilliam

Structured as an informal learning environment with a strong youth initiated mentoring component, Hexacago Health Academy (HHA) uses game-based learning as both a means of health education and stimulating interest in careers in medicine among adolescents from underrepresented minority populations. In this poster, we describe the 2016 and 2017 session of the Hexacago Health Academy, which focused on the topic of sexual and reproductive health (SRH) and alcohol and substance abuse.

8. **Hispanic Role Models in Health Careers**
National Association of Hispanic Nurses, Angie Millan

The purpose of this project is to increase the number of Hispanics into the field of Nursing. Currently there are 3 million Registered Nurses while Hispanics only represent less than 4%. The National

Association of Hispanic Nurses (NAHN) has partnered with Hispanic Communications Network (HCN) to create radio and video interviews that utilize Hispanic-nursing students as role models. An annual campaign is held where these radio interviews are promoted throughout the Country via PSA radio services.

A second component of this project is the Media Tool Kit. The kit contains a PowerPoint presentation on why consider a career in Nursing. The videos and radio interviews are integrated into this tool kit.

For the interested youth/adults, we have created a mentor/mentee database to assist the student through the process of searching for a school, applying to school and assisting them through nursing school.

9. **Human Health, Biodiversity and Microbial Ecology: Strategies to Educate**
American Museum of Natural History, Preeti Gupta

The overall goal of the NIH-SEPA project Human Health Biodiversity and Microbial Ecology: Strategies to Educate is to develop educational programs and exhibits that increase awareness, curiosity, and knowledge of human health and the microbiome. Findings will be presented from a polling kiosk where museum visitors answered knowledge and behavior-related questions on the topics of microbes, antibiotics and probiotics. Data from 15,000 respondents was analyzed for statistically significant differences based on age, gender, and country of origin. Implications from these findings can impact educational program design, museum exhibit design, scientific research protocols, and the public understanding of science.

10. **Interactive Family Learning in Support of Early Brain Development**
Oregon Museum of Science & Industry, Victoria Coats

The Oregon Museum of Science and Industry's (OMSI) Interactive Family Learning in Support of Early Brain Development project is creating a 1,000 square-foot bilingual (English/Spanish) traveling exhibition exploring brain development in young children. OMSI is working with expert advisors, including neuroscientists at the Oregon Health & Science University (OHSU), early childhood educators, and museum professionals. The exhibits and programs will inform parents and caregivers about the neuroscience of the developing brain and engage families with young children in developmentally

appropriate STEM learning experiences. To support various project and stakeholder needs, the project evaluation will include four phases (front-end, formative, remedial, and summative) and utilize a variety of mixed-method methodologies chosen to meet the unique needs and contexts of each phase.

Findings from Year 1 visitor studies and advisor meetings are summarized in the poster.

11. LEAH Knox Scholars Program in Biomedical Research
Health Resources in Action and Tufts Medical School, Laurie Jo Wallace, and Robert Sege

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. 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 teaching hands-on science lessons to elementary school students in afterschool programs. Second year LKS students are then placed in research lab internships.

12. More Than Just a Taste of Citizen/Community Science
Denver Museum of Nature & Science, Nicole L. Garneau

A decade of learning research and evaluation in the Genetics of Taste Lab has helped us to understand the structural and operational aspects needed to increase access by diverse community members, and to increase opportunities to incorporate citizen/community scientists into all aspects of the scientific process. We will share our most recent findings on how community scientists at various life stages and of diverse backgrounds fulfill their personal goals while being apprenticed into conducting scientific research and the practical implications of this work for other informal science programs that conduct or are considering implementing community-based scientific research.

13. The Partnership in Neuroscience Education
Duquesne University, John A. Pollock

The "Partnership in Neuroscience Education" creates narrative driven multimedia resources on issues related to modern neuroscience research and health literacy. Our current project, Bibliotech, is an app that supports interactive stories about the fundamental workings of the nervous system. Existing complementary resources are available at *http://thepartnershipineducation.com*. While complex health and science topics are studied in middle school, we have found that younger students are very capable of understanding and appreciating the underlying fundamental principles when presented in a manner that is both accessible and meaningful to the child. We believe that building a strong understanding of neuroscience early in life will dramatically enhance the learning that can be achieved in subsequent years.

Bibliotech Rebound: Beating Concussions
Type: iOS App & Android App
Audience: Elementary (Grades PK–5); Middle School (Grades 6–8); High School (Grades 9–12); Public/ Family
Access: *http://thepartnershipineducation.com/resources*

We have several apps that explore topics in neuroscience like sleep, concussions, and evolution. Complementary resources are available at *http://thepartnershipineducation.com*.

14. **PBS NewsHour: Health Literacy: A 5–year Project to Inform the Public and Train the Next Generation of Science Communicators**
Greater Washington Educational Telecommunications Association (WETA), Patti Parson and Leah Clapman

This bi-level program includes critical reporting about emerging health issues and biomedical research. One aspect involves middle/high school student reporting through an innovative youth science communicators program that supports STEM career interest. By working across broadcast digital audiences and the primary social networks that students and teachers create, the program seeks to advance health science literacy across the nation. By using a suite of media platforms, the program is creating a new infrastructural support for American understanding issues as divergent as the feature programming on the opioid crisis, advances in how dog ownership contributes to well- being, and new dental technologies.

15. **Weighing the Evidence**
Science Museum of Minnesota, Laurie Fink

Healthcare in the United States is expensive and complex. All too often, consumers feel confused or overwhelmed by their options. The Science Museum of Minnesota's Weighing the Evidence project informs the public and encourages them to become more aware and knowledgeable healthcare consumers.

Project participants

- Become aware of the need to be active, competent health care consumers who ask questions about the evidence that underlies different health claims;
- Begin to develop new strategies for questioning the evidence behind different health products. These strategies may include looking for evidence and analyzing the costs, risks, and benefits.
- Recognize and better understand the role of research in developing new health care products and in the advancement of medical treatments
- Appreciate the role that cultural traditions and values play in the shaping individuals' views on health and wellness – including our own.

The Health Crew outreach team only participants

- Become better prepared to pursue STEM careers in particular health sciences.

Teacher Professional Development

16. **Building Awareness, Respect and Confidence through Genetics (ARC)**
Harvard Medical School, Sanford Research, Marnie Gelbart, Ting Wu and Elizabeth McMillan

Building Awareness, Respect and Confidence through Genetics (ARC) is a partnership between the Personal Genetics Education Project (*pgEd.org*), the Sanford Program for the Midwest Initiative in Science Exploration (PROMISE), and teachers to bring the latest developments in genetics into classrooms and communities in Massachusetts and South Dakota. 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 preliminary outcomes from our professional development programs.

