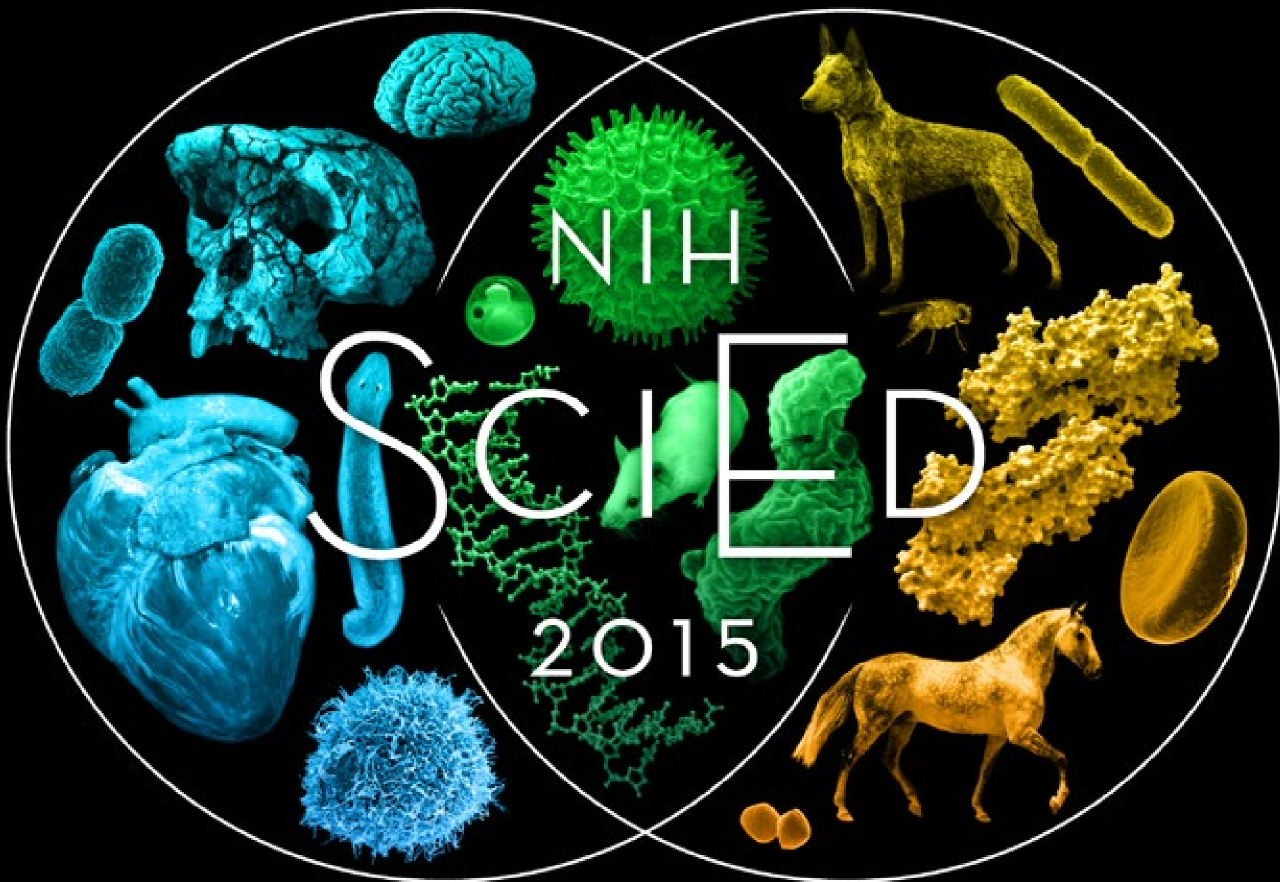

CONFERENCE REPORT

NIH SciEd 2015

Held May 20–23 in Washington, DC, NIH SciEd 2015 was the fourth NIH-wide conference for science education projects funded by the National Institutes of Health. The 77 projects represented at the conference were funded by the following programs:

- Science Education Partnership Award (SEPA), Office of Research Infrastructure Programs (ORIP), Division of Program Coordination, Planning and Strategic Initiatives (DPCPSI), Office of the Director
- Science Education Drug Abuse Partnership Award (SEDAPA), National Institute on Drug Abuse (NIDA)
- NIH Blueprint for Neuroscience Research Science Education Award
- Science Education Awards, National Institute of Allergy and Infectious Diseases (NIAID)

The 218 conference participants included 65 project PIs, 22 Co-PIs, 31 project managers, 40 project staff, 9 graduate students and post-doctoral fellows, 16 evaluators, 5 teachers, 13 other individuals, and 17 federal government employees – NIH staff and representatives from other federal agencies involved in science, technology, engineering and mathematics (STEM) education at the pre-kindergarten – grade 12 (P-12). The latter included the US Department of Education (ED), the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA) the US Department of Agriculture (USDA), and the Department of Energy (DoE).

The conference theme was "Increasing Diversity and Promoting Workforce Development via Synergistic Trans-NIH and Trans-Agency Interactions." Dr. Clyde Yancy (Northwestern University) gave an opening keynote address that reported on the findings of the NIH Scientific Management Review Board Working Group on Pre-College Engagement in Biomedical Science. The Report provided trans-NIH and trans-agency findings and recommendations to guide NIH's investment in pre-college education. Later in the meeting, participants engaged in rotating small group discussions about how their projects can support the SMRB recommendations.

To address trans-agency interactions, Dr. Joan Ferrini-Mundy (NSF) first gave an update on the Committee on Science, Technology, Engineering and Math Education (CoSTEM) 5-Year Strategic Federal STEM Education Plan and the Federal Coordinating STEM Inter-Agency Working Group. Next, representatives from ED, NASA, NOAA, NSF and USDA talked about their programs with the aim of helping NIH grantees identify potential opportunities for synergistic interactions. Six SEPA grantees who have found synergistic interactions among projects funded by two or more agencies provided brief overviews of their work. A plenary talk by Dr. Linda Rosen (Change the Equation) addressed workforce development and collaborations with the business community on STEM education. One set of four breakout sessions addressed different aspects of working with diverse audiences.

Additional breakout sessions addressed collaboration and partnership, educational materials development, educational technology, project administration, research and evaluation, and working with teachers, students and the public. Each project presented a poster about their work. Participants reported that they returned home energized by gaining new ideas for their projects, learning about STEM education priorities at the national level, networking and forming new collaborations

NIH SciEd 2015 Conference Organizing Committee:

Charles Carlson, The Exploratorium
Ann Chester, West Virginia University
Victoria Coats, Oregon Museum of Science and Industry
Andrij Holian, University of Montana
Adam Hott, HudsonAlpha Institute for Biotechnology
Michael Lichtenstein, University of Texas Health Science Center at San Antonio
Dina Markowitz, University of Rochester
Katura Reynolds, Oregon Museum of Science and Industry
Louisa Stark, University of Utah
J. Michael Wyss, University of Alabama at Birmingham

Conference Support

Funding for this conference was made possible in part by Cooperative Agreement U13OD012222 from the Office of Research Infrastructure (ORIP), Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI), Office of the Director, the National Institutes of Heath. The views expressed in written conference materials or publications and by speakers and moderators do not necessarily reflect the official policies of the Department of Health and Human Services; nor does mention of trade names, commercial practices, or organizations imply endorsement by the U.S. Government.

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CONFERENCE SCHEDULE

Wednesday, May 20

5:30–7:00 Conference Check-in and Networking Reception – *outside Grand Ballroom (lower level)*

Poster Set-up—*Salon E (lower level)*

Showings of SEPA-funded digital dome health-related content in Morehead Planetarium's portable dome—*Salon D (lower level)*

5:30 How We Grow

Duquesne University Partnership in Education, PI: John Pollock, PhD

6:00 Grossology and You

UNC-Chapel Hill Morehead Planetarium and Science Center, PI: Denise Young, EdD

7:00–7:10 Welcome

Louisa A. Stark, PhD
Chair, NIH SciEd 2015 Conference Organizing Committee, University of Utah

L. Tony Beck, PhD
Director of the Office of Science Education (OSE) & the Science Education Partnership Award (SEPA) Program, Office of Science Education (OSE)/SEPA, Office of Research Infrastructure Programs (ORIP), Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI), Office of the Director (OD), National Institutes of Health (NIH)

7:10–8:30 **Report on Findings of the NIH Scientific Management Review Board Working Group on Pre-College Engagement in Biomedical Science**

Clyde W. Yancy, MD
Chair, Pre-College Engagement in Biomedical Science Working Group, NIH Scientific Management Review Board (SMRB)
Vice Dean for Diversity and Inclusion, Magerstadt Professor of Medicine and Chief, Division of Cardiology, Northwestern University Feinberg School of Medicine

Q&A/Discussion

Thursday, May 21

7:15–8:30 Breakfast

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

8:30–9:00 Welcome

Louisa A. Stark, PhD
Chair, NIH SciEd 2015 Conference Organizing Committee Chair, University of Utah

James Anderson, MD, PhD
Director, Division of Program Coordination, Planning, and Strategic Initiatives (DPCPSI), Office of the Director (OD), NIH

Franziska B. Grieder, DVM, PhD
Director, Office of Research Infrastructure Programs (ORIP), DPCPSI, OD, NIH

Update on the SEPA Program

L. Tony Beck, PhD
Director of OSE/SEPA, ORIP, DPCPSI, OD, NIH

9:00–10:00 **Update on the CoSTEM 5-Year Strategic Federal STEM Education Plan and the Federal Coordinating STEM Inter-Agency Working Group**

Joan Ferrini-Mundy, PhD
Co-Chair, FC-STEM and Assistant Director, Education and Human Resources Directorate (EHR), National Science Foundation (NSF)

10:00–10:15 Break

10:15–11:15 **Panel of STEM-focused Agencies Involved in K-12 and Public Education: Updates on Activities During the Past Year**

Patricia O'Connell Johnson, PhD
Team Leader, Mathematics and Science Partnership, US Department of Education (ED)

Katie Veal Wallace, PhD
Director, Educator Professional Development, NASA Office of Education

Louisa Koch, MS
Education Director, National Oceanic and Atmospheric Administration (NOAA)

David L. Haury, PhD
Program Director, Directorate for Education & Human Resources, Division of Research on Learning in Formal and Informal Settings, National Science Foundation (NSF)

Robert L. Russell, PhD
Program Director, Directorate for Education and Human Resources, National Science Foundation (NSF)

James Kahler
National Program Leader, STEM, Agricultural Science & Technology, US Department of Agriculture (USDA)

11:15–12:00 **Examples of Synergistic Interactions Between Projects Funded by NIH and Other STEM-Focused Agencies**

Nancy Moreno, PhD
Baylor College of Medicine (NIH – ED)

Darrell Porcello, PhD
Lawrence Hall of Science, University of California, Berkeley (NIH – NASA – NSF AISL)

Paul Dusenbery, PhD
Space Science Institute (NIH – NSF AISL – NSF DRK-12)

Maureen Munn, PhD
University of Washington (NIH – NSF ITEST)

Rebecca Smith, PhD
University of California San Francisco (NIH – NSF AISL)

Louisa Stark, PhD
University of Utah (NIH – NSF DRK-12 – NSF Broader Impacts – ED MSP)

Q&A with panelists

12:00–1:30 Lunch

Mentor-Mentee Groups meet—*London I & II (lower level)*

1:30–2:15 **NIH Peer Review of SEPA Grant Applications**

Jonathan Arias, PhD
Scientific Review Officer, The Center for Scientific Review, National Institutes of Health, Department of Health and Human Services

2:15–2:30 Break

2:30–3:45 Concurrent Breakout Sessions

Engaging Participation in Citizen Science
Grand Ballroom (plenary room, lower level)

Evaluation 101
London II (lower level)

How to Find New Local Collaborators
Salon 2 (2nd floor)

Partnerships for Science Education with American Indian Communities
Salon 1 (2nd floor)

Sustaining Your Program Through Partnering with Small (or Large) Businesses
Salon 3 (2nd floor)

Using Authentic Scientific Data Sets in Challenging Students to Wrestle with Real-World Scenarios
London I (lower level)

3:45–4:00 Break

4:00–5:30 Poster Session I – even-numbered posters
Even-numbered posters 2 – 38: 4:00 – 4:45pm
Even-numbered posters 40 – 76: 4:45 – 5:30pm

Dinner on your own

7:15–8:30 Breakfast

Meeting for all new SEPA PI's—*London I & II (lower level)*

L. Tony Beck, PhD

Director of OSE/SEPA, ORIP, DPCPSI, OD, NIH

8:30–9:00 **The Institutional Development Award (IDeA) Program: Building and Enhancing Research Capacity in Underserved States**

Krishan K. Arora, PhD

Program Director, Center for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH

9:00–10:15 **STEM Vital Signs**

Linda P. Rosen, PhD

Chief Executive Officer, Change the Equation (*changetheequation.org/*)

10:15–10:30 Break

10:30–12:00 **Ways in which NIH SciEd Projects can Support the Recommendations in the SMRB Report**

World Café methodology:

- 20-minute discussions at each of 3 assigned tables
- Each table will be assigned a specific SMRB recommendation to discuss
- Record your group's ideas on the large paper on the table; 2nd and 3rd groups add to the previous group's ideas

At the end of the 3rd discussion:

- Everyone take 5 stickies
- Write the name of your organization on each sticky
- Post the large paper from your table with the papers from other groups who discussed the same topic (paper will be numbered)
- Peruse the ideas. Place each of your stickies next to a suggestion your and/or your project could support.