17. **Collaborating to Advance Teaching and Learning of Science Educators and Students: Emerging Pathogens**
    University of Florida, Mary Jo Koroly and Julia R. Bokor

    CATALySES: Emerging Pathogens is a professional development program for secondary science teachers, focused on infectious diseases and translational research, from discovery-based research to clinical therapeutics. Phase I teachers work with science and education researchers to develop lessons and laboratory exercises that convey content-based principles in the context of career choices and translating their experiences from a two-week summer institute into classroom action. Continued support from the CATALySES research team encourages science teachers' personal enrichment and professional advancement in biotechnology education. During the residential research fellowship program of Phase II, teachers are placed in authentic laboratory settings and develop robust curricular modules that integrate infectious disease and translational research topics into multi-day, case-based classroom units aligned with both state and national science standards.

18. **Empowering K–12 STEM Teachers through a Biosciences Teacher Academy**
    University of Texas Health San Antonio, Michael Lichtenstein and Teresa Evans

    The Voelcker Bioscience Teacher Academy's (VBTA) mission is to Empower K–12 STEM teachers. Hosting an annual dissemination conference for K–12 STEM teachers is vital to that mission. The conference provides access to area scientists who share current research with teachers. Collegial networks are formed and strengthened as teachers engage with colleagues from different grade levels across 19 area independent school districts. Since 2011, attendance to the conference has tripled. At the 2018 conference, the VBTA directly impacted over 150 teachers and, indirectly, over 19,000 K–12 students. With a repeat attendance of over 50%, the conference fills a vital niche.

19. **The Exploratorium Digital Teaching Box: A Professional Development Tool for Life Science Teachers**
    Exploratorium, Hilleary Osheroff, Julie Yu and Kristina Yu

    The Digital Teaching Boxes program for middle and high school life science teachers is designed to bring content related to health and biomedical research to students. This program brings together the expertise of the Exploratorium, research scientists, and life science teachers to work in small collaborative groups, mentoring one another as they assemble resources and develop curriculum materials.

    Over the five-year project, middle and high school life science teachers will develop digital teaching boxes that will be pilot tested in classrooms. During the project, thousands of students will be served by teachers developing and pilot testing digital teaching boxes.

20. FoodMASTER
East Carolina University, Melani Duffrin

FoodMASTER: Reach to Teach is a newly formed outreach component of the FoodMASTER initiative. The program aims to foster relationships between registered dietitian-nutritionists (RDNs) and science education communities. Reach to Teach has already introduced this concept to over a 1000 dietitian/nutritionists worldwide and challenges RDNs to start working with their local science education communities.

21. Frontiers in Physiology: Integrating Programs to Build Communities of Practice
American Physiological Society, Marsha Matyas

Our study is determining if a nationwide online PD program can positively impact participating teachers at three levels (knowledge, preparation, and actual use) in 9 areas. Participants were 6 middle school and 20 high school science teachers who successfully completed the APS Frontiers in Physiology-Six Star Science Online PD Program. Pre- and post-program survey data including self-reports on knowledge, confidence/preparedness, and actual use in each area indicated increased understanding and confidence/preparedness in most of the PD areas.

22. The Great Diseases: Bringing Biomedical Science to High Schools
Tufts Medical School, Karina Meiri and Jacque Berri

U.S. 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.

23. Hk Maker Lab: Engineering Design for High School Students and Teachers
Columbia University in the City of New York, Aaron M. Kyle

The Hk Maker Lab is a suite of interconnected programs that emphasizes engineering design for high school teachers and students. One component of the Hk Maker Lab is the creation of engineering design curricula for NYC high schools. To train teachers, we use our existing six-week engineering design summer program as a co-learning environment. STEM teachers receive hands-on training in the design while observing engineering instruction and its challenges. This firsthand experience provides teachers with real-time student feedback during design instruction in addition to receiving that instruction themselves. The co-learning approach exposes teachers to the inherent challenges that arise in teaching students how to identify and solve open-ended problems.

24. Modeling for Fidelity: Mentored Dissemination of a Novel Curriculum about Infectious Disease
Tufts Medical School, Karina Meiri and Berri Jacque

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.

25. Professional Competency Assessment of Flipped STEM Course Educators
University of Mississippi Medical Center, Marie Barnard and Rob Rockhold

The Science Teaching Excites Medical Interest (STEMI) project provides professional development to high school STEM teachers, focusing on flipped learning techniques to prepare students for higher education and careers in STEM/healthcare disciplines. Teacher competencies were identified via participatory evaluation techniques and assessments were aligned to the competencies. The competency of teachers in the skills needed for creation and delivery of superior flipped lessons is evaluated and reported using a radar graph to guide tailored professional development.

26. The Science and Ethics of Genome Editing
Milwaukee School of Engineering, Tim Herman

The Science and Ethics of Genome Editing is a professional development experience for teachers. In the first year of this project, teachers will explore the milestones of molecular biology that now allow us to edit the human genome. Tactile teaching tools developed for this workshop include models of CRISPR Cas9 (both 3D printed and foam-based) and a chromosome kit. In the second year of this two-year program, the teachers will participate in a one-week summer course at UC-Berkeley where they will have an opportunity to interact with the CRISPR researchers at the Innovative Genomics Institute.

27. Science Club Summer Camp: Training Teachers and Youth in Authentic STEM Practice
Northwestern University, Michael Kennedy

Science Club utilizes a novel, practicum-based approach to elementary school teacher professional development. In this model, third grade teachers learn about NGSS teaching shifts, grounded in authentic district-aligned curricula, then iteratively implement these shifts with 3rd grade youth in a summer science camp at a Boys & Girls Club site. This model has the benefits of 1) training and supporting elementary teachers in an authentic instructional setting, 2) bridging 'nature of science' learning for teachers and youth across formal informal environments, and 3) providing high quality summer learning opportunities for underserved youth.

28. Science Teaching Excites Medical Interest (STEMI)
University of Mississippi Medical Center, Rob Rockhold

STEMI has collaborated with the Mississippi INBRE program to design and evaluate a rubric to guide assessment of high school teachers in six areas of general competency deemed necessary to create and deliver high quality flipped learning activities.

Competencies can be discriminated among Novice, Intermediate, and Advanced practitioners using radar graph visualization. Digital credentials are delivered for attainment of each level of competency.

Use of a defined, rubric-based evaluation will improve consistency in flipped learning educational products.

29. Science Tools in the Classroom
New Mexico State University, Michele Shuster

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 workshop.

30. SEEC
University of Alabama–Birmingham, J. Michael Wyss and Katie Busche

The Next Generation Science Standards are intended to help students develop deeper content knowledge and stronger skills, thus developing a foundation very early; however, K–5 schools are very limited in science offerings. SEEC focuses on the earliest year students have a dedicated science class, (6th grade). Year 1–2 of GeoTeach focused on developing 6th grade science teachers' skills, familiarity with standards, inquiry-based science and content knowledge. In year 3, we expanded to grade 7/8 to address our aim of developing vertical teaming. Years 4–5 are examining the overwhelming positive feedback and data collected to continue to develop GeoTeach.