12:00–1:15 Lunch

Westat Pilot Test of Evaluation Protocols (by invitation only)—*London I & II*

1:15–2:45 Poster Session II—odd numbered posters

Odd-numbered posters 1 – 37: 1:15 – 2:00pm

Odd-numbered posters 29 – 77: 2:00 – 2:45pm

2:45–3:00 Break

3:00–4:15 Concurrent Breakout Sessions

"Authentic" Authentic Inquiry: Getting Students to Ask Questions

London I (lower level)

Developing Adolescents'Science Identity in NIH SciEd Projects

Salon 1 (2nd floor)

Experienced Project Managers Share Best Practices & Lessons Learned with New Project Managers

Salon 2 (2nd floor)

Finding Common Ground: Building and Maintaining Productive Partnerships Between Informal Science Education and Academic Medical Centers

Salon 3 (2nd floor)

Science Education and Ferguson, Continuing the National Discussion of Race

Tokyo (lower level)

So You Want to Make an App? Mobile Apps for Biomedicine and Health Outreach

London II (lower level)

Your Brain in Your World: Bringing Personal Relevance to Neuroscience Across K-12 Audiences

Grand Ballroom (plenary room)

4:15–6:00 Networking Reception

Demonstrations of Games, Apps & Technology-Based Educational Materials

Showings of SEPA-funded digital dome health-related content in Morehead Planetarium's portable dome

4:15 Grossology and You

UNC-Chapel Hill Morehead Planetarium and Science Center, PI: Denise Young, EdD

5:00 Our Cells, Ourselves

Duquesne University Partnership in Education, PI: John Pollock, PhD

5:30 Grossology and You

UNC-Chapel Hill Morehead Planetarium and Science Center, PI: Denise Young, EdD

Dinner on your own

Saturday, May 23

7:15–8:30 Breakfast

8:30–9:45 Concurrent Breakout Sessions

Developing Curriculum Materials that Align to the Three Dimensions of the Next Generation Science Standards (NGSS)

Salon 3 (2nd floor)

Engaging Latino Audiences—and Measuring Impacts!
Salon 1 (2nd floor)

Overview of STEM Education Priorities, Funding Opportunities and Resources from the National Science Foundation
London II (lower level)

Program Integration: Teacher Challenges and Tips, A Panel Discussion
Grand Ballroom (plenary room)

See One, Do One, Teach One: Student-Produced Videos to Enhance Their Understanding of Data Collection in Research
London I (lower level)

What Common Nutritional Recommendations Should We Be Using for Type 2 Diabetes Prevention and Management?
Salon 2 (2nd floor)

9:45–10:00 Break

10:00–11:15 Concurrent Breakout Sessions

Digital Education
Salon 2 (2nd floor)

Environmental History Performed: Using Performing Arts to Educate and Engage Audiences of All Ages
London II (lower level)

Project Evaluation: Sharing Evaluation Instruments and Designs
London I (lower level)

Sustainability: Capitalize on Your Intellectual Property!
Salon 1 (2nd floor)

Using the EQuIP* Rubric to Evaluate the Alignment of Educational Materials to the Three Dimensions of the Next Generation Science Standards (NGSS): Applications to Curriculum Development and Selection
*Educators Evaluating the Quality of Instructional Products
Salon 3 (2nd floor)

11:15–11:45 Town Hall Discussion

L. Tony Beck, PhD
Director of OSE/SEPA, ORIP, DPCPSI, OD, NIH

Louisa A. Stark, PhD
Chair, NIH SciEd 2015 Conference Organizing Committee; University of Utah

Lunch on your own

Report on Findings of the NIH Scientific Management Review Board Working Group on Pre-College Engagement in Biomedical Science

Wednesday, May 20, 7:10–8:30 PM

Presenter: **Clyde W. Yancy, MD,** *Chair, Pre-College Engagement in Biomedical Science Working Group, NIH Scientific Management Review Board (SMRB); Vice Dean for Diversity and Inclusion; Magerstadt Professor of Medicine; and Chief, Division of Cardiology, Northwestern University Feinberg School of Medicine*

Reporter: **Michael Lichtenstein, MD,** *University of Texas Health Science Center at San Antonio*

Dr. Yancy began his presentation by describing the role of the NIH Scientific Management Review Board (SMRB), which was set up in 2006 to provide findings and recommendations to the NIH Director to most effectively organize and deploy NIH resources to meet its missions. Dr. Yancy chairs the SMRB's Pre-College Engagement in Biomedical Science (PEBS) Working Group that was charged to (a) optimize NIH pre-college programs and (b) ensure the pipeline of science students and professionals for the biomedical workforce.

The Working Group took on its task by examining the evidence base to look for effective pre-college biomedical science programs. They catalogued the NIH portfolio of programs, which finally included 246 activities (many of which were intramural) and included grants (like the SEPA program), websites, internships, and outreach science visits to the NIH campus. The Working Group then discussed what could be done and where NIH could redeploy resources to be more effective.

The Working Group identified two alarming trends. First, there is not enough standardized consistent training for teachers. Second, there are marked educational disparities adversely affecting minorities underrepresented in science. The Working Group concluded that NIH must champion STEM education with an emphasis on outreach and improving the quality of education for minority students.

Dr. Yancy outlined the following six key findings in the Report to guide the NIH going forward. Recommendations are also provided in the Report for each finding.

1) There are limited opportunities for under-represented minority and low-SES students to engage in biomedical science education.
2) It is important to broaden workforce categories as a way to convey the full range of career options to pre-college youth who might consider careers in biomedicine.
3) NIH has a large portfolio of pre-college STEM activities that could be streamlined and enhanced through better coordination.
4) There are no standard measures of success for the existing NIH pre-college STEM activities. A more rigorous evaluation process may strengthen all activities and produce new best practices.

5) There is untapped potential in NIH's research community.
6) There are many opportunities to partner with other entities that are commited to pre-college STEM outreach.

The full Working Group report is available at
http://smrb.od.nih.gov/documents/announcements/SMRB_Report_2015_FINAL_revised_508.pdf

Dr. Yancy's presentation set the stage for a session later in the conference during which conference participants used World Café methods to discuss how their projects can support the recommendations in the SMRB Report.

Update on the CoSTEM 5-Year Strategic Federal STEM Education Plan and the Federal Coordinating STEM Inter-Agency Working Group

Thursday, May 21, 9:00–10:00 AM

Presenter: Joan Ferrini-Mundy, PhD, *Co-Chair, FC-STEM and Assistant Director, Education and Human Resources Directorate (EHR), National Science Foundation (NSF)*
Reporter: Louisa Stark, PhD, *University of Utah*

Dr. Ferrini-Mundy began by talking about the serious challenges the US faces in STEM education and the fact that we are not where we would like to be in terms of excellence in this area. She noted that President Obama made it clear early on that he was committed to STEM education, which has impacted on what the agencies have done. However, federal funding—about $3 billion—is relatively small in terms of the overall STEM education investment in the US. The goal of the CoSTEM Strategic Plan is to make the government's investment as strategic as it can be and have as much impact as it can.

There has been a lot of commentary saying that if only our scores on standardized tests were better, the US would be better. For example, two economists recently predicted in a paper that if we could raise performance by all US students so that they could accomplish the very basic tasks on the PSIA test, it would have enormous economic impact. PSIA tasks involve everyday reasoning in mathematics, science and problem-solving, rather than specific curricula

We face issues with teachers' readiness for teaching. For example, 15-20% of math and science teachers in high need elementary schools are teaching out of field. In high need middle schools, 35-40% of math and science teachers are teaching out of field

The US has great inequities across many dimensions. For example, 23% of science classes in schools with the highest concentrations of poverty are taught by novice teachers as compared to 10% in schools with the lowest concentrations of poverty. There also are alarming inequities in curricular access for students; i.e., access to the full range of science and math courses. Only 57% of black students attend schools where they have access to advanced math and science courses and the courses leading to those advanced courses, while 71% of white students have this type of access. Therefore, we so not have equal access to learning in the US. There is a great disparity in participation in STEM occupations—participation by underrepresented groups is low—and thus we do not have equity in contribution to the STEM enterprise in the US.

The bulk of our time available for learning is outside of school. Therefore, the role of informal learning environments is very important for STEM education.

At the undergraduate level, 57% of students entering 2-year institutions need remediation and 29% of those entering 4-year institutions. Students who need developmental math are delayed in beginning STEM majors that require advanced math, such as calculus. Some innovative programs have been initiated to shorten the time needed for this remediation. Fortunately, attrition in STEM majors is not worse than for other majors.

A survey found that of the employed PhD-level STEM graduates and engineers, 12% were employed in conducting basic research, 19% were conducting applied research, and 60% were not involved in R&D, but were doing work critical to the STEM enterprise. Therefore, graduate education needs to attend to the skills, knowledge and experiences trainees need in order to learn to be productive members of the the STEM enterprise. For example, a survey of STEM graduate students found that the topic they would most like more attention paid to was science communication. Other topics included interdisciplinarity and mentorship.

In 2010 $1.1 trillion was spent on K-to-postsecondary education; 94% of this was spent at the state and local levels. The federal contribution was 0.3%. To make the most of this contribution it was decided that the most strategic approach would be to create more coordination across the federal agencies. This work was begun with an inventory of what the federal agencies were doing in STEM education. This inventory found that $3.4 billion was spent on STEM education; 252 investments (programs) were identified. ED, NSF and NIH were the largest funders.

The charge to the CoSTEM committee was to develop and implement a 5-year strategic plan and to report to Congress annually on progress in addressing that plan. The committee discussed how to coordinate and assess federal government investments in STEM education, identified priority areas for investments, and identified near-term and longer-term milestones and actions. The agencies that signed on committed to developing coordination and strategic synergies. The plan was released in May 2013 and is available at
https://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf
It identifies five broad priority areas: P-12 education, undergrad education, graduate education, broadening participation, and public engagement.

A part of the work is making sure that program officers across agencies learn from each other and make connections. The Committee on STEM education (CoSTEM) meets 2-3 times/year. The Federal Coordinating STEM Inter-Agency Working Group (FC-STEM subcommittee) had responsibility for developing and implementing the strategic plan. It operates through five interagency working groups (IWGs; 1/area) that are working on how to implement the plan.

Each of the priority areas has an ambitious goal. Quarterly progress reports on these Cross-Agency Priority (CAP) goals are available at
http://www.performance.gov/content/stem-education?view=public#overview

A challenge the committees are addressing is figuring out metrics and methods for reporting on their progress

An example of the types of collaborations that have emerged is: ED's 24st Century Community Learning Centers are piloting collaborations with the National Park Service and the Institute of Museum and Library Sciences (IMLS) and are expanding their NASA collaboration. These collaborations bring together the assets of the participating agencies. Another example is that trainees in the NSF Graduate Research Fellowship can now participate in the Graduate Research Internship Program (GRIP), which provides internships in the laboratories of other agencies. And many of the agencies participated in the White House College Opportunity Day of Action Summit, held in December 2014 (*https://www.whitehouse.gov/blog/2014/12/04/college-opportunity-day-action-ensuring-there-s-no-limit-what-we-can-achieve*). The committees and agencies are looking for opportunities to bring together other collaborations that take advantage of the assets at multiple agencies. For example, NSF is considering changes in their Noyce program the could take advantage of assets at NOAA.

A strategic objective for the P-12 STEM IWG is to support teacher preparation using evidence-based methods. Most agencies do a lot of in-service teacher professional development. They are looking at how to infuse their resources into preservice teacher education. They also have a goal of increasing and improving authentic STEM experiences for both inservice and preservice teachers. They are identifying "hot spots" where there is a convergence of activities supported by several agencies.

The undergraduate education IWIG is working to get an item added to the high school longitudinal survey (conducted by the National Center for Education Statistics (NCES) at ED, that has to do with undergraduate math instruction. They want to learn what faculty are doing in math education.

The graduate education IWIG is working with the undergraduate IWIG to develop a portal to provide information about government options for employment.

The broadening participation IWIG is working on baseline activities, finding out what the different agencies are doing so synergies can be formed and investments can be focused across agencies.

The public engagement IWIG is working on STEM education in out-of-school time. They seek to identify what the government can do across agencies that will provide and improve access to learning outside of school.

Dr. Ferrini-Mundy provided these closing thoughts: The CoSTEM-related committees see the process of focusing federal investments in STEM education as dynamic and responsive to emerging needs and opportunities. While they have identified milestones and metrics, there are opportunities to revisit these. The focus is on the assets of each agency; how to preserve culture and priorities of each agency but also move toward common goals. They are concerned with having and documenting impact over time.

She identified authentic research experiences as a common thread across many of the IWGs. The agencies that are focused on a specific mission (NIH, NASA, NOAA, USDA, etc.) have wonderful opportunities to provide these, and had a retreat on how to focus this work. Marcia Linn and colleagues published a recent paper in Science about undergraduate research experiences (Linn MC, Palmer E, Baranger A, Gerard E, Stone E. Undergraduate research experiences: Impacts and opportunities.

Science 347, 1261757; DOI: 10.1126/science.1261757). NSF and many other agencies support these types of programs. However, there has been very little research on the impacts of these experience; e.g., what aspects of these experiences really make a difference for students. Linn et al. suggest that programs need to start by finding out where students are in terms of their beliefs and expectations about a research experience, and then construct programs that address these findings. Particular attention needs to be paid to mentoring. We also need to develop outcome measures that reflect the programs' goals. She asked: Why do we invest in these programs? Is it to get students to go to graduate school? To help students envision what their future may include? She believes the people who run these types of programs do not have an unanimity of purpose and suggested that program purpose(s) and outcomes are areas for further study. During the Q&A she also said that it is not clear what constitutes an authentic research experience for a middle school student, and that this needs to be carefully studied.

Dr. Ferrini-Mundy ended by saying that the federal government cannot do everything that people in the agencies would love to do. What are the best places for federal investments?

Aside from the CAP goal reporting, the CoSTEM committees do not have good mechanisms for interacting with the STEM education community and getting feedback. During the Q&A time she suggested that perhaps they could have a "question of the month" to ask program participants.

Panel of STEM-focused Agencies Involved in K-12 and Public Education: Updates on Activities During the Past Year
Thursday, May 21, 10:15–11:15 AM

U.S. Department of Education (ED)

Presenter: Pat O'Connell Johnson, PhD, *Team Leader, Mathematics and Science Partnership, US Department of Education*

The Mathematics and Science Partnership (MSP) program is a formula grant program to states. States make competitive awards for professional development (PD) programs that are partnerships between STEM faculty at institutions of higher education (IHEs) and high-need local education agencies (LEAs). The program supports intensive, sustained, content-based PD with an emphasis on evaluation of impacts on teachers. $150 million went to states in Performance Period 2012 (PP12).

MSP data from PP12, which can also be found at:
http://www.ed-msp.net/images/public_documents/document/annual/MSP%20PP12%20Annual%20Final%20Report%2012-1-14%20FINAL.pdf

- Over 40,000 educators participated nationwide
- The median number of hours of professional development received by each educator varied by the model type. Models that only included a summer institute provided an average of 80 hours of PD, summer institutes with follow-up activities provided an average of 97 hours, and models that focused on academic-year activities provided an average of 68 hours.
- 3,169 IHE faculty participated in ED MSP projects in PP12, with an average of 7 IHE faculty/project.
- Over 7,200 organizations participated in 488 projects
- Over 2.3 million students were impacted in PP12
- Most projects received $500,000 or less in funding, with a median project grant of approximately $213,000 and a mean of approximately $345,000.
- 53% of projects were led by LEAs, 34% led by IHEs, 13% led by non-profits
- The median number of educators served per project = 47 (range of 6-1,382)
- MSP grants support enhancement of teacher knowledge and skills
- 74% of projects had a main goal of improving teacher content knowledge
- 2% of projects had a main goal of training teacher leaders
- 22% of projects had both of these goals as equally important

Evaluation is a key component of MSP projects. The goal is to measure the impact of the PD on teacher content knowledge, not on measuring teaching quality or subsequent STEM teaching. ED has used a carrot approach to induce the use of experimental or quasi-experimental designs for project assessments. 48% of MSP projects in PP12 used a quasi-experimental or comparison group evaluation design to compare the effects of the MSP program on participating teachers and/or their students to comparison, non-participating teachers and/or students.

National Aeronautics and Space Administration (NASA)

Presenter: Katie Veal Wallace, PhD, *Director of Educator Professional Development, NASA Office of Education*

The vision for NASA's Office of Education is to advance high quality STEM education using NASA's unique resources, which include people, mission and facilities. To develop the most talented STEM workforce, NASA focuses on building interest in STEM careers as early as possible through both formal and informal education outreach. NASA is focusing its education efforts on supporting the strategic priorities of the Federal Committee on STEM Education (CoSTEM), formed under the National Science and Technology Council, which produced a Federal STEM Education 5-Year Strategic Plan released in May 2013.

The five priorities of the CoSTEM strategic plan are:

- Improving STEM instruction by preparing 100,000 new K-12 STEM teachers by 2020, and supporting the existing STEM teacher workforce
- Increasing and sustaining youth and public engagement in STEM by increasing the number of U.S. youth who have an authentic STEM experience each year prior to completing high school
- Enhance STEM experience of undergraduate students by graduating an additional one million students with STEM degrees over the next 10 years
- Better serve groups historically under-represented in STEM fields
- Design graduate education for tomorrow's STEM workforce

The Department of Education's 21st Century Community Learning Centers (CCLC) program is the Federal government's largest investment in after-school programming, serving more than 1 million students a year. Announced at the beginning of 2015, CCLC is spearheading three inter-agency collaborations that effectively leverage the STEM education investments of three different Federal agencies. These collaborations are supporting important goals in the STEM Strategic Plan: offering students authentic STEM content and experiences, as well as opportunities to engage with STEM subject-matter experts.