31. Teachers and Students for Community Oriented Research and Education
University of Kansas, Megha Ramaswamy and Karin Chang

The objective of Teachers and Students for Community Oriented Research and Education (T-SCORE) is to develop an innovative Health Science Career Pathway curriculum and empower teachers to incorporate inquiry-based learning, health science research, and local health disparities into engaging lessons for students. From 2015–2018, our team of 15 teachers and T-SCORE staff developed 11 inquiry–project-based learning units in the health sciences. In this poster, we describe teacher professional development, unit creation, and implementation of units in high schools over the last three years. We describe successes, challenges, and next steps for implementation of the T-SCORE objective.

32. Teaching the Genome Generation
The Jackson Laboratory, Charles Wray and Gareth Howell

Teaching the Genome Generation (TtGG) is a teacher professional development program and high school biology curriculum that supports interwoven classroom instruction of human molecular genetics, bioinformatics, and bioethics. TtGG uses an intensive professional development course to train high school teachers and subsequently supplies portable a laboratory as well as lesson plan and technical support during the academic year. Participating teachers from across New England implement the curriculum at a high rate in a variety of biology classrooms. Evaluation data indicate that TtGG has increased teachers' abilities to integrate complex concepts of genomics and bioethics into their classes.

33. Turning K–12 Environmental STEM Education InSCiEd Out
Mayo Clinic and University of Minnesota, Chris Pierret and James Cotner

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 short- ages, 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 zebra fish resource for use in environmental toxicology by all STEM researchers. The successful completion of the InSciEd Out PE work 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 zebra fish model system.

InSciEdRS View
Audience: Elementary (Grades PK–5); Middle School (Grades 6–8); High School (Grades 9–12); Undergraduate; Public/Family
Type: iOS App, Android App & Microscope and software
Access: Order forms, URL and Google Play

For the purposes of partnership in classrooms with a transparent living model (zebra fish), and applicable to all microscopy needs, we have designed and brought to market a classroom "lunchbox microscope". At a fraction of the cost of typical student microscopes, the InSciEdRS View includes the ability to 3D print replacements to over half of its parts. Its 1080p HD WiFi signal can be accessed on any phone, android, PC, or Mac with auto-calibration and measurement functions outpacing much more expensive options.

34. Young Scientists, Ambitious Teachers Improving Health in an Urban Ecosystem
Iowa State University & University of Wisconsin, Madison, Katherine Richardson Bruna and Lyric Bartholomay

The new Teaching & Learning With Insects course at Iowa State University provides elementary education students with opportunities to learn about mosquito biology, ecology, and epidemiology through ambitious science teaching and learning activities. Engaged curricular components such as field trips to an authentic mosquito laboratory and to communities planning for mosquito control, as well as participation in the Mosquitoes & Me summer camp and after school programs, energize their interest in science as a public service, elevate their confidence, and prepare them for effective formal and informal instruction of youth historically excluded from science.

Rural STEM

35. The MENTORS Project

Texas A&M Health Science Center, Robin Fuchs-Young, Carolyn Cannon, Timothy Lightfoot, Bugra Yalvac and Natalie Johnson

The MENTORS Project (Model Education Network To Optimize Rural Science) aims to enhance STEM education and stimulate interest in STEM careers, especially in URM students. The project has two major programs for teachers. The Summer Institute for K–12 Educators which is a 4–day professional development conference, and the Summer Educator Fellowship which is a 3–week long research-inspired curriculum development program at TAMU. The project also focuses on three major programs for students. Field Experiences where students visit TAMU and participate in different SIM labs, the Lab Rats program where high school students conduct 6-weeks of hands-on hypothesis-driven research

at TAMU, and our SHARE (School-based Health Awareness and Regional Education) program where students are trained throughout the year to become Health Ambassadors in their community by participating in a community Health Expo at the end of the school year.

36. PiPES: Possibilities in Postsecondary Education and Science

University of Tennessee, Melinda Gibbons and Erin Hardin

We will describe our PiPES curriculum and highlight recent research projects resulting from our intervention.

37. The Wolbachia Rodeo - a STEM Learning Competition

University of Mississippi Medical Center, Donna Sullivan and Rob Rockhold

The Wolbachia Rodeo is a STEM learning activity for high school students participating as teams from schools in Mississippi. Prior to the event, teachers from participating schools receive intense training in skills necessary for detection of Wolbachia in insects by polymerase chain reaction, including preparation of buffers, gel electrophoresis, and DNA extraction. Each teacher then selects a team of 4–5 students for participation in a competition and engage them in a flipped lesson plan employing videos and at home assignments. STEM topics include insect taxonomy, chemistry, microbiology, molecular biology of DNA, analysis of results, and scientific communication skills.

Student Science Enrichment

38. Accelerating Access: Health Science Education in Native American Communities

University of Nebraska Medical Center, Maurice Godfrey

Improving science instruction in the classrooms serving our Native American partners is key to this project. Our objectives are accomplished by creating and adapting hands-on, age appropriate lessons. Teacher support through summer workshops, mentoring, and in-service education facilitate implementation of novel science strategies. Student engagement will be enhanced through summer experiences from science camps for middle school to longer term enriching programs for select high school students. Full day programs to introduce hands on science or in depth engagement and career

exploration are other novel aspects of our program. We continue to introduce Native role models across disciplines.

39. ArkanSONO: A Technology Based Outreach Exposure Program for High School Students
University of Arkansas for Medical Sciences, Kevin D. Phelan

ArkanSONO is an outreach program for 9th grade students in the Little Rock public school system that takes advantage of technological advances in simulation and ultrasound technology to provide students an opportunity to experience first-hand the transformative power of these new educational tools. The program uses these technologies in the classroom and in a proposed weeklong cardiovascular health focused summer day camp to stimulate student interest in STEM and increase student and teacher STEM content knowledge. ArkanSONO will serve as a unique model for attracting students towards a STEM career and to help diversify the STEM workforce of the future.

40. CityLab and Urban Squash: A New Pathway to Achieve STEM Success
Boston University and Fordham University, Carl Franzblau, Donald DeRosa, and Carla Romney

CityLab is partnering with SquashBusters (a Boston squash education program) to engage middle school students in better understanding their health using self-generated and personally-meaningful physiological data. We will present data from our initial pilot studies and relate them to the overall goals of our current SEPA project. We will also share our experiences in building a partner- ship among several academic institutions and community-based academic enrichment programs for students from backgrounds that are traditionally underrepresented in STEM.

41. Community of Bilingual English-Spanish Speakers
University of Nevada, Reno, Ruben Dagda, Jenica Finnegan, and Jacque Ewing-Taylor

This poster focuses on the Community of Bilingual English-Spanish Speakers (CBESS) project design and development. Each participant type is highlighted to demonstrate how supported participants contribute to strengthening the pipeline of Spanish-English bilingual secondary students and higher education/career paths in STEM-healthcare fields. Project schematics illustrate various components of CBESS and how they interact.