These efforts include:

- afterschool middle school engineering challenge programs in 10 states
- hosting 16 4-H delegates from high schools across the country who shared their views on what constitutes a valuable out-of-school STEM experience
- a STEM webinar series that highlighted graduate student research
- several NASA-NIH SEPA collaborations
- engaging high-preforming undergraduate pre-service STEM teachers as part of Minority University Research and Education Project (MUREP) Educator Institutes
- The Museum Alliance, which includes informal education institutions/organizations and professionals from across the US who regularly use NASA materials in their programs and exhibits.

Key ways to obtain NASA materials include:

- View and download from the NASA website: *www.nasa.gov/education*

- Subscribe to NASA Education EXPRESS for weekly updates: *www.nasa.gov/education/express*
- The NASA Wavelength Digital Library for Educators: *http://nasawavelength.org/*
- Additional resources for educators: *www.nasa.gov/audience/foreducators/*

National Oceanic and Atmospheric Administration (NOAA)

Presenter: Louisa Koch, MS, *Education Director, NOAA*

NOAA Education is focused on advancing the CoSTEM strategic plan, in conjunction with The Office of Science and Technology Policy (OSTP) and the Office of Management and Budget (OMB). As mentioned in the previous presentation, the CoSTEM strategic plan has been defined by the Federal Committee on STEM Education (CoSTEM), formed under the National Science and Technology Council, which produced a Federal STEM Education 5-Year Strategic Plan released in May 2013, which is available at:
https://www.whitehouse.gov/sites/default/files/microsites/ostp/stem_stratplan_2013.pdf

OMB and OSTP budget priorities are focused on reducing STEM program fragmentation and redundancies. Goals also include using evidence to guide program design and implementation or build evidence about what works in STEM education, using appropriate metrics and improving the measurement of outcomes.

The science education community could leverage opportunities by expanding connections with the Education Department, focusing on their 21st Century Community Learning Centers (CCLC) and the Mathematics and Science Partnership (MSP) program, a formula grant program to states. NOAA grantees have successfully competed for MSP funding.

NOAA's Climate.gov website provides news and feature articles, maps and data, and resources for managing climate-related risks and opportunities, including peer-reviewed reports and publications on climate issues and impacts. The website also has resources for teaching about climate and energy, including the 2014 National Climate Assessment Resources for Educators. These consist of a series of guides for educators that focus on the regional chapters of the Assessment Report, helping to unpack the key messages of each region and point to related, high-quality online resources. The key message of these materials is that climate change has and will continue to cause wide-ranging health impacts. Climate change threatens human health and well-being in many ways, including impacts from increased extreme weather events, wildfire, decreased air quality, threats to mental health, and illnesses transmitted by food, water, and disease-carriers such as mosquitoes and ticks. Some of these health impacts are already underway in the United States.

Exploring the Strategies of NSF Funding in STEM Education

Presenter: **David L. Haury, PhD,** *Program Director, Directorate for Education & Human Resources, Division of Research on Learning in Formal and Informal Settings, National Science Foundation (NSF)*

Three major aims of every NSF investment in innovative STEM education:

- Participants have enriching encounters within STEM Learning Environments.
- Advance knowledge in STEM education.
- Contribute to broadening participation in STEM education pathways and careers.

NSF funding programs differ in terms of:

- Type of Research: Foundational vs. Applied.
- Type of Learning Environment: Formal, informal, or blended.
- Strategic Mission: Classroom teaching and learning, workforce development, strategic partnerships, public engagement, and more.

Investments come in various amounts:

- Smaller Investments: Early stage research that focuses on emerging ideas and innovations.
- Mid-level Investments: Design and Development research that builds on ideas showing evidence of promise.
- Larger Investments: Studies of efficacy or impact.

Overview of NSF's STEM Education Research Programs

Presenter: Robert L. Russell, PhD, *Program Director, Directorate for Education & Human Resources, Division of Research on Learning in Formal and Informal Settings, National Science Foundation (NSF)*

Key Programs

1) Advancing Informal STEM Learning (AISL)
2) Directorate for Education and Human Resources (EHR) CORE research
3) Innovative Technology Experiences for Students and Teachers (ITEST)
4) Discovery Research Pre-K-12 (DRK-12)
5) STEM + Computing Partnerships (STEM+C)
6) Advanced Technological Education (ATE)

The common elements of all of these programs:

- Require research.
- Require external review/evaluation.
- Have a focus on STEM.
- Support development of new knowledge.
- Have options that support a progression of work.

1) The Advancing Informal STEM Learning (AISL) program seeks to advance new approaches to and evidence-based understanding of the design and development of STEM learning opportunities for the public in informal environments; provide multiple pathways for broadening access to and engagement in STEM learning experiences; and advance innovative research on and assessment of STEM learning in informal environments.
2) The EHR Core Research (ECR) program of fundamental research in STEM education provides funding in critical research areas that are essential, broad, and enduring to increase public understanding of science and engineering. EHR seeks proposals that will help synthesize, build and/or expand research foundations in the following focal areas: human learning in STEM, STEM learning environments, STEM workforce development, and research on broadening participation in STEM.
3) ITEST is a program that promotes PreK-12 student interests and capacities to participate in the science, technology, engineering, and mathematics (STEM) and information and communications technology (ICT) workforce of the future. To achieve this objective, ITEST supports the development, implementation, and selective spread of innovative strategies for engaging students in experiences that: (1) increase student awareness of STEM and ICT careers; (2) motivate students to pursue the education necessary to participate in those careers; and/or (3) provide students with technology-rich experiences that develop their knowledge of related content and skills (including critical thinking skills) needed for entering the STEM workforce.
4) The Discovery Research K-12 program (DRK-12) seeks to enhance the learning and teaching of STEM Science by preK-12 students, teachers, administrators and parents. All DRK-12 projects address an important need or topic. The emphasis in DRK-12 is on research projects that study the development, testing, deployment, effectiveness, and/or scale-up of innovative resources, models

and tools. DRK-12 Project Types will likely be revised in a new solicitation.

5) The STEM+Computing Partnerships program seeks to significantly enhance the learning and teaching of science, technology, engineering, mathematics (STEM), and computing by K-12 students and teachers through research on, and development of, courses, curriculum, course materials, pedagogies, instructional strategies, models, or pedagogical environments that innovatively integrate computing into one or more other STEM disciplines, or integrate STEM content into the teaching and learning of computing.

Choosing the right program:

- Foundational learning research (ECR)
- Evaluation methods (PRIME, *http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504995*)
- Resources, Models, & Tools (DRK-12)
- Informal STEM learning (AISL)
- Workforce development in STEM for youth & teachers (ITEST)
- Early Career Research and Education Integration (CAREER)
- Innovative cyber platform designed to enhance learning (Cyberlearning*)

*Note: this program has been archived.

Where to find more information:

- All current HER funding opportunities: *https://www.nsf.gov/funding/pgm_list.jsp?org=E HR*
- Program resource centers for most programs (CAISE, STELAR, CADRE)
- David Haury: dhaury@nsf.gov
- Bob Russell: rlrussel@nsf.gov

U.S. Department of Agriculture: National Institute of Food and Agriculture (NIFA)

Presenter: James Kahler, *National Program Leader, STEM, Agricultural Science & Technology, US Department of Agriculture (USDA)*

The national headquarters of 4-H is located within the Division of Youth & 4-H at the National Institute of Food & Agriculture (NIFA) of the U.S. Department of Agriculture (USDA). Building upon the four "New Biology for the 21st Century" challenges, USDA-NIFA refocused its mission to direct agricultural sciences research, education, and extension programs on addressing five Priority Areas:

- Global Food Security and Hunger
- Climate Change
- Sustainable Energy
- Childhood Obesity
- Food Safety

K–12 Education Programs

- 4-H Youth Development Program: 4-H is the youth outreach program from the Land-grant Universities, Cooperative Extension Services, and the USDA. It involves 6 million youth and 500,000 volunteers.
- Agriculture in the Classroom, which includes the National Agricultural Literacy Curriculum Matrix, is an online, searchable, and standards-based curriculum map for K-12 teachers: *http://www.agclassroom.org*
  - It is used by 120,000 teachers and 6.5 million students.
- Forest Service resources:
  - Climate Change Live: *http://www.climatechangelive.org*
  - Natural Inquirer, a science education journal written for a middle school audience about scientific research conducted by scientists in the USDA Forest Service. See more: *http://www.naturalinquirer.org/*

K–12 & higher education

The Secondary Education, Two-Year Post-secondary Education, and Agriculture in the K-12 Classroom Challenge Grants (SPECA) program seeks to: (a) promote and strengthen secondary education and two-year postsecondary education in agriscience and agribusiness in order to help ensure the existence in the United States of a qualified workforce to serve the food and agricultural sciences system; and (b) promote complementary and synergistic linkages among secondary, two-year post-secondary, and higher education programs in the food and agricultural sciences in order to advance excellence in education and encourage more young Americans to pursue and complete a baccalaureate or higher degree in the food and agricultural sciences. See: http://nifa.usda.gov/funding-opportunity/secondary-education-two-year-postsecondary-education-and-agriculture-k-12

Pollinator Initiative

- *pollinator.org*
- Sponsors the annual Pollinator Week, which was initiated and is managed by the Pollinator Partnership. *http://www.pollinator.org/PDFs/USDASecretary.pdf*
- National Public Lands Day

Examples of Synergistic Interactions Between Projects Funded by NIH and Other STEM-Focused Agencies

Thursday, May 21, 11:15 AM–12:00 PM

Presenters: **Nancy Moreno, PhD,** *Baylor College of Medicine*
Darrell Porcello, PhD, *Lawrence Hall of Science, Univ. of California, Berkeley*
Paul Dusenbury, PhD, *Space Science Institute*
Maureen Munn, PhD, *University of Washington*
Rebecca Smith, PhD, *University of California, San Francisco*
Louisa Stark, PhD, *University of Utah*
Reporter: **Dina Markowitz, PhD,** *University of Rochester*

This session provided examples of synergistic interactions between projects funded by NIH and other STEM agencies.

Nancy Moreno: Baylor College of Medicine Academy @ Ryan

- NIH SEPA and Department of Education (ED) funding
- STEM magnet middle school located in Houston – high poverty/minority students
- School prepared students for rigorous STEM high school, using SEPA-funded education materials and local resources
- Students had >95% passing rate on reading and mathematics state exams after first year

Darryl Porcello: "DIY" mobile apps

- NIH SEPA, NASA, and NSF AISL funding
- Created 4 apps for mobile devices
  - DIY Nano (NSF Nanoscale Information Science Education Network) – established layout and design
  - DIY Sun Sciences (NASA) – code template and interactivity
  - DIY Human Body (NIH SEPA) – localized app and Spanish version
  - DIY Lake Science (NSF AISL) – dynamic simulations

Paul Dusenbery: STAR Health Program

- NIH SEPA, NSF AISL & DRK-12 funding
- Science Technology Activities & Resources for Libraries – outreach and travelling exhibit program for libraries in rural Colorado
- Program includes bilingual resources, and training for libraries and scientists
- Promotes collaborations among numerous partners
- Research agenda for libraries to effectively deliver STEM content

Maureen Munn: Genome Sciences Education Outreach

- STARNet – funded by NIH SEDAPA grant (2005-2009)

- Students investigated the effects of genes and the environment on smoking behavior; >3,700 conducted research in their classrooms.
- Students wrote questions for a research questionnaire that was administered to adults and also genotyped research subjects' DNA.
- Products included a curriculum and a smoking behavior database.

- Exploring Databases – funded by NSF ITEST grant (2009-2013)
  - Students used the database to test their hypotheses about smoking behaviors.
  - Products included: a revised curriculum, teacher professional development, research on student learning, research on teacher and student understanding of association and causation.

Rebecca Smith: Science Festivals

- Funded by NIH SEPA and NSF AISL
- Bay Area Science Festival (2014) – 54 events in 10 days; 63,000 attendees – the largest free education event in the Bay Area history
- Discovery Day – 164 exhibitors at 3 Discover Day events; exhibitors shared work supported by 7 federal agencies and private organizations.
- Open lab events – students and parents can experience lab science and interact with scientists.
- National network of science festivals – evaluation of what we can learn from a science festival and the value added by a festival.

Louisa Stark: Curriculum Development, Teacher Professional Development & Research

- Learn Genetics and Teach Genetics websites – NIH-funded curriculum (SEPA, SEDAPA, NIAID and Blueprint for Neuroscience)
- Development of curriculum materials in HTML5 (for iPads) – ED MSP grant funded; used lessons learned in NIH and NSF projects.
- Game development: Agent Antibiotic (NIH NIAID) and Pigeonetics (NSF BIO; Broader Impacts); used lessons learned in NIH, NSF and ED projects.
- Teacher professional development – funded by NIH; use lessons learned in NSF DRK-12 and EPSCoR projects.
- Research on randomized controlled trials and development of assessment items – NIH funded; will use lessons learned in NSF and ED projects.

NIH Peer Review of SEPA Grant Applications

Thursday, May 21, 1:30–2:15 PM

Presenter: **Jonathan Arias, PhD,** *Scientific Review Officer, The Center for Scientific Review, NIH*

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

Reviewing SEPA applications is a 2-step process

1) The applications are received by the Center for Scientific Review (CSR) and assigned to a study section, where they are evaluated for their scientific and technical merit by a panel of reviewers with in S.T.E.M. education. 40-60 SEPA applications are typically received and reviewed each fiscal year by the NIH.
2) The cognate NIH Advisory Council/Board evaluates applications for their program relevance and makes funding recommendations.

Key considerations in preparing and submitting a SEPA grant application

- Prepare to apply and register (Grants.gov & eRA Commons)
- Find opportunity (submit in response to FOA)
- Prepare application
- Submit (via your organizational rep), track & view (use eRA Commons)

Information for SEPA applicants: *http://grants.nih.gov/grants/guide/pa-files/PAR-14-228.html*

General information in preparing a grant application

Obtain NIH instructions, guidelines and forms from the "Grants and Funding" webpage: *https://grants.nih.gov/grants/oer.htm*

Contact NIH Program/Review staff to discuss a proposed submission (contact information in the SEPA FOA).

Obtain a pre-review of the application from colleagues

What do reviewers look for in a grant submission?

- Significance and impact
- Exciting and innovative ideas
- Realistic aims and timelines
- Brevity about things widely recognized
- Potential weaknesses and alternative approaches
- Clear and concise language
- Importance of your ideas
- Insider's Guide to Peer Review for Applicants:
- *http://www.csr.nih.gov/applicantresources/insider*
- The composition and function of an NIH Study Section

Key People:

- The Scientific Review Officer (Designated Federal Official with overall responsibility for the review process)
- Study Section Chair (established senior investigator who guides and summarizes study section discussion)
- The Reviewers

Before the Study Section Meeting:

- Each application is assigned to 3 or more reviewers 5-6 weeks in advance of the panel meeting.
- All reviewers provide an overall impact score and a written critique.

Overall impact section and review criteria (each scored 1-9):

5 core review criteria:

- Significance
- Investigator(s)
- Innovation
- Approach (Evaluation/Dissemination plans)
- Environment

Sub-criteria:

- May affect the final impact score: Human Subjects, Vertebrate Animals
- Not scored: Biohazards, Select Agents, Budget etc.