42. Engaging Families to Enhance Science Learning and Interest in STEM Careers
Seattle Children's Hospital, Amanda L. Jones

For this project, we measured the impact of two new curriculum modules delivered onboard Seattle Children's Research Institute's mobile science lab and two family-based activities, all of which were designed to encourage and support student learning and interest in science careers. Our data demonstrate content knowledge gains in understanding of body systems, vital signs, and brain functions among participating grade four students as well as gains in interest in STEM careers. We have also detected longer-term retention of these gains in science learning and interest through assessments conducted in grades five through seven.

43. Get in the GROOVE!
University of Miami, Patrice G. Saab and Judy Brown

Girls Realizing Options though OpenSim Virtual Experiences (GROOVE) involved a randomized controlled trial comparing two intensive, three-week summer enrichment program for middle school girls promoting healthy lifestyle and focused on nutrition and physical activity: GROOVE and GROOVE+.The project is a partnership of the University of Miami, the Frost Museum of Science in Miami, and the New York Hall of Science.

44. Health Quest: Engaging Adolescents in Health Careers with Technology-Rich Personalized Learning
North Carolina State University, James Lester (NCSU) and Elizabeth Ozer (UCSF)

The goal of the Health Quest project is to create an intelligent game-based learning environment and associated resources to increase adolescents' knowledge of, interest in, and self-efficacy to pursue health science careers. The Health Quest Career Adventure Game will be an intelligent game-based learning environment that leverages AI technologies to create personalized health career adventures. It will be complemented by the Health Quest Student Discovery website, which will feature interactive video interviews with health professionals, and the Health Quest Teacher Resource Center website, which will provide online professional development materials and in-class support for teachers' classroom implementation of Health Quest.

45. HISci
University of Hawaii, Kelley Withy

The HISci program now has over 1000 students engaged in health science career activities as well as regular teacher training for 25 teachers a year. Student activities include college/career readiness, skills development, mentoring, research, and shadowing. Program impact shows increases in confidence and intent, plus 68% application success rate.

46. In-Classroom Biology Internships for Students and Teachers in Underserved Schools
Walter Reed Army Institute of Research, Debra Yourick

The Gains in the Education of Math and Science (GEMS) enrichment program is designed to encourage student engagement in STEM, foster positive attitudes toward science, and enhance STEM learning through partnerships between schools and STEM research entities. The program is completing its third year of implementation in 9th grade biology classrooms, with near-peer mentors delivering NGSS-aligned, inquiry-based modules. Results from the first two years of implementation revealed statistically significant differences between enrichment and comparison groups, with medium to high effect sizes. The enrichment group performed better on standardized exams and class assessments, while also reporting more positive attitudes toward science.

47. Medicines and Me: Understanding and Using Medicines Safely
University of Rochester, Dina Markowitz

Adolescents are uniquely prone to errors in self-administering medicines, and many adolescents have serious misunderstandings about potential risks of over-the-counter (OTC) medicines. The goal of our "Medicines and Me" project is to increase adolescents' understanding of concepts essential for the safe

use of OTC medicines and to increase their awareness of how medicines are developed. Our hands-on and minds-on "Medicines and Me" lessons are being disseminated to secondary school teachers throughout the US. We also created "Medicines and Me" field trip programs and community outreach activities that are led by scientists at the University of Rochester's Life Sciences Learning Center.

48. San Gabriel Valley Science Education Partnership Award Collaborative
Beckman Research Institute, City of Hope, Christopher Sistrunk

The San Gabriel Valley Science Education Partnership Award (SEPA) Collaborative is a partnership between the Beckman Research Institute at City of Hope (COH), a nationally recognized Comprehensive Cancer Center, and Duarte Unified School District (DUSD). The Collaborative was developed with three aims: 1) establishment of a K–8 research education program, 2) establishment of a professional development program for K–12 teachers, and 3) establishment of a two-stage research education program for rising high school juniors and seniors. We will review the accomplishments made for aims 1 and 3 over the last 6 years, with a special emphasis on the K–8 program.

Authentic Research Experiences for Students & Teachers

49. Barcode Long Island: Exploring Biodiversity in a Unique Urban Landscape
Cold Spring Harbor Laboratory's DNA Learning Center, Sharon Pepenella and David Micklos

Barcode Long Island (BLI) provides high school students with a unique opportunity to contribute to distributed-research projects for documentation of Long Island's biodiversity using DNA bar coding. A "DNA barcode" is a unique pattern of DNA sequence in an organism's genome that can be used to potentially identify any living organism. BLI engages students through hands-on experimentation and aims to stimulate independent thinking across different levels of biological organization, while students contribute to citizen science efforts to develop an understanding of their local environments. BLI measures the effects of a large-scale science research experience on students and teachers, which will be presented alongside updates from the program.

50. Barcode Long Island – A Mentor Account of Authentic Student Research
Cold Spring Harbor Laboratory's DNA Learning Center, John Halloran and David Micklos

Authentic research experiences for high school students have been shown to improve critical thinking skills and increase student engagement in STEM fields. For teachers, implementing these experiences can be daunting, with numerous obstacles to successful student experiences. Over the past four years, I have used Barcode Long Island as a gateway program to teach students how to design, implement and complete a research project. Through this approach, students have experienced the process of scientific research while improving their critical thinking skills. Their research has led to the discovery of novel GenBank sequences, the detection of invasive species, and increased enrollment in advanced classes and internships.

51. BioSTORM
Salish Kootenai College, Mary Larson and Elizabeth Rutledge

In an effort to increase the number of American Indian high school students who are prepared for college academic majors in the biomedical fields, Salish Kootenai College (SKC) developed BioSTORM, a dual enrollment STEM Academy. The 2017–18 academic year marks the initiation of the Academy, which has three major components: (1) academic coursework that is rigorous and transferrable as college credit, (2) authentic biomedical research, and (3) an outreach component through which BioSTORM students present their research to elementary, middle, and high school students. Participants experience a culturally relevant learning environment that enhances students' educational outcomes, including college readiness.

52. BrainWaves
New York University, Wendy A Suzuki

The BrainWaves program is a lab-based brain science course in underserved high schools, where students carry out their own original brain experiments using real brainwave scanning equipment. A primary goal of the program is to provide a unique opportunity for students to get first-hand experience with the scientific process. Following a curriculum covering the basics of neuroscience and psychology, students design, conduct and analyze data from their own research experiments.

53. Bringing Research Into the Classroom (BRIC)
Montana Tech, Marisa Pedulla and Rayelynn Brandl

The BRIC program will highlight the past year's student and teacher research successes. In 2017–18, students and teachers completed extensive projects, some of which were eligible for publication and presented and the national science fair. We will include evaluation outcomes for the overall project as well as a discussion of teacher retention and future directions.

54. Day of Discovery: A STEM Pipeline Program for Middle School Students
Vanderbilt University, Virginia Shepherd and Jennifer Ufnar

The Vanderbilt Center for Science Outreach (CSO) developed the Day of Discovery (DoD) STEM program for middle school students. Students attend the DoD for one day per week in laboratories on the Vanderbilt campus and Stratford STEM High School. The program is co-taught by scientists and teachers, and provides students with rigorous research-based STEM curriculum. The goal is to encourage students to continue STEM studies in high school, and apply for admission to two high school programs previously funded through SEPA awards: the School for Science and Math at Vanderbilt and the Interdisciplinary Science and Research program.