During the Study Section Meeting

- Top-half of the applications are discussed (an application in the bottom half can be considered for discussion, if requested by a panel member)

Both assigned and non-assigned reviewers on an application present their views

- Final impact scores are given by all panel members to each discussed application; applications that are not discussed receive only initial criterion scores from the three assigned reviewers.

After the Study Section Meeting

- The Scientific Review Officer prepares summary statements
- Provides review information to NIH Institutes and Centers

Summary statement: Feedback to the applicant and the assigned NIH Institute(s) or Center(s) that may fund the proposed studies; Additional information for discussed applications

NIH Peer Review Information on the Web

National Institutes of Health (*http://www.nih.gov*)

- Grants and funding
- Electronic submission
- Forms and deadlines

- Grants policy

Center for Scientific Review (*http://www.csr.nih.gov*)

- CSR Study Section Descriptions, rosters and meeting dates
- Applicant resources: planning, writing and submitting a grant application
- Reviewer resources: tools and guidance in reviewing, critiquing and scoring applications

The Institutional Development Award (IDeA) Program: Building and Enhancing Research Capacity in Underserved States

Friday, May 22, 8:30–9:00 AM

Presenter: **Krishan K. Arora, PhD,** *Program Director, Center for Research Capacity Building, National Institute of General Medical Sciences (NIGMS), NIH*

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

Overview of National Institute of General Medical Sciences(NIGMS)

- Supports research, builds research capacity, provides leadership, enhance diversity in science workforce
- Center for research capacity building supports: NARCH (Native American Research Centers for Health), IDeA (Institutional Development Award) and SCORE (Support of Competitive Research).

Overview of Institutional Development Award (IDeA) program

- There are IDeA states across country, including Alaska and Hawaii (approximately 23 states), also Puerto Rico.
- IDeA supported programs: COBRE, IDeA-CTR, INBRE

IDeA Networks of Biomedical Research Excellence (INBRE)

Goals: to build statewide multi-disciplinary research network; to provide support to undergraduates to serve as pipeline to health research; to enhance science and technology knowledge of the state's workforce; and to increase research support to faculty, postdoc fellow and students.

The network and breadth of INBRE programs and two examples of INBRE networks (Montana and Mississippi) were discussed during the presentation.

SEPA Projects in IDeA States

Approximately 18 projects in IDeA States (e.g., University of Kansas, Montana Tech, Montshire Museum)

Many collaborations between SEPA and INBRE/IDeA project

Examples of INBRE and SEPA Connections (West Virginia SEPA, New Mexico SEPA) were provided during the presentation.

Collaborative Opportunities for SEPAs with IDeA program

Contact the PI listed on the Program Directory for collaboration opportunities.

Resources for accessing information about INBREs

NIGMS
http://www.nigms.nih.gov/

INBRE
http://www.nigms.nih.gov/Research/CRCB/IDeA/pages/INBRE.aspx

INBRE Program Directory includes
http://www.nigms.nih.gov/training/IDeA/documents/INBRE2013directory.pdf

NIGMS' Support of Science Education
http://publications.nigms.nih.gov/order/pubs_gateway.html

STEM Vital Signs

Friday, May 22, 8:30–9:00 AM

Presenter: **Linda P. Rosen, PhD,** *Chief Executive Officer, Change the Equation*
www.changetheequation.org

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

STEM employment

STEM fields have high percentage of total jobs in U.S.

STEM begets jobs; One tech job leads to 4.3 jobs in local goods and service industries.

There is high demand for health care jobs.

Most new STEM graduates earn more (e.g., physics $41,300, engineering $62,891) than those with non-STEM degrees; less unemployment among grads with STEM-related degrees than non-STEM degrees.

STEM jobs are a significant slice of U.S. economy (revenue and employees)

A July 2014 survey asked employers how many of their job openings required STEM literacy or knowledge. The 114 employers who responed had 201,600 jobs available. 60% required basic STEM literacy; 42% required advanced STEM knowledge (some jobs required both).

Employers' view of the skills gap—only 3% reported that there is no problem. The rest reported that this gap is somewhat to very problematic.

Strengthening the Economy and Student STEM achievement

The U.S. would gain an extra $2.5 trillion in Gross Domestic Product between now and 2050 if students scored at international avg. on math and science tests. We are being outpaced—U.S. 15-yr-old rate 21 out of 34 in science test scores among developed nations.

Only 39% of elementary teachers report feeling very well prepared to teach science.

STEM discrepancies

Test results - Discrepancies among 8th-grade U.S students (gender and racial):

- Boys perform similarly on math and science tests.
- Gap in math vs. science achievement for girls (score higher in math than science)
- Gap between performance of white girls vs. other races

Many states are scoring "below basic" on the Nation's Report Card (states use very different cut scores for science achievement, however).

Only 58% of 8th grade science teachers report having the science resources they need. This drops to 50% for teachers of mostly black students.

There is unequal access to physics (minority students are more likely to attend a school that does not offer physics).

Females are underrepresented in many STEM fields (e.g. physics, computer/IT, engineering).

STEMworks

STEMworks has many STEM initiatives. These include key STEM design principles (i.e., need, inquiry, capacity, evaluation, partnerships, sustainability).

Results from STEMworks programs are showing meaningful growth and learning.

Next steps: expand corporate support of STEMworks programs; build opportunities for employee volunteerism; share your STEM moment (#STEMstart)

Contact information

Linda Rosen: *lrosen@changetheequation.org*
www.changetheequation.org
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Engaging Participation in Citizen Science

Facilitators: Tony Beck, *NIH-SEPA*
Antonia Florio, *Cold Spring Harbor Laboratory*
Marisa Pedulla, *Montana Tech*
Reporter: Maggie Ryan Sandford, *Science Museum of Minnesota*

The session began with an overall introduction to "citizen science" as a concept, after which Tony Beck readied the audience to hear about specific SEPA Citizen Science projects, and engage in a discussion about citizen science as it relates to the rigorous and clinical work of professional scientists.

Defining Citizen Science:

"Projects in which volunteers partner with scientists to answer real-world questions."

...Sometimes called **"interactive digital media"**

...More recently called **"open innovation"** as part of a paradigm that suggests organizations can and should solicit contributions from external volunteers. This paradigm categorizes citizen science alongside activities like "crowdsourcing," innovation challenges," and the "maker movement."

In an educational setting, citizen science should have a marked benefit for students. Benefits to scientists were discussed throughout, especially the scientific community's widespread concern that data collected by citizens is not reliable (more below).

Presenters then shared a list of **resource organizations,** which provide members (participants in citizen science projects) with resources and guidelines for universal best practices:

National Oceanic and Atmospheric Association (NOAA)'s Citizen Science Community of Practice

Citizen Science Association

Federal Community of Practice on Crowdsourcing and Citizen Science (represents 40 federal agencies)

Citizen Science Example Projects:

- Cooperative Observer Program
- mPING - crowdsourced weather reporting
- Kachemak Bay Research Reserve
- Cyclone Center
- LiMPETS (Long-term Monitoring Program and Experiential Training for Students)

Antonia Florio then presented on her projects, including:

- ***DNA Subway,*** a project in which students learn DNA sampling, sequencing, and species identification, then blast findings/results
- ***Urban Barcode Project,*** which garnered attention for identifying sushi ("Is my sushi what they say it

is?") and the herbs in Chinese medicinal cocktails

- *Ant Diversity Project,* in which student used attracted and ID'd species of ants (seven species on one cookie!) Barcode Long Island

Marissa Pedulla discussed her project ***Phage Hunters,*** which allowed high school student to collect and identify viruses (phages) in local water

Highlights of Audience Q & A:

How do the DNA projects meet costs without funding?

You can't, really. You have to have other programs that generate income.

How do you know if citizen-collected data is reliable?

You find ways to compare citizen data to professional scientists' data. You can also work with an oversight committee. But this is an ongoing concern, especially with the increase in phone apps, which allow easier access... Sometimes people report wrong data for their own reasons. Scientists will often use citizen data as a first pass: if all 20 observers notice the same thing, professional scientists will go in and conduct research themselves. It's just *more* data.

Does the government have a right to this sensor data?

If it's collected on public not private property, there should be no problem. Projects do their best to get permits and educate scientists in government policies.

Who owns the discoveries made?

They're publicly available.

...What if a drug company finds data, makes money off of findings, who owns the patents, etc?

We haven't gotten there yet. Time will tell.

Participants

Naomi Luban, Children's National Medical Center
Marisa Bowers, City of Hope National Medical Center and Beckman Research Institute
Berri Jacque, Tufts University School of Medicine
Kristina Yu, Exploratorium
Julie Yu, Exploratorium
Julie Ho, Seattle Children's Research Institute
Tony Ward, University of Montana
Margery Anderson, Walter Reed Army Institute of Research
Donna Loden, Healthworks
Deborah Peek-Brown, Michigan State University
Toby Citrin, University of Michigan
Diane Adger-Johnson, NIH/National Institute of Allergy and Infectious Diseases
Donna Cassidy-Hanley, Cornell University
Susanna Cunningham, University of Washington
Heather Kleiner, Sci-Port: Louisiana's Science Center
Emily Kalnicky, Phipps Conservatory and Botanical Gardens
Barbara Baumstark, Georgia State University
Debra Yourick, Walter Reed Army Institute of Research
Carla Romney, Boston University
John Craven, Fordham University
Shiraz Mishra, University of New Mexico
Shannon Carlin-Menter, University of Buffalo
Rebecca Sanchez Pitre, Ochsner Clinic Foundation
Samantha White, NIH/National Institute of Allergy and Infectious Diseases
Laurie Fink, Science Museum of Minnesota
Rayelynn Connole, Montana Tech
Jayatri Das, The Franklin Institute
Sarah Boyd, SageFox Consulting Group
Tracey Meilander, Great Lakes Science Center
Chuck Wood, Wheeling Jesuit University
Maggie Ryan Sanford, Science Museum of Minnesota

Gail Fletcher, Center for Science Technology and Human Innovation
Leonard Munstermann, Yale School of Public Health Peabody Museum
Diana Johns, Pacific Science Center
Monroe Duboise, University of Southern Maine
Michael Lichtenstein, University of Texas Health Science Center at San Antonio
Rachel Boulay, University of Hawaii

Evaluation 101

Presenters: Nancy Moreno, *Baylor College of Medicine*
J. Michael Wyss, *University of Alabama at Birmingham*
Reporter: Maggie Ryan Sandford, *Science Museum of Minnesota*

This session was designed to present evaluation from the principal investigator's (PI's) point of view: what PIs need to know and put in place to implement evaluation plans. SEPA classroom-based P-12 projects must use either a randomized controlled trial or well-matched comparison study evaluation design to evaluate project effectiveness.

Program evaluation started with participant satisfaction, including such metrics as quality of instruction (met teachers' needs, presenters were prepared and engaging), adequacy of facilities, and quality of materials provided. Satisfaction surveys still are used in terms of course evaluations. But it is just the beginning of a formative evaluation and is not sufficient for SEPA evaluations.

Evaluation Defined

Evaluation is the systematic investigation of the worth or merit of the program. It is not the same as research, which is hypothesis driven, or assessment, which is the collection of information to inform decision making. However, data collection and analyses may be useful to more than one of these (research, evaluation, assessment). Evaluation relates to project goals and one can divide evaluation into three types (or purposes): formative or process evaluation looks at whether the program is moving toward achieving its goals and objectives, and how the project can use evaluation to improve. Implementation evaluation is documentation about the project and whether it has been implemented as planned. Summative evaluation examines whether the project achieved its goals. Goals outline the major aims of the program while objectives are measurable indicators that progress is being made toward accomplishing the goals.

A logic model can guide the evaluation. A logic model is a systematic and visual way to present the project's resources/inputs, strategies, outputs, outcomes, and impacts. Notably, during a project's grant cycle, one almost never gets to the impacts, which are often the "years down the road" workforce outcomes. Evaluation occurs at the arrows between the boxes of a logic model: do your strategies lead to your outputs? Do your outputs lead to your outcomes?

Common Evaluation Challenges

The following list provides some of the major challenges principal investigators may face around the issue of evaluation and some ideas for addressing the challenges.

- Cost

- Leverage strategies/tools across projects
  - Don't use an external consultant for everything; use internal folks for data collection and tracking, which may be needed for the research anyway
- Limited funds and time for evaluation
  - Work to build a "culture of evaluation" within your project
- Goals and objectives are hard to measure
  - If they can't be measured, think about redefining them
- Teacher and student mobility
- Incomplete data sets
  - Attrition, lack of signed consent forms, missing a pretest or a post-test
  - Particularly a problem in an after-school environment
- Designing, maintaining, administering, and interpreting survey instruments and data
  - Even if a survey has been piloted, it is important to pilot it with the population with which it will be used
- Finding ways to handle qualitative and anecdotal data
- Protecting human subjects

How to Design an Evaluation to Meet Rigor Requirements?

There are a number of best practice tips for designing a rigorous evaluation.

- Plan all data collection and design in advance. Random assignment to groups (experimental) is a better design than using well-matched groups (quasi-experimental), which is better than pre/post assessments only. Be sure to avoid contamination among groups.
- Be sure to have sufficient sample sizes (approximately 30 teachers or students per group) (There was CBE Life Sciences Education article in 2013 on effect size measures that could be useful in determining needed sample sizes and using the right measure given the analysis being used: *http://www.ascb.org/files/CBE/CBE-Highlight-2013.pdf*)
- Provide equal stipends (compensation) to the treatment and control/comparison groups to get better control/comparison group participation
- Pay attention to instruments (reliability and validity issues). Even established instruments may need to be piloted.
  - Instruments and tools for YOUR population
    - Validity—measure what it is supposed to measure
    - Reliability—does it perform consistently
- Can use a staggered intervention (program), with the lagging cohort serving as the control so that everyone gets the intervention eventually.

Remember that you do not need to do a full-blown field test with comparison group until the materials have been pilot tested and refined. There can be a development period during which an experimental or quasi-experimental design would not be appropriate.

Making Comparisons

The point of having control or comparison groups is to have something against which to judge the outcomes made by the participants in your program. Meaningful comparisons can be made by looking at pretests versus post-tests in the program group and a comparison group, or looking at post-test only among the program group and a comparison. Comparison groups may be randomized samples, matched samples, or created via a timeline study using the "self" as baseline group.

Useful Tips

Several participants in the session and the facilitators have found video or audio recordings of classrooms to be particularly useful data sources for learning about how their program is working.

For those who are running projects that involve online professional development or student engagement strategies, Jim Slotta, currently at the University of Toronto, who was a PI for Project WISE while at UC Berkeley, has developed resources for evaluating discussion boards and other features of online learning activities. His resources could be useful to local evaluations.

Final Question

There is a question of whether all SEPA grantees can use a couple of common instruments that would allow us to look across projects and understand the extent to which particular outcomes have been achieved at the national program level.