55. Empowering Pre-service Teachers and Students With Environmental Health Research
University of Wisconsin-Milwaukee, David Petering and Craig Berg

The goal of the UW-Milwaukee 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 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-ser- vice teacher training, various student learning opportunities (e.g., research activities, Student Research Conference), and program evaluation.

56. High School Research Initiative

University of Texas at Austin, Gwendolyn M. Stovall

The High School Research Initiative (HRI) provides a dual-enrollment research course, teacher training, and high school-university partnerships. The dual-enrollment course offers students high school credit, as well as an option for University of Texas (UT) course credit, upon meeting eligibility requirements. The research course is a blend of inquiry-based and University-partnered research, which is taught at the high school campuses by the professionally trained high school teachers.

Aptly called the Research Methods-FRI course, the yearlong research course is a unique melding of a UT Research Methods course and a UT Freshman Research Initiative (FRI) experience. Through the first half of the course, students engage in inquiry-based research, requiring student to learn how to "ask" and "answer" their own questions in a scientific manner. In the second semester, students engage in a FRI-like experience by partnering the high school class with a UT FRI lab and sharing similar research objectives.

First-time Research Methods-FRI course teachers attend a 3–week professional training over the summer and alumni teachers return each summer for an abbreviated professional training. It is during this time that the teachers build their knowledge in inquiry-based research (e.g., how to guide students toward projects), statistics (e.g., standard error, chi squared, t-tests, ANOVA, etc.), as well as the discipline-/research-specific skills. Additionally, the teachers are matched based on their research interests and teaching/learning backgrounds with a UT FRI faculty members. The teachers and FRI faculty member begin building their research objectives and curriculum for the second part of the research course.

57. HSTA Citizen Science

West Virginia University, Ann Chester

A distinctive piece of HSTA is its students' development of research projects that examine, and address health issues faced by their communities. These projects form the core of the HSTA experience and drive the academic learning the program promotes. The projects turn HSTA students into community advocates who address health and social issues at home, even as they prepare to move on to college and beyond. Project results have been published in peer-reviewed journals.

58. Insights into Promoting Environmental Stewardship at a Rural School District through Barcode Long Island

Cold Spring Harbor Laboratory's DNA Learning Center, Daniel Williams and David Micklos

As a mentor for the Barcode Long Island (BLI) high school science research program, I have grown as a teacher by helping students to design scientifically accurate projects, interpret results, and look beyond easy answers to critically think about their research. BLI guides participants to analyze the natural world through hands-on experimentation, in contrast to standard classroom memorization.

Project results were a window into local biodiversity, with the discovery of novel GenBank sequences and unexpected finds. More importantly, these results sparked scientific curiosity and helped students understand human impacts on the environment. Through this program, students increased their scientific knowledge and understanding of local biodiversity, and developed an appreciation for their role as environmental stewards.

59. NeuroLab
Coastal Marine Biolabs Integrative Biosciences Program, Ralph Imondi and Linda Santschi

NeuroLab establishes a model of biomedical citizen science that bridges education and neuroscience research. The project includes residential research institutes that engage students in deep explorations of developmental neuroscience and the scientific model-building enterprise. These highly collaborative experiences provide unique opportunities for students to identify new tools to visualize/manipulate developing neurons. The project's scientific strand supports these activities by creating web-based technologies for students to organize and share molecular genetic and neuronal expression data with the neuroscience community. NeuroLab also involves the development of new instructional resources, including an interactive, neuroscience-centered game space, aimed at extending program reach.

60. Measuring a Student's Researcher Identity Using the BEAR Assessment Framework
University of California San Francisco, Shruti Bathia, Rebecca Smith, and Katherine Nielsen

In the first half of the poster, I will discuss the development of a novel Researcher Identity Scale (RIS) to measure student's self-identification as a researcher. The instrument development is a four-phase iterative process based on the principles of the Four Building Blocks. (BAS, Wilson & Sloan, 2000). The four phases are construct mapping, instrument design, outcome space, and measurement model.

After having created the instrument, we administered it to nearly 80 students over consecutive years. We built a statistical model to analyze student responses. Hence, in the second part, I will discuss the results and key findings of the research.

61. San Francisco Health Investigators
Science & Health Education Partnership at the University of California San Francisco, Ben Koo, Rebecca Smith, and Katherine Nielsen

San Francisco Health Investigators (SFHI) engages 20 high school students annually in a yearlong 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, and then study the effectiveness of these messages. The 2017 theme for SFHI was antibiotic resistance. Our student investigators surveyed over 500 San Francisco residents about their knowledge and awareness of antibiotic resistance and utilized this data to inform their health message campaign. We will share our program design, health message campaign and project outcomes in our poster.

62. Science Education Against Drug Abuse Partnership Program (SEADAP)
East Carolina University and Temple University, Rhea Miles and Scott Rawls

The SEADAP program in its fourth year continues to implement hands-on curriculum educating students about the science of drug addiction and the adverse effects of widely abused substances.

The program exposes students in inquiry-based research activities to increase their interest in STEM careers. Students are lead to design their own experiments on planaria, a type of flatworm, with nicotine, alcohol, and sucrose solutions. The curriculum also involves conducting investigations, which specifically address the National Science Education Standard & Common Core.

63. Seeing the Science of Drug Addiction with Flatworms in K–12 Classrooms
Temple University School of Medicine, Scott Manning Rawls

An enduring gap in youth substance abuse education programs is the inability to study addictive substances in living organisms. We have used planarians to develop a scalable, cost-effective, and scientifically-relevant curriculum that arouses interest in student learners by enabling them to 'see' and 'quantify' addictive-like effects (e.g., dependence, withdrawal, drug seeking, anxiety, depression, and change in motility) following exposure to nicotine, caffeine, ethanol, or sugar. We have trained over 200 K–12 teachers across 4 states (PA, NY, VA, NC) and reached about 8000 students. Assessment data reveal significant student gains in knowledge about the hazards of addictive substances, increased interest in biomedical science careers, and better understanding of why animals are used in research.

64. The Western New York Genetics in Research and Healthcare Partnership
State University of New York at Buffalo, Stephen Koury and Shannon Carlin-Menter

The Western New York Genetics in Research and Healthcare Partnership targets schools in Western New York with the highest rates of underrepresented students and is designed to serve as a pipeline for the recruitment of 9–12 students into STEM careers, with an emphasis on Genomics and Bioinformatics. We recruited high school biology teachers and trained them to use the GENI-ACT Toolkit (Genomics Education National Initiative – Annotation Collaboration Toolkit). Teachers then worked with their own schools to deliver GENI-ACT Modules to students. The hands-on experience provided opportunities for the students to find, understand, and critically evaluate others' research.

Early STEM (PK–3)

65. DNA Runs in the Family
Georgia State University, Barbara Baumstark

Using DNA as a molecular alphabet, we have developed age-appropriate genetics learning modules for presentations at K–12 schools, libraries, and community centers. Our results indicate that children as young as five years old can grasp genetic principles and solve simple genetic problems. However, we note the well-documented observation that many children, and especially immigrant children, tend to lose interest in science as they transition to late elementary and middle school. We are currently testing various parameters (such as dual language, culturally rich subject matter, and family involvement) to determine what factors might influence this loss of engagement.

66. K–3 STEM Foundations: Life Science
Baylor College of Medicine, Nancy Moreno

Scientists and Educators at Baylor College of Medicine and the University of Texas San Antonio are developing a new series of teaching materials for grades K–3 focused on life science themes and

disciplinary literacy skills. The first unit, Life Cycles and Heredity, is being piloted in 20 classrooms in Houston and San Antonio during April - May 2018.

67. This is How We "Role": Inspiring Future Researchers through Veterinary Medicine
Purdue University College of Veterinary Medicine, Sandra San Miguel

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 an interactive science and math 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 research careers. In 2017, the program expanded to Colorado State University College of Veterinary Medicine and Biomedical Sciences, Cummings School of Veterinary Medicine at Tufts University, Lincoln Memorial University College of Veterinary Medicine, and Michigan State University College of Veterinary Medicine.

Curriculum Development

68. Developing Skills in Health Literacy
BSCS Science Learning, Anne Westbrook

The Developing Skills in Health Literacy project is developing curriculum modules for use in both middle school and high school science 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.

69. GEMNet: A Health and STEM Network
University of Washington, Maureen Munn and Helene Starks

This poster highlights two new complementary curriculum units that integrate type 2 diabetes education into Health and Biology classrooms. The curricula contribute to student understanding of key learning targets and standards for each discipline, and link to broader social issues including environmental influences, scientific research, personal choice, access to resources, diet and exercise, and public policy.

These curricula provide a foundation for future teacher professional development, additional curriculum development, and a research study that asks questions about learning gains and shifts in behavior and self-efficacy for students who received the curricular intervention in one, two, or more classes over time.

70. Genes and Microbes: Engaging Students and Teachers in NGSS-Aligned Curricula and Professional Development
University of Utah, Genetic Science Learning Center, Louisa A. Stark

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 unit is currently being pilot tested with students and teachers. 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.

71. A New Approach to Evolution Curricula: Development and Testing of an NGSS-aligned Unit that Integrates Heredity and Argumentation

University of Utah Genetic Science Learning Center, AAAS Project 2061 and Rockman et al, Louisa A. Stark, Kevin Pompei, Peter Anderson, Nicola Barber, Kagan Breitenbach, Dina Drits-Esser, Amy J. Hawkins, Sheila Homburger, Sam Katz, Max Kelly, Molly Malone, Ryan Perkins, Harmony Starr, Jo Ellen Roseman, George DeBoer, Joseph Hardcastle, and Kristin M. Bass

In response to calls for NGSS-aligned curriculum materials that integrate genetics and evolution, the project team (including teacher partners) has developed and tested a 5–module, 7–8 week curriculum unit and assessments for introductory high school biology. Results from Phase 2 of a rigorous 3–phase field-testing have shown significant student conceptual and science practice learning gains and teacher advancement in skillful implementation of relevant NGSS practices. Preliminary results from Phase 3 (RCT) indicate that that students who used the new curriculum showed significantly greater pre/post gain scores than students in the control condition (business-as-usual) in their understanding of evolution.

72. A New Genomic Framework for Schools and Communities: Health in Our Hands

Michigan State University; University of Michigan, Joseph Krajcik, and Toby Citrin

We used Community-Based Participatory Research (CBPR) as an approach to design, enact, and sustain a middle school science curriculum. The project-based learning curriculum focuses on gene-environment interactions in Type–2 diabetes and addiction.

Classroom activities are coordinated with community action projects, where students examine ways to improve the health of their environment and present findings back to the community. Unit I was enacted with students in a high-needs urban, racially diverse district (N=650). Our research focused on how to effectively engage multiple partners from schools, community-based organizations, museums, libraries, and universities throughout the process of curriculum development and enactment using CBPR.

SageModeler

Type: Website, web-based systems dynamics modeling tool
Audience: Middle School (Grades 6–8); High School (Grades 9–12)
Access: *https://concord.org/our-work/research-projects/building-models/*

SageModeler is a free, web-based systems dynamics modeling tool for secondary school students to construct dynamic models and validate their models by comparing outputs from their own models and data from one or more other sources, including experimental data from probes or data generated by simulations. We're using SageModeler in our curriculum to engage learners in three-dimensional

learning by using crosscutting concepts (systems and systems modeling, cause and effect, and energy and matter) with various scientific practices (particularly modeling, but also analyzing and interpreting data and engaging in argument with evidence), integrated with disciplinary core ideas.

Gene-environment Interaction: How does food affect the health of sand rats?
Type: Website
Audience: Middle School (Grades 6–8); High School (Grades 9–12)

In this simulation, students plan and carry out investigations to understand the effect of both genetic information and environmental factors on the health of sand-rats, an animal model for studying diabetes. Students examine the genetic composition of sand rats, sort them into different pens, and vary the food source.

They collect data to see how both food and genetics affect the health of the rats.

73. PAGES (Progressing Through the Ages: Global change, Evolution, and Societal Well-Being)
University of Illinois, Barbara Hug, Becky Fuller, Brian Reiser, and Tania Jarosewich

In this poster, we present our early curriculum 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 exemple. 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. Additionally, curriculum and professional development efforts across the project will be addressed.

74. Pandem-Sim
Wheeling Jesuit University, Charles Wood

Pandem-Sim is a suite of programs for 11–12th grade students on the epidemiology of infectious disease outbreaks, epidemics and pandemics. The main elements are (1) a live simulation that immerses students in the identification, control and treatment of outbreaks around the world, and (2) the Pandem Resource Center (PDC) with a massive collection of problem and case-based learning modules supported by life science resources and career information. During 2017–2018, we completed pilot testing and revision of the sim, and recruited teachers for field testing, which is nearly completed. The PDC was reviewed by a content expert and is now online.

75. Sharing ASSETs: Expanding Science Opportunities in K–12 Classrooms
Cornell University, Ted Clark

ASSET provides hands-on, inquiry-based K–12 science education materials that use live protozoa to examine fundamental biological concepts. Individual ASSET modules are adapted for use in elementary, middle, or high school, and include teacher guides, student protocols, all needed materials, and a free equipment lending library. ASSET also offers support for high school students interested in pursuing classroom independent research, providing guidance and the loan of materials and equipment. ASSET Science and Society activities engage students in a consideration of the impact of science and technology in shaping society, and of the reciprocal effect of societal pressures on scientific endeavor.