Participants

Sharon Danoff-Burg, New Knowledge Organization
Susan Hershberger, Miami University
Carol Mareitant, NIH/National Center for Advancing Translational Sciences
Revati Masilamani, Tufts University
Kristine Chadwick, Independent Consultant
Julia McQuillan, University of Nebraska
Brinley Kantorski, Duquesne University
Agnieszka Rykaczeswska, Claremont Graduate University
Mike Wyss, University of Alabama Birmingham
Alana O'Reilly, Fox Chase Cancer Center
Kenneth McMartin, University of Nebraska
Elizabeth Tuck, American Society of Human Genetics
Shreya Shah, Cold Spring Harbor Laboratory
Michael McKernan, The Jackson Laboratory
Jawed Alam, Ochsner Clinic Foundation
Melani Duffrin, East Carolina University
Allender Lynch, East Carolina University
Shue Casillas, Georgia State University
Katrina Schleisman, University of Minnesota
Diane Munzenmaier, Milwaukee School of Engineering
Margaret Shain-Stieben, American Physiological Society
Barbara Hug, University of Illinois
Malena Ramos, Stanford University
Laura Tenenbaum, Walter Reed Army Institute of Research
Christopher Villa, Helix Solutions

How to Find New Local Collaborators

Facilitator: Kelley Withy, ***University of Hawai'i, Manoa***
Panelists: Mary Jo Koroly, ***University of Florida***
Lisa Marriott, ***Oregon Health & Science University***
Darrell Porcello, ***University of California, Berkeley***
Reporter: Chondraah Holmes, ***Meharry Medical College***

Kelley Withy, who directs of the Hawai'i/Pacific Basin Area Health Education Center (AHEC) at the University of Hawai'i, Manoa, gave background on three sources for SEPA health careers recruitment from the Health Resources and Services Administration: the AHEC, the Health Careers Opportunity Program related to AHEC as well as the NIH Idea Networks for Biomedical Research (INBRE) program. Withy explained the importance of finding other collaborators in your local area that may be engaging or implementing similar projects, so as not to reinvent the wheel, and also to increase one's chances of procuring additional funding. Furthermore, explanations were given for various partners that have provided funding or other support for SEPA projects including: NIH COBRE and SEDAPA, US Department of Education (ED) with money coming from the state Department of Education block grant to the SEPA project (Lisa Marriott has been very successful at subcontracting Department of Education funding-look at the ED website for your state contact (*www.ed-msp.net*), NSF MSP, ITEST, DRK, STEM-C, EHR, other local partners (HOSA, 4H), and other federal agencies (NASA, USDA, Department of Labor, NOAA, and CDC). Mary Jo Koroly, Lisa Marriott, and Darrell Porcello gave detailed descriptions of various branches of organizations and grants that they have had successful relationships with in past years. Participants also chimed in on their collaborations. Darrell and Mary Jo have received funding for supporting the Broader Impacts part of NSF scientific research grants. Kelley asked each participant to briefly describe any collaborative efforts in which they had participated. Tiffany Farmer, explained the relationship that her organization has with their local school district through which they receive approximately $300,000/fiscal year to sustain their programs after SEPA funding ended. The "How to Find New Local Collaborators" session provided in-depth and useful information regarding the importance of being aware of and utilizing resources, fostering new collaborations, and the best paradigms for doing so.

Topics raised were:

- Collaborations with museums and exhibits
- How to facilitate science learning collaborations between different states
- How to develop strong relationships within school districts in different states
- Utilizing the best partners for the type of project that your organization desires to pursue
- Learning about common programs that perform science awareness/how to initiate contact
- Understand the different types of science partnerships and programs in other states
- Don't underestimate the power of a glossy brochure
- Go to your institutional research department and make friends with the chair; let him/her know what outreach you can do
- Make a list of your dream supplies; sometimes NIH/NSF program officers will have small amount of end of year funding that can be used to pay for your supplies.

- The Institute for museum and Library Sciences has grants of up to $150K/yr
- Non-federal sources: Oracle, Motorola, Best Buy. Find out who is in your area. Foundations usually contact you if they know and want what you do, but you can reach out to them.
- CDC-if you have prevention research you can apply for supplements.

Participants

Chondraah Holmes, Meharry Medical College
Dare Vannier, National Institute of Health
Melinda Gibbons, University of Tennessee
Ginger Cross, Mississippi State University
Renee Bayer, Michigan State University
Tiffany Ellis-Farmer, Vanderbilt University

Partnerships For Science Education With American Indian Communities

Facilitator: Maurice Godfrey, ***University of Nebraska***
Reporter: Kim Soper, ***University of Nebraska***

Al Kuslikis, American Indian Higher Education Consortium

60-80% of Native students have developmental challenges of some variety. There are 37 Tribal Colleges or Universities in 13 states. They have adopted a model called the National Partnership Model, so that TCU's can serve as a hub to link programs, resources and strategies to the communities. Even though suicide is a large issue for Native peoples, it seems that suicide is lower for college students than others.

Jody Tallbear, US Department of Energy

Department of Energy is holding several "STEM in Indian Country" round table meetings across the country: 1). June 29 in St. Paul and 2) Oct. 31 in Washington DC at the SACNAS (Society for Advancement of Chicanos/Hispanics, Native Americans in Science) meeting.

They are hoping to continue sponsoring the Science Quiz Bowl, one of the problems in Indian Country is finding someone who will be a coach to meet with students after school and work with them. They also are hosting some Quarterly Webinars. The Dept. of Energy funds a lot of STEM labs, but often TCU's are underfunded and not eligible for many of their grants.

David Wilson, Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)

Challenges for Native students:

- Disseminating information to them and to their parents
- Lack of role models
- Important to get parental and community support
- SACNAS wants to support and expand Peer and Professional Networks

A main question that SACNAS likes to ask: How does this career impact/benefit your tribe or community?

Participants

Rosie Roche, Northwestern University
Jenny Williamson, University of Washington
Debra Burkey-Piecka, Wheeling Jesuit University
Nicole Weber, Lesley University
Kim Obbink, Montana State University
Jennifer Trygstad, University of Washington
Laura Fawcett, Yale Peabody Museum of Natural History
Kenneth Rath, SageFox Consulting Group
Sandy San Miguel, Purdue University
Kathryn Peters, University of New Mexico
Sally Davis, University of New Mexico
Johnny Fraser, New Knowledge
Naomi Delaloye, University of Montana
Charles Wray, The Jackson Laboratory
Maureen Cullins, Duke University
Kim Soper, University of Nebraska
Marlys Witte, University of Arizona
Victoria Coats, Oregon Museum of Science and Industry
Cathrine Sasek, NIH/National Institute of Drug Abuse

Sustaining Your Program through Partnering With Small (or Large) Businesses

Facilitator: Dina Markowitz, *University of Rochester*
Reporter: Celia Besore, *National Association of Hispanic Nurses*

The issue addressed by this session was: Grant funding will only be available for a limited amount of time. The presentations discussed ways in which you can partner with other businesses or create your own to sustain your program beyond the life of the grant. The session included several presentations that showcased how different entities were able to develop for-profit companies.

Dina G. Markowitz, Ph.D. from the University of Rochester described how her project established a for-profit subsidiary, Science Take-Out, which develops, manufactures, and sells hands-on science kits designed for students in grades 6 through community college. The original grant was to develop lesson plans—she created the company to sell pre-made kits for the lessons. The project started selling 8 types of kits in 2008 to teachers in New York State. It now sells 40 different types of kits to about 2,000 customers in the US and overseas. They partnered with two distributors to get the kits better known (Ward's Science and New Path Learning).

Tim Herman, Ph.D., established the Center for BioMolecular Modeling at the Milwaukee School of Engineering (MSOE) in 1999. Tim and a partner spun off 3D Molecular Designs to print 3D physical models of proteins and other molecular structures for biomedical researchers, and innovative educational models for educators. They also utilize software developed through one of the grants to encourage teachers and students to model their own proteins. They make custom models for researchers but the educational material kits have oversold the custom-models line of business. The company received several Small Business Innovative Research (SBIR) grants which supported further development of the technology. They also have developed kits (Water Kit©, DNA Discovery Kit© and Amino Acid Starter Kit©).

Georgia Hodges, Ph.D., from the University of Georgia described how their grant-related business, Cogent Education, impacted the community where the business is located. A group of professors at the University of Georgia were concerned that many of their incoming freshman students did not understand key concepts in biology. Cogent sells games that provide interactive case studies for science classrooms helping students learn biological concepts through inquiry and problem-solving.

Janet Dubinsky, Ph.D., from the University of Minnesota, spoke about the development of a model and other materials to explain neuroscience to teachers and students. BrainU.org was created to host a myriad of educational resources to explain neuroscience.

Lessons learned at the session include:

- You have to do a needs assessment and have a business plan. Talk with many people to identify stumbling blocks and to further develop your idea. Don't finalize your business plan until you have done enough research.
- It is important to identify whether there will be any potential conflict of interests and to identify potential licensing issues up front.
- Sometimes you need to spend money to make money (in consultant, legal and other expenses).
- Take advantage of available business incubator organizations who will assist you in starting a business.
- Make sure you do not lose the rights to your product/invention if you partner with another organization during any steps of the project.
- Get educators involved in the development of the product if they are going to be who you are selling to.
- Look into applying for Small Business Technology Transfer Research grants (STTR) and Small Business Innovation Research Grants (SBIR). Make sure the PI is employed at least 50% by the company if you interested in a (SBIR) grant.

Participants

Danielle Yancey, University of Alabama at Birmingham
Christopher Burnett, Baylor College of Medicine
Katura Reynolds, Oregon Museum of Science and Industry
Danielle Alcéna, University of Rochester
Kathy Hoppe, National Science Foundation
Celia Besore, National Association of Hispanic Nurses
Matthew Fierman, Tufts University
Chris Tallarida, Temple University
Scott Rawls, Temple University
Valence Davillier, Great Lakes Science Center
Amanda Jones, Seattle Children's Research Institute
Shanita Brown, Meharry Medical College
Ella Greene-Moton, University of Michigan
Judy Brown, Patricia and Phillip Frost Museum of Science
Kristi Bowling, Rice University
Nicole Weber, Lesley University
Virginia Shepherd, Vanderbilt University
Paul Dusenbery, Space Science Institute
Ted Clark, Cornell University
Alex Turbyfield, University of Georgia
Stephen Borden, Cogent Education
Jared Jackson, Cogent Education
Jackie Shia, Challenger Learning Center
Kristin Bass, Rockman et al.

Using Authentic Scientific Data Sets in Challenging Students to Wrestle with Real-World Scenarios

Presenters: Kelly East, ***HudsonAlpha Institute for Biotechnology***
Adam Hott, ***HudsonAlpha Institute for Biotechnology***
Reporter: Linda Morell, ***University of California, Berkeley***

The SEPA-funded game, ***Touching Triton,*** is a computer-based activity designed to develop student understanding of common complex disease risk, prevention, and treatment. In the game, students are presented with a scenario in which they need to assess the risk of six astronauts (named Charlie, Elijah, Gabriella, Geraldine, Kara, and Koray) for developing different diseases during a 6-billion mile, 20-year mission from Earth to Triton, and then pack for each astronaut based on their risk. Students are given medical records, family history, genomic data, medical records, and packing options. Figure 1 shows a presentation slide that diagrams how students use data to pack for launch into space. Figure 2 shows the path students follow to make risk assessments and packing choices (students do not see this path diagram).

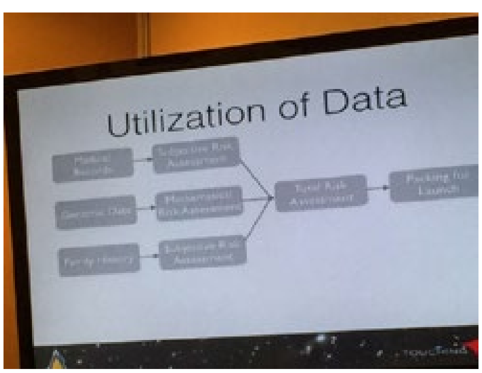

Figure 1: ***Touching Triton's*** Diagram for deciding what to Pack

Figure 2: Path pattern for ***Touching Triton***

Game developers consulted with experts (genetic counselors) to determine likely health issues and outcomes so that the students' assessments could be displayed along side expert opinion. The game is designed to ensure that multiple outcomes are possible so that students (and teachers) do not try to game the system to get the "right" answer.

Students generally play the game for 45 minutes to 1.5 hours. Once all their decisions are made they push the "launch" button to see the results of their proposed mission. The results pop up almost instantaneously after the launch.

During the discussion portion of the presentation, questions ranged from the practical to the design aspects of the game. For example, we discussed:

- The astronauts' individual risks versus the average population risk
- The fact that the game "black boxed" issues related to space travel like radiation and bone density, etc
- The developers initial decision to not allow any of the astronauts to die, and their revised decision to let up to 3 astronauts die during a given mission
- Why the developers did not include a chat box in the game
- How to deal with teachers and students who were overly focused on getting the "right" answer
- How a (teacher-developed paper-and-pencil) worksheet took the rich engagement out of the activity and reduced it to a hunt-and-find exercise

The game was developed using HTML5 and can be found at: *http://triton.hudsonalpha.org*

Participants

Brett Taylor, Sentinel High School
DeDee Ludwig-Palit, Museum of Science and Industry
Jason Dupuis, Museum of Science and Industry
Rebecca Daugherty, Northwestern University
Karina Mein, Tufts University
Greg Doctor, Montana State University
Linda Morell, University of California Berkeley
Antoinette Hillian, University Hospitals Case Medical Center
Manetta Calinger, Wheeling Jesuit University
Suzanne Kirk, Virginia Commonwealth University
Maureen Munn, University of Washington
Candice Etson, Tufts University
Jessica Preleski, University of Chicago
Bev Stambaugh, National Science Foundation
Kara Pezzi, National Science Foundation
Elliot Lee, University of Utah
Michelle Ventura, Georgia State University
Billy Roden, Seattle Children's Research Institute
Deborah Cornelison, National Science Foundation
Mary Pattersen, National Science Foundation
Jennie Aizenman, Bridgewater State University
Linda Santschi, Coastal Marine Biolabs
Douglass Coleman, Duke University
Ralph Imondi, Coastal Marine Biolabs
Peter Crown, University of Arizona
Rochelle Schwartz-Bloom, Duke University
Louise Mead, Michigan State University
Elizabeth Godin, Duke University
Virginia Carraway-Stage, East Carolina University
Jessica Ehule, Meharry Medical College

"Authentic" Authentic Inquiry: Getting Students to Ask Questions

Presenters: Peter Crown, *University of Arizona*
Marlys Witte, *University of Arizona*
Reporter: Peter Crown, *University of Arizona*

This session addressed the challenge of getting students to ask questions in and out of class. Motivated by curiosity, questions are the basis of scientific inquiry. Too often they are not encouraged by teachers for a variety of reasons. This session suggested ways to bring questioning back into the classroom and to students' ways of relating to them. The simplest most direct thing a teacher can do is to reward questioning —to make it clear to students that questions have value and even might contribute to grades. Since questions can come to mind at any time, our group developed and demonstrated an app specialized to collect questions from students which they can submit on a smart phone or computer: *http://curiosityforall.org*

The ensuing discussion was enthusiastic because the topic of questioning struck a responsive chord among the teachers present. This sentiment was shared in the final session.

Participants

Kara Pezzi, National Science Foundation
Donna Loden, HealthWorks
Shreya Shah, Cold Spring Harbor Laboratory
Antonia Florio, Cold Spring Harbor Laboratory
Heather Kleiner, Sci-Port: Louisiana's Science Center
Candice Etson, Tufts University
Billy Roden, Seattle Children's Research Institute
Karina Mein, Tufts University
Michael Lichtenstein, University of Texas
Melani Duffrin, East Carolina University
Danielle Yancey, University of Alabama at Birmingham
Julie Yu, Exploratorium
Susan Hershberger, Miami University
Elliot Lee, University of Utah
Suzanne Kirk, Virginia Commonwealth University
Naomi Delaloye, University of Montana
Barbara Baumstark, Georgia State University

Developing Adolescents' Science Identity in NIH SciEd Projects

Presenters: Kristin Bass, *Rockman et al.*
Julia McQuillan, *University of Nebraska*
Rebecca Smith, *University of California, San Francisco*
Reporter: Kristine Chadwick, *Independent Consultant*

The session started out by having participants think about how you know if a youth is a "science kind of person." In small groups, participants listed actions, characteristics, and indicators. They thought about descriptions that both included the word science and did not include the word science. Participants said that “science kind of people” are curious, use the expression, “Let’s see what happens,” they like to tinker with things and are willing to take risks. They are comfortable with data and can focus deeply on an activity. They ask questions, are comfortable with failure, persevere, and have a passion. They have a math aptitude and can be creative.

Participants also discussed whether any youth could become a “science kind of person.” Some say it depends on what one means by “science kind of person.” Everyone can be science literate but maybe not all will be scientists.

Julia McQuillan discussed why they decided to study science identity. They started out by doing research on comics versus essays in helping students learn about viruses (Spiegal et al.., 2013). They looked at four levels of science identity (low, moderate low identity, moderate high identity, high identity). Comics reached the low science identity kids better than essays. Science could be a loaded term so they used “discovery orientation”.

Science identity should matter and can change. Youth with higher science identities are more engaged with science and more likely to persist in STEM careers (May & Chubin, 2003; Carlone & Johnson, 2007; Chemers et al.., 2011; Spiegel et al., 2013). Friendships (i.e., social networks) play a powerful role in identity development and behaviors.

Identity refers to our internalized, stable sense of who we are, including role identities, social categories, and personal characteristics. Identity theory examines the ways society shapes how we view ourselves, and how these views, or identities affect our behavior. We use categories to specify who we are and to locate ourselves in relation to others. Identities are self-concepts that specify how we relate to others or self-concepts in a specific role. Identities are linked to social role. People mention role identities most often when they are describing themselves (e.g., parent, employee, citizen). Role identity can be context dependent.

There may be a difference between doing science and being a scientist. Kids can do science but they may not claim the label of being a scientist. Everyone can be a scientist. Commitment increases with the salience of a particular identity.

Julia McQuillan shared some of the items in the project's Discovery Orientation scale, such as "How much do you like taking things apart to learn more about them?" and "How much do you like learning about new discoveries?"

Science identity varies by gender, race, and ethnicity, and discovery orientation. These are mediated, however, by science enjoyment, science salience, science competence, science verification, and how they believe a generalized other (i.e., societal norm) thinks of them.

Rebecca Smith and Kristin Bass discussed a prior SEPA project (Pathways) that i partnered UCSF postdocs with teachers to work through where students have struggled with engagement and/or conceptual understanding and had the postdocs interact with the students directly. The postdocs spent enough time with the students to get to know them and students humanized them as scientists. The personalized experience was important for students. The nature of questions that scientists ask in the classroom are qualitatively different (more reasoning and process based) from the types of questions that teachers ask (more fact based) and that was informative about characteristics of those who identity themselves as scientists. Changing the perceptions of how students perceive scientists was at the core of this prior SEPA grant. This project did change how students perceived scientists. Students who interacted with the postdoc scientists thought scientists were caring, fun, did interesting work, and were "just like us."

How students perceive scientists influences whether they can identify as scientists. There is the notion of possible selves, which is influenced by your perceptions of who you have been in the past, who you are now, and who you might be in the future. Possible selves are influenced by social context. Influencing the social antecedents of possible selves can be part of a project's goals.

After the presentations, the presenters responded to questions.

- What's the interaction between gender and race when it comes to identity? The findings from the study showed no difference in discovery orientation, but a big difference in science identity, science competence, science relevance, science self-verification, and generalized other. Some differences were by gender, some by race/ethnicity, and some by an interaction of the two. Further work will need to explore the reasons why the differences exist. There may be different reasons.
- What kind of push-back might you get from the SEPA program regarding a more qualitative approach to understanding identity versus a more "gold standard" approach to the research or evaluation? Their numbers were so small that they weren't getting useful information from the quasi-experimental design so they shifted to a qualitative design to better understand the perceptions of scientists and development of science identity.
- Have the speakers looked at stereotype pressures by teachers and parents? The speakers told some anecdotes about the power of stereotypes and the importance of addressing and counteracting them.

The participants finished the session by discussing in small groups

- how their programs promote positive images of scientists or counteract negative stereotypes
- the types of evidence participants are collecting to examine students' perceptions of scientists or identification with science
- the challenges participants have encountered as they try to promote positive science perceptions and identities, or to document those outcomes

A few key points from these discussions: It is important to collect data about student science identity. Role models seem to be important, not just for students of that community but also for the general community. Other participants have seen a big disconnect between ability and desire: girls in their programs may see themselves as having the ability to be scientists, for instance, but they don't want to be one. There is still a lot of pressure from peer groups to conform to norms that may not include being a scientist. Teens often think of themselves in absolutes: "I can be this *or* that" but not have multiple identities. One approach is to separate kids from their usual peer groups to allow them a safe space to "try on" a new identity. Teachers' perceptions of scientists are important. One might even ask the graduate students and postdocs at the higher education universities whether *they* think of themselves as "scientists."

Participants

Jennie Aizenman, Bridgewater State University
Julie Ho, Seattle Children's Research Institute
Melinda Gibbons, University of Tennessee
Elizabeth Tuck, American Society of Human Genetics/NIH NHGRI
Kristi Straus, University of Washington
Linda Morell, University of California Berkeley
Diane Munzenmaier, Milwaukee School of Engineering
Monroe Duboise, University of Southern Maine
Stephen Borden, Cogent Education
Margery Anderson, Walter Reed Army Institute of Research
Charles Wray, The Jackson Laboratory
Kim Soper, University of Nebraska
Ralph Imondi, Coastal Marine Biolabs
Michele Shuster, New Mexico State University
Christopher Villa, Helix Solutions
Linda Santschi, Coastal Marine Biolabs
Scott Rawls, Temple University
Emily Kalnicky, Phipps Conservatory and Botanical Gardens
Maureen Munn, University of Washington
Deborah Peek-Brown, Michigan State University
Kristine Chadwick, Independent Evaluation

Experienced Project Managers Share Best Practices & Lessons Learned with New Project Managers

Presenter: Adam Hott, ***HudsonAlpha Institute for Biotechnology***
Reporter: Erin Burr, ***Oak Ridge Associated Universities***

Summary of Best Practices & Lessons Learned Shared by Question

Is there one specific skill set a new PM needs and what was it?

- They need to be fearlessly organized.
- Do not be afraid to strike up conversations or email people you meet at the SciEd conference.

Communicate.

- Willing to ask questions—you don't have to know all of the answers.
- Flexibility—open to change—what you have written in your proposal does not have to be carried out in stone.
- Organization and documentation - things you can share so others can know how great your work is.
- Technology tools—Outlook calendars are very helpful.
- Read your grant proposal and read it over—demand your staff goes to a monthly meeting. All deliverables should be on each monthly meeting agenda. Keep it in the forefront on an ongoing basis.
- Fearlessness when it comes to taking ownership of this project. You have to be confident, even if the PI is not available.

What advice do you have for managing students and subcontractors?

- Have a running task list with people's names next to them.
- Don't let too much time go by between meetings.
- Use a Gaant chart (preferred package?—Excel)
- Start by setting your calendar and move everything out to account for unexpected delays. Set reminders throughout and use color coding in Outlook.
- When you get close to the end of the grant you will have to turn your files over. Make sure they are organized and all in one place so it is easy to turn over and in the right format.
- If working with someone developing something for you (a contractor), give yourself extra time because they will likely not get it to you on time.
- Use Dropbox to share files for general content materials. For IRB requirements you need to keep some files in locked cabinets and on encrypted thumb drives. Have a protocol for managing data.
- With students, share you task list so that everyone can see (e.g., BaseCamp).
- With community-based organizations, it is harder to keep people on schedule so it is important to stay on track by communicating with them regularly.
- Make sure all stakeholders have a chance to share with you' team what their needs are.
- Lots of importance in building personal relationships with students and contractors. It helps later when you need them to help you with something quickly outside of the grant (e.g., budget for future grants).
- See what the students want out of the experience. They will be more likely to help you out that way.
- Take time to celebrate successes with your team.
- If you are working with a technical contractor who has expertise you don't (e.g., game design), make sure you are very clear about your expectations for the product.

What kind of PM organization tools do you use?

- BaseCamp

- Microsoft Access
    - Excel—multiple tabs (executive summary, Milestones, Small Task list, Explanation of Budget)
    - Dropbox
    - Google Docs

What is your biggest personal failure for your project and how did you turn it around?

- We promised to document /describe student projects. We found the teachers didn't want to do it. Ask what they want to do. Find out what people want to do through surveys or focus groups.
- Test, triple-test technology. Last minute changes by third parties can impact your technology use. Let your contractors know what you need to know in advance because it is something that could impact your project timeline.
- Teacher workshops associated with stipends during the summer. Make sure they only get paid after doing what you want; otherwise they might take the money and leave. Pay incrementally for teachers' involvement through the evaluation.
- Keel contracting groups separate. Don't let one subcontract out for you to cover all of the work. If one goes out of business it halts all of your work.
- Make contractors' payments contingent on a deliverable.
- Encourage people to contact you early on if something seems to be going wrong (e.g., if someone isn't getting paid).

Can you set the number of teachers to be recruited for your project by a certain time and not pay the staff member responsible for the recruitment if they don't deliver?

- Only pay after they have recruited the number of teachers indicated. You can indicate the number of recruitment events. Make sure to get the names and contact information.
- Consider making the payment 20% up front and then by deliverables. The grassroots organizations may need your involvement to get things going.
- Fire people if you need to. Sometimes you keep giving people chances over and over and you get burned for it when it really matters and they don't deliver. You can change staff if you need to—just contact Tony Beck when it is a key staff member.
- If you don't do what you are supposed to do, you are supposed to give the money back.
- Don't hide anything—tell your PI. You can say, "I am doing x, y, z...., but this is what is going wrong." You are responsible for your PI's reputation. You can talk to risk management advisors.
- Never say to partners you are working with that "you have a real problem." You can call things a challenge and present the challenge alone with potential solutions.
- If you experience conflict, ask the person who is upset if they have a suggestion for a solution.
- Don't be afraid to do work. You may work lots of extra hours.

What percent of a full-time employee (FTE) are you written into your SEPA grants for?

- Project management needs to be at 50-60% of an FTE at a minimum. 75% of an FTE is better.

How do you decide who goes to meetings and the frequency of meetings?

- You need to decide the purpose of the meetings and their objectives. Who are the stakeholders?

Who can you communicate with via email or via conference call?

- Monthly partner meetings (sometimes virtual), but they should always be open to everyone
- For initial planning lots, of people
- Later down the road, smaller groups may be better for some.
- For people on advisory committees who don't want to participate, consider involving them in some way that gets them to buy into the project (e.g., present at a summer workshop, be a speaker for an event, get them to review curriculum). Sometimes you have to re-envision what an advisory board looks like. It does not always have to be a meeting—they can have other ways to contribute that they find meaningful.
- Everyone meets initially at the kick-off, after that there are a lot of smaller team meetings, fewer people in working meetings (3 or 4 people).

Participants

Matthew Fierman, Tufts University
Jessica Preleski, University of Chicago
Shanita Brown, Meharry Medical College
Erin Burr, Oak Ridge Associated Universities
Erin Hardin, University of Tennessee
Maria Isabel Leeder, Patricia and Phillip Frost Museum of Science
John Fraser, New Knowledge
Toby Citrin, University of Michigan
Gail Fletcher, CSTHI

Finding Common Ground: Building and Maintaining Productive Partnerships between Informal Science Education and Academic Medical Centers SEPA and CTSA

Presenters: **Tracey Meilander,** *Great Lakes Science Center*
Antoinette Hillian, *University Hospitals Case Medical Center*
Victoria Coats, *Oregon Museum of Science and Industry*
Lisa Marriott, *Oregon Health & Science University*
Reporter: **Allender Lynch,** *East Carolina University*

Discussion of three projects that involve informal science organizations and CTSA's

Vickie Coats and Lisa Marriot

Background:

Vickie: in the past OMSI brought in partners as speakers and advisors. Their largest partnership was with Brain Awareness Week, month, and season. SEPA challenges them to bring it to a different level of partnership due to the grant itself. Most interesting partnership was with the SEPA-funded Small Research Collaborative about fitness and nutrition. The great collaboration focused on obesity prevention and provided fitness training and metabolic kitchens. OMSI brought in the Body World, exhibit which led to the opportunity to collaboration with OHSU. A special thing for both groups was the data collection part of the health fair.

Lisa: OHSU was at OMSI for one week. They received a lot of requests after the collaboration. Supplements were fund through CTSA and SEPA. A total of 18,000 individuals participated within the research. It was a great way for them to get involved with research. They had close to 1000 volunteers and about 850 special volunteers. They collected diet, sleep, cancer, epigenetics, blood chemistry and body composition information from participants, who also completed pre- and post-assessments of self-efficacy, attitudes, etc. They created small exhibits for the health fair, which are a great attractor and give the participants something to do while they are waiting. They were surprised by the number of people who were willing to give samples and participate and were even more surprised by their eager participation. Each table is its own exhibit for each area targeted in the intervention listed above. The project was fully approved by IRB. The partnership was synergistic. They did not expect it to become so large. The program has had wide spread and impact. A created curriculum is still being used widely in New Zealand (covers noise and hearing loss).

Advantages:

- The Museums do a beautiful job of making exhibits appealing. They assisted in making the activities durable and pretty.

Challenges:

- They didn't have money to make the exhibit larger
- How do you find and develop a partnership? They had a prior history of working together. CTSAs

are at major research institutions. You want to find the person who is the major communicator within the network because they can connect you to everyone within the community. Talk to people who like interacting with the community. You also can utilize current relationships to assist with networking to find someone who is appropriate for your research.

Great Lakes Science Center:

Background:

- The goal of their program is to develop students' interest in the wide range of science and medical careers available. Students experience 6-8 weeks of research in a clinical laboratory. There they are provided the opportunity to develop their knowledge in science and communicating various science, health, and research aspects. The program also prepares the students for internship experiences. Students learn how to be professional, being late, emails, professional dress, etc. and they learn about financial aid, applying to colleges, and preparing a resume. They partnered with the 4 major hospitals in Cleveland who provide a large mentor pool. They have had 70 students through the program (connected with 70 mentors). The relationships are strong and long term investments. They build students' confidence, and open them to other opportunities outside their original interest. The program also builds their medical and science knowledge. This is a paid experience

Advantages:

- Have access to the top notch researchers and are able to connect the public to these researchers. In addition, they are able to have them be a part of the various exhibits and community engagement.
- They assist with making the situation comfortable regarding communication, appearances, educating the students not only on science but proper professional behaviors and practices.
- This is an opportunity for the researchers to give back to the community, especially considering that 90% of the population are socioeconomically challenged.
- Three of the hospitals serve this population, and allow these students to see their potentials and opportunities. The long term hope is for the students to return and contribute to their communities within these facilities or others.
- For the mentors there is less hierarchy within the program and lives are not on the line. Therefore, the program provides a more relaxed environment.

How was the partnership developed?

- They contacted the director of CTSC for assistance with organizing and planning the project and the partnership was born.

Challenges:

- Differences in the cultures.
- Preventing loss of contacts and possible loss of partnerships. They lost the Co-PI in CTSC and had to go through the process of obtaining a new Co-PI.
- It is important to have multiple lines of communications within the relationship. You want to develop "bridges": Finding people who are familiar and know how to navigate through the experience. They must also be interested and invested in your interest and investments as well.

Ideally will be able to communicate regularly.