76. Strengthening Middle School Science and Health Education for Diverse Learners by Linking Grade Level Reading of Complex Texts and Inquiry
University of Missouri, William Folk and Melinda Van Garderen

Science requires sophisticated literacy skills to access scientific terminology, interpret arrays of data, comprehend scientific texts, engage in interpretive and critical reading, and to read and write scientific explanations. We will describe a multimodal text set "The Flight of the Bumblebee" that is being implemented in Missouri classrooms with accompanying support for teachers. This innovative text set focuses upon the development and validation of acoustic monitoring of bumblebee buzzes (NGSS

MS-ETS1 [Engineering Design] and MS-PS4 [Waves and Their Applications in Technologies] to address a real-world problem – the declining number of bee populations essential for ecosystem services and biodiversity (NGSS MS-LS2 [Ecosystems]).

77. SYSTEMS: Stimulating Young Scientists to Engage, Motivate, and Synthesize
University of Georgia, Georgia Hodges

Our game, the Virtual Vet, was tested in a controlled study with 300 students during the 2017 school year, with 150 in a control group and 150 in the treatment (game play) group. This poster will present our methods as well as the analytic framework that we used to collect and analyze the data. We will also present findings and limitations of the study. We will have the game available for perusal as well.

SYSTEMS: The Virtual Vet
Audience: Elementary (Grades PK–5)
Type: Game
Access: http://bodysystems.coe.uga.edu

This serious educational game immerses elementary learners in an environment in which they become veterinarians tasked treating an adorable, obese kitty named Cookies. To help Cookies, students explore the body systems, collecting and analyzing data in this NGSS 3-D aligned environment and determine varying treatment plans for Cookies. Come play and see if you can help Cookies!

78. The Washington University Science Partnership Program
Washington University School of Medicine, Cherilynn Shadding

The Washington University Science Partnership Program is a collaboration between Washington University (WU) in St. Louis and the Jennings School District, a largely African-American school district in St. Louis County. We seek to improve STEM education for underrepresented minorities. Our key research question is, "What is the level and timing of experiential learning necessary for STEM persistence?" To address this question, we propose to develop the genomics and bioinformatics skills of these students through authentic STEM experiences, both in class and through research internships at WU in these disciplines. We are preparing for our first cohort of summer interns.

79. Interactive Multimedia: Science Fact or Fiction

Developer: Space Science Institute, Anne Holland presenting

Type: Game
Audience: Elementary (Grades PK–5); Middle School (Grades 6–8); High School (Grades 9–12); Undergraduate; Public/Family
Access: By Request (Free)

The Science Fact or Fiction game allows users to determine whether the science in popular TV shows and movies is Science Fact, or Science Fiction. Users will also see what other participants guessed.

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

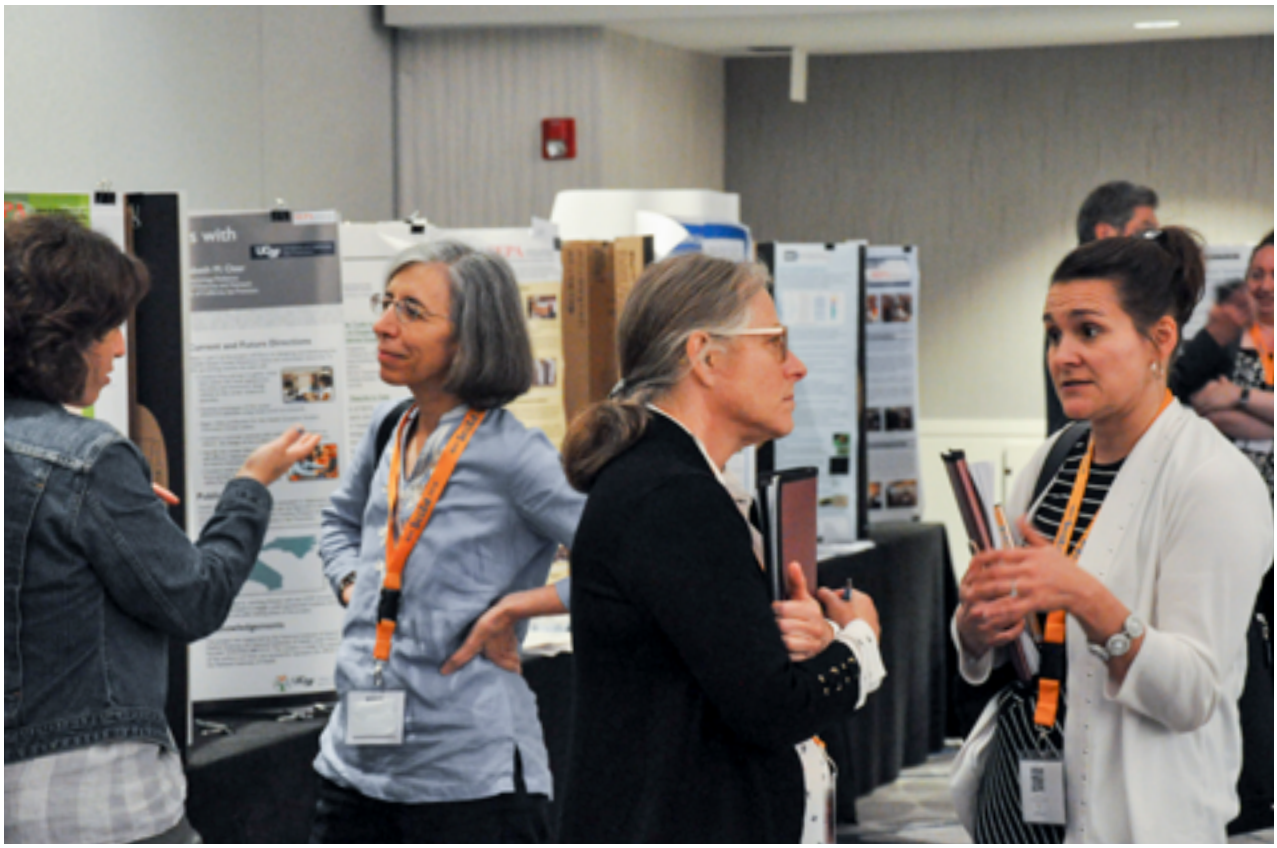
DRL – Research on Learning in Formal and Informal Settings	
AISL	Advancing Informal STEM Learning
ATE	Advanced Technological Education
CSforAll:RPP	Computer Science for All
DR-K12	Discovery Research PreK–12
ECR	EHR Core Research

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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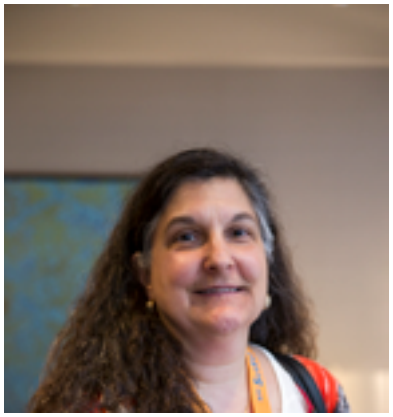