- When identifying mentors, approach them individually. They working from the top down, but would like to work from the bottom, and just have a pool of mentors from which the mentees could choose.
- Would like for it to be more streamlined, rather than just piecing it together as you go. Suggestion: Contact training directors to tap into training pool.

Bob Russell: Project Evaluator

- Partnerships are relationships, you can meet them in different ways. It can be long built/short built. You're all in this together.

Challenges:

- The communication is there but an issue that can occur is that it is not a large science center. Individuals are stretched amongst multiple projects and may not be 100% dedicated to your project. You want to find someone who you can communicate with easily.

Background:

- Works with a bilingual population within rural areas where there are not many medical professionals. Have to ensure they are getting health care and remember that they are a part of the economy.
- Developed a partnership with the CTSC which runs the community engagement core and manages the area health communication centers. Also are working with libraries, which are non-profit, to develop tabletop exhibits and computer activities.
- The libraries are pretty self-sufficient. Libraries can almost be a community learning center. Many include ongoing programs and exhibits similar to museums.
- Other partnerships? Media component- Spanish radio, TV segments, and newspaper features. They try to surround people with science all the time.

The content borrows from other programs

"Conducer de Cuerpo"

Lisa has been an advisor regarding program development.

Have done suitcase exhibits that have focused on different parts of the body and now utilize the exhibits for current projects.

Other Questions and Points of Discussion:

What are the students allowed to do?

- In the clinic it is more observational, in the lab they are able to participate.

Do the students get to choose where they go? Lab, communication, clinical?

- Yes, but it's based on what resources and mentors are available.
- Also have to thoroughly and constantly communicate with the students to ensure they are getting all their paper work to participate in the experience.
- Also try to engage with the students and determine the type of mentor they need (Nurturing,

independent, etc.). There are also age restrictions for certain parts of the experience.

How involved are the parents?

- Most of the time do not touch base with the parents until the end of the program when the students present their presentations to the community and family members. A very powerful and moving moment.
- Trying to change student trajectory. Their path is heavily influences by their life experience, but they believe they have assisted with redirecting many students.

Any success stories?

- Have observed students proceed in a health career of some sort. The career may not have been their original choice, but they are still typically interested in health areas.

Evaluations:

- It can be problematic to determine where to get your IRB. Must determine and factor in time and cost.

John: Have had great IRB experiences with hospitals in comparison to the commercial IRBs.

Participants

Allender Lynch, East Carolina University
Jawed Alam, Ochsner Health System
Denise Young, Morehead Planetarium and Science Center
Carol Merchant, National Institute of Health
Kristina Yu, Exploratorium
Bob Russell, Space Science Institute
Valence Davillier, Great Lakes Science Center

Science Education and Ferguson, Continuing the National Discussion of Race

Presenter: Susan DeRiemer, *Meharry Medical College*
Reporter: Sandra San Miguel, *Purdue University*

Topics Discussed/Presented:

- How reactions to Ferguson, Baltimore, etc. varied by geographic region (heavily impacted some areas, yet in others there was no mention or discussion at all)
- How SEPA students reacted (African American teenage males became antsy, separated from the larger group, program attendance dropped off)
- Misperception that increasing diversity results in decreased quality
- Missouri standardized test results showed more White students than African American students advancing in standardized tests in the same school district.
- Museums science center audiences don't always reflect the neighborhoods in which they are located.
- Examples of racism or microaggressions noted during the NIH SciEd Conference (i.e. "these children" vs. "our children"; we need to get URM students to fill in our project; we need to lower the bar to attract a diverse audience; middle class kids as the main characters in videos/materials; not thinking how URM participants educate the majority population; lack of diversity among SEPA PIs, speakers, panelists, SciEd attendees)
- Results of peer-review process on discrepancies in NIH funding

Key Points:

- Discussions raised awareness for the majority population to ensure materials and role models are representative. Target audiences should all be able to see themselves.
- URM individuals should be role models for both underrepresented and majority students.
- Take steps to understand the needs of the community (e.g., focus groups can be used to understand barriers to museum attendance and strategies to welcome local residents. Barriers could include large, stark entrances; greeters; and, police officers in lobby).
- Racism or microaggressions should be pointed out immediately and conversations had.
- The traditional "bars" we are using might not reflect the talent pool
- We need to increase the diversity of SEPA PIs/staff and NIH leadership in terms of race, ethnicity, and generation at a minimum.
- Cultural competency training is essential.

Take Homes/Considerations for future discussions:

- Bring more color into leadership
- Role models and mentors of color and of "all ages"
- Diversification in all aspects of the SEPA meeting
- Be visible, don't be afraid, push the envelope

- Fund programs that show high numbers and success in URM participation by both teachers and students
- Highlight the positives of diversity
- Make programs more personally relevant
- Study the challenges within SEPA: Is there an acceptance discrepancy? Can we find discrepancies in the review process?
- Meet audience where they are-not everyone has the same story
- Diversity the review panels
- Implicit association testing and cultural competency training for everyone, especially reviewers
- Require SEPA PIs to engage in activities to broaden the diversity of the investigator science education workforce and report these activities on annual progress reports.

Participants

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So You Want to Make an App? Mobile Apps for Biomedicine and Health Outreach

Presenters: Judy Diamond, *University of Nebraska*
Darrell Porcello, *University of California, Berkeley*
Andrij Holian, *University of Montana*
Katrina Schleisman, *University of Minnesota*
Reporter: Robin Taylor, *Oak Ridge Associated Universities*

The presenters highlighted apps created to help targeted populations learn STEM- and health-related material using engaging and innovative techniques. Each presenter provided a unique approach for how apps were used to engage learning: a) Porcello and Holian introduced gaming approaches that encouraged learners to progress through their games, increasing knowledge of the subject area, b) Schleisman highlighted an educational app which logs performance data of students and documents the learning processes of learners, and c) Diamond showcased a comic strip app which included supplemental instructional components to the learning material. The following list is intended to provide a summary of best practices and helpful hints for others creating apps to engage student learners.

- To engage students, educational apps need to be competitive as students have high expectations and are exposed to a wide range of quality games and systems.
- Do your market research, and then do it again—creating an app is an iterative process. Keep the end user involved through formative processes of evaluating your app. (Familiarity with curriculum standards is also important.)
- Create the right team (e.g., curriculum/content experts, app/game developer, evaluator, etc.).
- Apps can be used to provide valuable feedback on the learning process by logging how students approach their responses as well as their response.
- Familiarize yourself with the three major platforms (Apple app store, Google Play, Amazon app store) and consider advantages/disadvantages for publishing in each.
- Reviews are critical to app success.

Participants

Yukari Okamoto, University of California Santa Barbara
Ginger Cross, Mississippi State University
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Nicola Barber, University of Utah
Virginia Carraway-Stage, East Carolina University
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Kelley Withy, University of Hawaii

Your Brain in Your World: Bringing Personal Relevance to Neuroscience Across K-12 Audiences

Presenters: Jayatri Das, ***The Franklin Institute***
Nancy Moreno, ***Baylor College of Medicine***
Susanna Cunningham, ***University of Washington***
Dina Markowitz, ***University of Rochester***
Reporter: Brett Taylor, ***Sentinel High School***

The primary focus of this session was how to best communicate central concepts of neuroscience to a variety of audiences in an age-appropriate manner. Each presenter gave a brief overview of their projects under the common theme of making neuroscience relevant to students in a personal way. The various projects support the life science core ideas of how organisms detect, process, and use information about their environment using appropriate grade level breakdowns. The Next Generation Science Standards are addressed at the elementary level through the use of models to describe how animals receive information through sensory receptors. The standards of using technical information to explain the aspects of wave behavior are covered at the secondary level.

Project Summaries:

- Learning Brain—Interactive Inquiry for Teachers and Students, Baylor College of Medicine. Educational modules have been developed that integrate neuroscience and language arts. K-1 modules cover the senses; modules for grades 4-5 address training the brain; and grade 6 modules focus on brain chemistry. Extensive online support is available particularly through the use of videos. The neuroscience modules have been used extensively at the Baylor College of Medicine Academy at Ryan where assessment data shows significant neuroscience conceptual gains in implementation classes versus comparison classes.
- Sowing the Seeds of Neuroscience, University of Washington. The primary goals of this project are to develop, evaluate, and disseminate new curriculum about neurosciences specifically for middle school students. The curriculum centers on the extraction of neuroactive chemicals from plants and then analyzing the effects of these chemicals. An example would be extracting a neuroactive chemical and determining the effect of that chemical on the heart rate of planaria. The curriculum is disseminated through kits that contain all of the supplies, organisms, and equipment. The project evaluation assesses both content knowledge gains and student attitudes about science. Ultimately, this project allows student to do authentic science that promotes citizen science.
- Neuroscience Activities for Hands-on Learning, University of Rochester. This project is developing engaging, hands-on activities that address core neuroscience concepts. The 11 activities involve real life scenarios which are designed to be integrated into a standard high school introductory biology course and they come ready to use. There are introductory lessons such as the use of models to explore reflex pathways and there are extension activities addressing topics such as concussions and how using caffeine can cause neural fatigue. Lessons include pre and post assessment tools. The project is soliciting feedback from teacher focus groups with an ultimate goal of national dissemination.
- Neuroscience in Your World, Franklin Institute. This project has produced an interactive neuroscience exhibit. Students navigate through the exhibit and explore topics such as their own brain, a neural stimulator light show that models neuron function and neural pathways. There is an accompanying K-12 exhibit guide available to teachers allowing them to maximize the experience for their students. In addition to Neuroscience in Your World, the Franklin Institute provides professional development for K-8 educators on becoming a learning scientist and implementing brain based learning strategies. There is a memory and multitasking workshop for middle school students. Curriculum titled understanding the teen brain is available for biology students in grades 9-10 and there is a semester curriculum titled neuroscience and society for grades 11-12.

The project overviews were followed by small group discussion. Each group was charged with choosing a target audience or grade and a neuroscience topic. The groups were then asked to brainstorm methods for teaching the topic but strategies should include students being able to connect new information with existing knowledge; employing multiple sensory modalities; and mechanisms that allow students to revisit the main concepts. Group responses varied tremendously but there appeared to be consensus regarding using modern medical imaging; the extensive use of modeling including the possible use of 3-D printers to print representations of different types of animal brains; exploring topics that students can discuss at home with their families; and that lessons should be centered around intriguing storylines.

Participants

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Katura Reynolds, Oregon Museum of Science and Industry
Maurice Godfrey, University of Nebraska
Tim Herman, Milwaukee School of Engineering
John Pollock, Duquesne University

Developing Curriculum Materials that Align to the Three Dimensions of the Next Generation Science Standards (NGSS)

Presenters: Barbara Hug, *University of Illinois*
Maureen Munn, *University of Washington*
Nancy Moreno, *Baylor College of Medicine*
Nicola Barber, *University of Utah*
Reporter: Louisa Stark, *University of Utah*

Barbara Hug began the session by giving an overview of the NGSS. Development of the NGSS was based on the NRC's A Framework for K-12 Science Education, which envisions science learning and instruction as embodying three dimensions: (a) Science and Engineering Practices (SEP), (b) Crosscutting Concepts (CC), and (c) Disciplinary Core Ideas (DCI) in life science, physical science, earth and space science, and engineering and technology. The NGSS provide Performance Expectations (PE) of what students should be able to do as a result of instruction; they are not a curriculum. Each PE incorporates a SEP, a CC and a DCI. Each of the presenters then showed how they were adapting or developing curriculum materials to align with the three dimensions of the Framework and NGSS.

Maureen Munn discussed how their team is incorporating the NGSS during development and revision of their Genes, the Environment, and Me curriculum materials, which includes two units: (a) What can we learn from worms?: How the nematode C. elegans maintains balance in a changing environment, (b) Type 2 Diabetes: A complex disease of gene and environment interactions. They showed the alignment of the units to the 3 dimensions of the NGSS and to a specific Performance Expectation. They faced several challenges in developing these units. For the Worm unit, students do not design the experiment (the PE states that students are to "plan and conduct an investigation…"), and the unit exceeds the NGSS-specified assessment boundary by including the cellular processes involved in feedback mechanisms and in translation. For the Diabetes unit, anatomy and health are not explicit NGSS DCIs, and although the unit addresses several DCIs, CCs, and SEPs, it fulfills few specific NGSS PEs.

Nancy Moreno discussed Operation Rescue, a unit that provides a real-world science immersion experience for middle school students. In 2013, Typhoon Yolanda killed over 6,000 people and damaged over 1 million homes. The unit addresses several SEPs, CCs and DCIs for life, physical and earth/space science. Students learn about infectious diseases that are breaking out as a result of the devastation wrought by the storm and participate as members of a disaster relief team that plans the weight and volume of supplies to take to Tacloban, Philippines in a C-130 Hercules cargo plane, and plans its route from Houston, TX to Tacloban. Classroom testing with 656 students showed a highly significant increase in scores between the pre and post knowledge tests ($p < 0.001$; Cohen's $d = 1.75$). The examples of teachers' feedback that were presented were very positive about students' level of engagement and utilization of math-related skills. Challenges faced with this unit include: (a) the unit requires 1-2 weeks to teach, (b) teachers need new skills (Google Earth) to guide student work, (c) it was difficult to select a topic that integrated DCIs, SEPs and CCs, (d) development of the unit required a range of expertise, and (e) the unit connects to a variety of content and skills across disciplines (health, social studies, and reading/language arts as well as science and math), requiring students and teachers to make connections and utilize skills that they are unaccustomed to doing in a science class.

Nicola Barber presented the Genetic Science Learning Center's and AAAS Project 2061's efforts in developing a set of NGSS-aligned, 3-dimensional lessons and assessment items on natural selection, targeted to high school biology. The lessons particularly engage students in the SEPs through: (a) working with scientific data from published research studies on stickleback fish as well as several other species, and (b) constructing evidence-based arguments. Classroom testing of the prototype lessons with 308 students and 7 teachers showed a highly significant increase in overall scores between the pre and post knowledge tests ($p < 0.001$; Cohen's $d = 0.49$), as well as highly significant increases in the thematic categories of (a) data analysis, (b) genetics/heritability, and (c) natural selection theory ($p < 0.001$ for each category). Challenges the curriculum developers faced were: (a) the SEPs need to be made explicit to students if students' ability to use the SEPs are to be assessed, (b) deciding on the appropriate scaffolding for students in constructing evidence-based arguments, (c) that it takes instructional time to make the SEPs and CCs explicit to students, and (d) how to balance phenomena, DCIs, SEPs and CCs. Barber ended by posing two questions: How can crosscutting concepts be adequately addressed in a small unit or curriculum supplement? and How do we address school districts' more literal interpretation of the NGSS and the prescribed bundling of the three dimensions in performance expectations? – curriculum developers may find that these "proscriptions" do not work well when developing actual curriculum.

Participants

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Kara Pezzi, Einstein Fellow at Department of Energy
Sally Davis, University of New Mexico
Elliot Lee, University of Utah
Mike Wyss, University of Alabama at Birmingham
Matthew Fierman, Tufts University
Margaret Shain-Stieben, American Physiological Society
Shreya Shah, Cold Spring Harbor Bio Lab
Antonia Florio, Cold Spring Harbor Bio Lab
Erin Hardin, University of Tennessee
Judy Brown, Frost Science Museum
Margery Anderson, Walter Reed Army Institute of Research
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Chuck Wood, Wheeling Jesuit University
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Gail Fletcher, Center for Science Technology
Agnieszka Rykaczewska, Claremont Graduate University
Mike Kennedy, Northwestern University
Danielle Yancey, University of Alabama at Birmingham

Engaging Latino Audiences

Presenters: Katura Reynold, *Oregon Museum of Science and Industry*
Ivel Gontan, *Oregon Museum of Science and Industry*
Reporter: Maggie Ryan Sandford, *Science Museum of Minnesota*

Recently, Katura Reynold lead her exhibit team in developing and building a highly successful bilingual English/Spanish exhibit at the Oregon Museum of Science and Industry (OMSI). She began her presentation by emphasizing the importance of bilingual content, saying it helps family members with all levels of language mastery experience all aspects of an exhibit, fully and simultaneously. She also noted that OMSI has worked on other bilingual projects, and makes sure to consider different types of inclusivity (access, safety, age, etc...)