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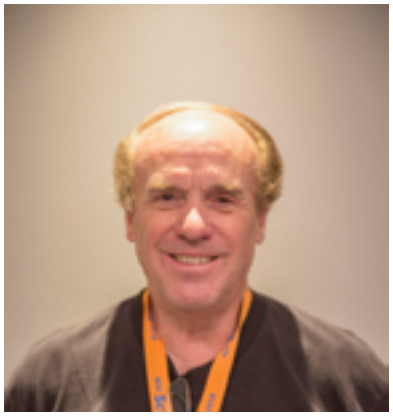

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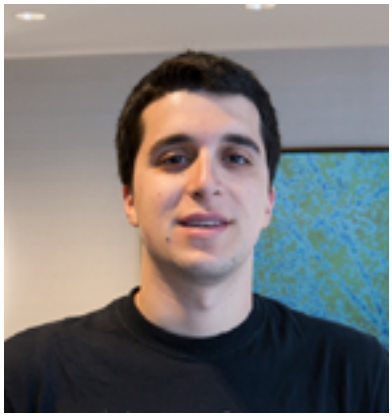

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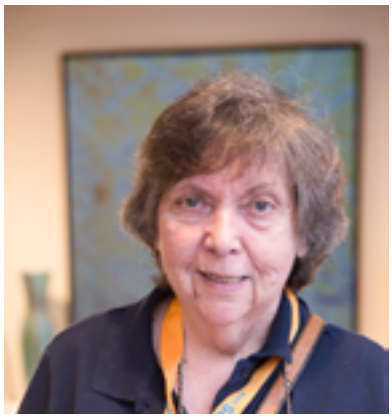

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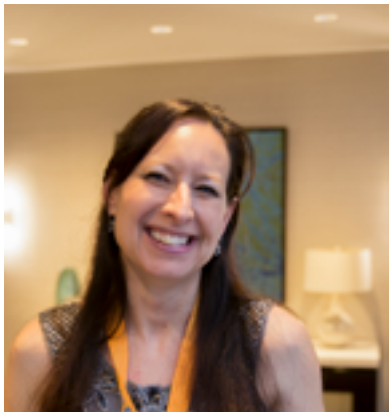

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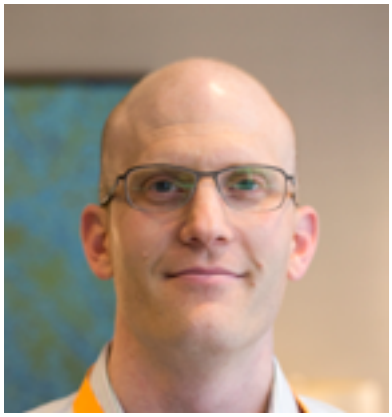

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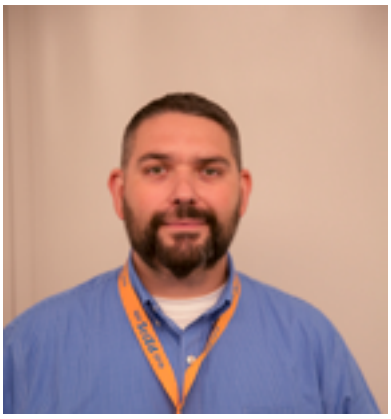

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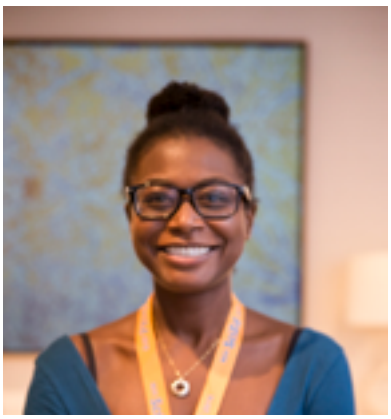

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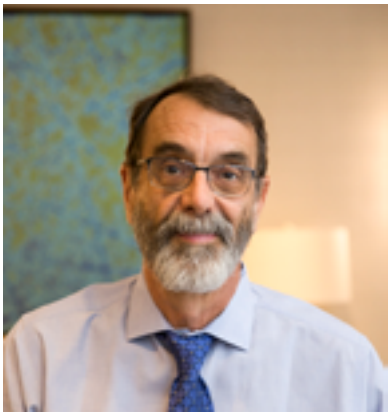

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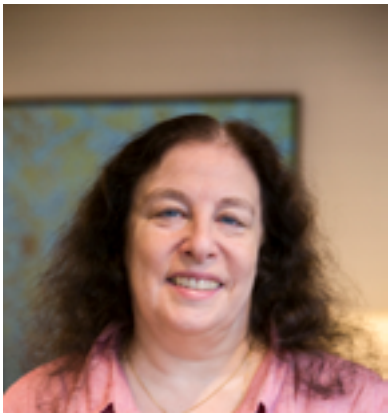

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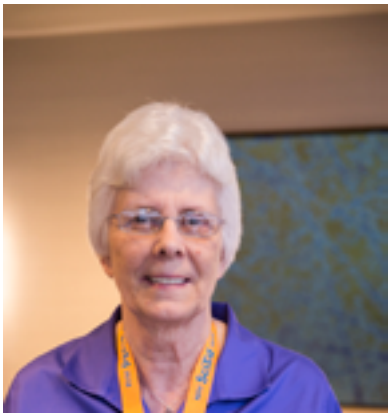

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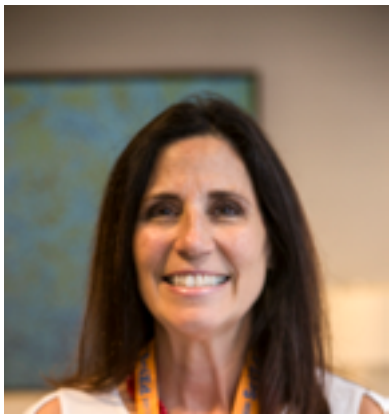

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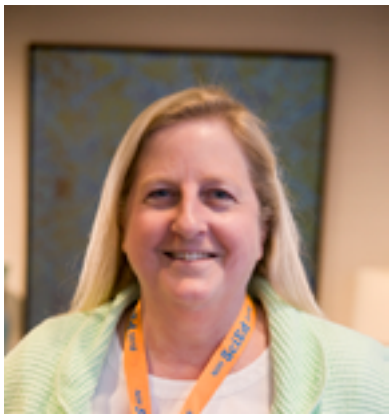

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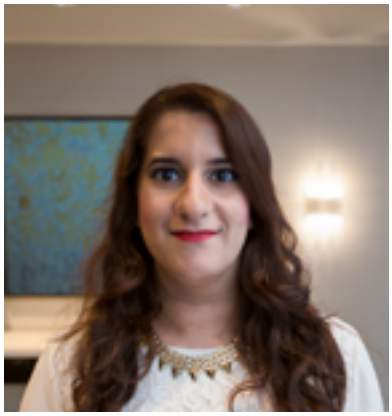

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