Reynold cited the NSF-funded Bilingual Engagement Research Initiative (BERI) study, which established the baseline findings her team used to build their exhibit. These findings include:

- English speakers will not feel alienated in a bilingual exhibit.
- Families can discuss the exhibit together, as opposed to the dynamic of having kids translate for elders
- Bilingual speakers will engage with both languages (code switch)
- It is critical to give equal weight to both languages

Even more than being bilingual, Reynold's team wanted their exhibit to be: bi*cultural*. In order to achieve this, she (herself a non-native Spanish speaker) co-developed the exhibit with an exhibit developer of Columbian background. The evaluations were carried out by (co-presenter) Ivel Gontan, who is of Cuban descent.

How did they do it?

They started in Spanish first! From ideas to mock-ups, through to the final product, the entire exhibit was co-developed, and checked* for bilingual/bicultural access along the way. They prototyped the exhibit at their local Latino Science Fest, watching people use it and taking note of both successful areas and areas of improvement.

*Said "checking" was carried out by **scientists, proofreaders,** and museum employees (reading for the **"tone of the museum"**) who were fluent in both Spanish and English, and who *were not* involved in developing content or writing the copy.

Front-End Evaluation involved members of community (focus groups and leaders in the community)

Formative Evaluation involved bilingual staff and data collectors

Summative Evaluation involved bringing in new groups of visitors who had not previously used the exhibit via outreach, sign-ups for free tickets, and small incentives

[Interesting conversation occurred around the subject of the "Boluntorio"—a combination of the English word *volunteer* and the Spanish word *bolonto* meaning something akin to "obilgation." The hybrid term refers to a museum volunteer who ropes in members of his/her family to volunteer as well.]

Evaluation Findings:

- Code switching (switching between languages) was natural and regular
- Family members found their way through both languages simultaneously (that is: younger visitors could read the English at the same time elders read Spanish, allowing for smoother simultaneous experience of the exhibit)
- Spanish-speaking families felt they shared exhibition experiences
- Spanish-speaking families expressed appreciation for the languages being listed side-by-side
- Spanish-speaking families felt emotionally welcomed
- Spanish-speaking families felt the exhibit's attempt to be culturally relevant was successful
- The experience gave family members a chance to practice the language with which they were less comfortable

Other Models:

Translation method: Finalize all text in English, then translate to Spanish. (Include Spanish science advisor reviews, "three sets of eyes.")

Post-development adaptation: Existing English project is adapted, modified, and re-done in a new complimentary Spanish version. (Include Spanish science advisor reviews, "three sets of eyes.")

Building Bicultural Exhibits At-A-Glance:

1) English and Spanish copy written in sync
2) Internal team review (graphic design, etc)
3) English & Spanish science content review
4) Update content, re-sync both languages
5) Proofreading, re-sync both languages
6) "Last Look" before final text to print
7) Evaluate, remediate as needed

Discussion around engagement:

- Nicole Weber of Lesley University suggested having more gathering spaces in museums, and…
- Spanish Family Nights
- Latina Girls' Nights

Other suggestions included:

- Latino Family Engineering Nights
- Posting signs about free days on community boards and in churches
- Advertising on radio and cable talk-shows
- Inviting leaders to come for free tours
- Inviting leaders to hold gatherings or meetings at the museum
- Diversifying staff (age-old museum problem)

- "Never start a meeting immediately"—let people get to know each other first

There was also discussion around the culturally preferred autonym: Latino vs. Hispanic vs. Spanish vs. origin-specific (e.g. Chicano). Short answer: Regional differences can change meaning; names are not interchangeable

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Participants

Sandra San Miguel, Purdue University
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David Micklos, Cold Spring Harbor Laboratory
Debra Yourick, Walter Reed Army Institute of Research
Nicole Weber, Lesley University
Sarah Boyd, SageFox Consulting Group
Jennifer Trygstad, University of Washington
Rosie Roche, Northwestern University
Paul Dusenbery, Space Science Institute
Julia McQuillan, University of Nebraska
Barbara Baumstark, Georgia State University
Michelle Ventura, Georgia State University
Marisa Bowers, City of Hope Beckman Research Institute
Chris Nilla, Helix Solutions

Overview of STEM Education Priorities, Funding Opportunities and Resources from the National Science Foundation

Presenter: Robert L. Russell, *National Science Foundation*

Introduction

- When in doubt, call a program officer!
- Most applicable grant opportunities are in DRL
- Call a program officer to find out if the grant supports Pre K
- Funding level is ~10%, which may feel discouraging but resubmissions are encouraged
  - Program officers can provide targeted feedback on reviews
  - It's your call about whether to address reviewers concerns in a resubmission
  - There's no limit on the number of resubmissions (2-3 re-submissions are ok; 1-2 re-submissions is typical)
  - NSF does not have standing review panels, so each panel may review your grant differently
- Generally 1 call/program/year, occasionally 2 rounds

EHR Core Program (ECR)

- Foundational funding to study learning (higher % funding than some other programs)
- Proposal based on strong theory, strong research design and strong review of literature
- Basic STEM learning within different environments
- Workforce development (career development theory)
- Broadening participation (variables of URMS and women)
- Two types
  - Capacity building ($300 K) to lay the groundwork for your research, max 3 years
  - Core research project maximum 5 years, $1.5 million max
- What makes a research question foundational?
  - Are the question/results generalizable?
  - Are they theory building?
- Research in Engineering Education (REAL) may merge with EHR Core

CAREER Awards

- Designed to start your research and launch a research agenda
- Must be tenure track faculty member; post docs are not eligible

PRIME: Research on evaluation

- Development of new theory
- Developing techniques or building instrumentation
- Growing evaluation capacity

- Two types:
  - Exploratory: Planning grant; lay ground work for projects max $250 K for 2 years
  - Capacity building: Max $800 K, 3 years

DRK-12

- Built around a hypothesis; the program should be the context for the research
- For health related interventions, must be solid science
- Ask program officer before applying
- Involves development of resources, models and tools (RMTs) within the context of asking research questions
- 4 strands of DRK-12
  - Assessment
  - Curriculum in STEM
  - Teaching strands (pre/inservice programs for teachers)
  - Implementation-variables that affect quality and effectiveness of implementation of the program
- Three types
  - Exploratory
  - Research and development
  - Conference ($250-300K) must include series of activities; workshop grants available (up to $50 K)-without outside review
- Contact program office with one page concept paper to get feedback on your ideas
- Can jump into full R&D, but it's wise to start with an exploratory
- Must always write about any prior NSF work in NSF proposals; can also write about NIH funding, but be creative; write about what you have done and how it lays the foundation for what you are proposing to do
- Must form an intellectual foundation for what you propose; integrate this with your literature review

ITEST

- Youth learning about STEM while incorporating technology
- The last few few rounds were highly competitive
- Funding from H1B VISAs
- Aim is to improve workforce development, so a career focus is a must
- Position evaluation as research to some degree; the findings should be of interest to the nation (generalizable)
- Information and Computing Technology (ICT, traditional STEM careers, range of STEM professions)
- All projects must provide direct service to students but can have some teacher professional development

- Two types:
  - Strategies projects: creation and innovation workforce related activities; max $1. 2 Million
  - SPrEaD projects: dissemination of successful strategies projects; max $2 million

AISL

- Focus on knowledge building; ask research questions about how programs work and why
- Major thrust should be outside of the classrooms, but may have some resources for schools, (online for example)
- Audience- anybody, anytime, anywhere
- Helpful to relate to NGSS, Common Core Math, etc.
- Pathways – exploratory projects
- Research in service to practices - research to advance knowledge and provide an evidence base
- New learning resources to be done in a new way – developing exhibits
- Broad implementation - dissemination and research-based rationale for approach (how does it work under different circumstances, what is most effective
- Conferences and workshops; workshop proposals can be submitted at any time
- Science Learning Plus (+) - US researchers collaborate with UK researchers

Putting Your Proposal Together

- Look at the funding announcement Goals and Purposes
- Choose an appropriate program; there are some overlaps
- When in doubt, call a program officer
- Budget should be consistent with level of work
  - Higher budgets will not penalize the submission; however, reviewers do look at the budget
  - Two months salary max on all NSF proposals (can ask for more % effort with rationale)
  - Indirect costs set by institution and auditors; these are not factors in review process (only direct costs)
  - No cost sharing (can leverage existing resources, however)
- Project description; 15 page max
- Overview - introduction to project
- Goals and objectives of project/research
- Summary of effectiveness and impact of prior support
- Explanation of principles guiding the project design, informed by the literature
- Detailed work plan with a timeline
- Qualifications of key personnel
- Anticipated results
- Research plan (if applicable/appropriate)- must be strong; discuss validation and reliability of instrumentation, statistical approaches of analyses, etc.

- IMPORTANT- Questions, data, analytical plan, expertise of investigators
- Advisory board (critique research design and implementation)
- Third party evaluation (independent)
- Choose what is effective for project
- Dissemination plan
  - Be creative beyond the typical publishing and conference presentations (do this but include other ideas); e.g. community of practice and network for dissemination
- Fatal flaws leading to return without review: font size, margins, required elements
- Points to remember
  - Must be STEM relevant
  - Must have good literature review, including reference to other funded projects
  - Must have strong research design
  - Don't ignore what is required
  - Have clear plan for implementation
- Intellectual Merit: Why is this an interesting research problem? Tie research design to literature and intellectual foundations.
- Broader Impacts: Why is this project relevant nationally?
- Go to *nsf.gov* for questions

Program Integration: Teacher Challenges and Tips, A Panel Discussion

Facilitators: Tony Ward, *University of Montana*
Andrij Holian, *University of Montana*
Naomi Delaloye, *University of Montana*
Panelists: Brett Taylor, *Sentinel High School*
Reporter: Tony Ward, *University of Montana*

Topics discussed and/or presented:

This breakout session included a panel of four teachers from varying content areas (biology and chemistry) and grade levels. The goal of this session was to discuss strategies and challenges related to implementing SEPA programs into the science classroom. In addition, this session discussed methods for teacher recruitment (conferences, list serves, social media, going to schools), different evaluation protocols within the classroom, as well as strategies for generating program feedback from participating teachers.

Key points and challenges:

Teachers discussed the challenges that they face in trying to integrate outside programs into the classroom. For many SEPA projects, curriculum or other materials are provided to schools. However, because of time constraints and/or these materials not being linked to state or national standards, these materials may not be effectively utilized. To address this, the panel made suggestions, such as providing materials to the classroom that are in finite sections or modules, and aligned with state/national standards. Follow up and ongoing support were also stressed as a need.

Following implementation of the program within the classroom, a discussion was held on the best way to contact teachers throughout the school year. Email, phone calls, and snail mail were all identified as useful strategies, with periodic meetings (in classroom or Skype) suggested in addition to meetings at the conclusion of the school year. Importantly, teachers suggested that they should be included in the entire process of the development of grant-related materials, and not necessarily primarily participating as end-users of materials.

Participants

Erin Burr, Oak Ridge Associated Universities
Stephen Koury, University of Buffalo
Shannon Carlin-Menter, University of Buffalo
Marisa Pedulla, Montana Tech
Rayelynn Connole, Montana Tech
Danielle Alcena, University of Rochester
Dina Markowitz, University of Rochester
Michele Shuster, New Mexico State University
Tania Jarosevich, Censeo Group
Melinda Gibbons, University of Tennessee
Kenneth Rath, SageFox Consulting Group
Julie Ho, Seattle Children's Research Institute
Ginger Cross, Mississippi State University
Donna Loden, HealthWorks
Carla Romney, Boston University
Jackie Shia, Wheeling Jesuit University

See One, Do One, Teach One: Student-Produced Videos to Enhance Their Understanding of Data Collection in Research

Presenters: Peter Crown, *University of Arizona*
Marlys Witte, *University of Arizona*
Reporter: Peter Crown, *University of Arizona*

This session began with an overview of the widespread use of science videos in classrooms and their utility and effectiveness. Most attendees agreed, with the exception of a few from rural and remote areas where the Internet was not available in classrooms or had low band width incapable of supporting video. A majority of good quality videos are produced commercially, or by a variety of interested and talented individuals and groups who publish on YouTube. The main focus of the session was on the concept of videos produced BY students, rather than FOR students. This is a major departure, which puts students in the role of teacher of their peers. This approach puts to the test the idea that in order to reach others effectively, you must know the material well in the first place. It also adheres to the medical school adage of "learn one, do one, teach one" where students teach their peers what they have learned. Research on this approach is recent and sparse, but that which exists supports the notion that the act of students planning and producing videos helps them better understand the concepts involved in the research they are presenting. Our informal evaluation of this approach has proven to help students understand the basic fact of scientific research, which is answering questions. Discussion among the group turned to the issue of video production skills and access to video equipment – neither of which are guaranteed in every classroom. We have found that the vast majority of our students, most of who come from disadvantaged backgrounds, own smart phones and if they haven't used them to record, edit and post produce video, they learn it very quickly on their own or from friends, using free or low cost apps such as iMovie. The use of a smart phone for video production was demonstrated by mirroring the iPhone video on the projector and passing the phone to participants.

Participants

Chris Vanags, Vanderbilt University
Rebecca Smith, University of California, San Francisco
Deborah Peek-Brown, Michigan State University
Kristin Bass, Rockman et al.
Bazla Shahzad, Bio-Bus Program
Shue Casillas, Georgia State University
Kelley Withy, University of Hawaii

What Common Nutrition Recommendations Should We Be Using for Type 2 Diabetes and Management?

Facilitators: Darrel Porcello, *University of California*
Ann Chester, *West Virginia University*
Melani Duffrin, *East Carolina University*
Reporter: Allender Lynch, *East Carolina University*

Points of Discussion:

- Is it possible to develop a tool or model, which investigators can modify to their projects?
- What are possible challenges of making the proposed model?

Ann: Has watched the progression of obesity in her state. Diabetes prevention has been their main focus by slowly gaining groups' interest. They have shied away from the guidelines. Instead they have brought in students, screened for sugar and cholesterol, BMI, self-esteem using a community engagement approach. Then they have had students create their own goals and paired them with mentors to work with their goals. While working with students they used the federal guidelines. What they found was if students had a weight loss goal they had a significant difference with their weight loss in comparisons to those outside the programs.

Melani: FoodMASTER in Eastern North Carolina. They deal with similar issues with rural low socioeconomic communities, but slightly different cultures. When working with kids they focus less on the nutrition and health aspect and focus more on math and science hoping they gain the concepts through these activities. These activities also include at home activities. Teachers aren't concerned about nutrition and health because they have limited time. Therefore, making it a science and math education program is a way to complete the nutrition and health lessons.

- The book of lessons they developed has many USDA approved recommendations, including eating a variety of fruits and vegetables. Students practice mathematics by basing it in daily recommendations, serving sizes, reading labels, and understanding what they are eating.

Virginia: When we teach math and science it's very much based in nutrition and food concepts. Therefore, we have added science and math into these nutritional concepts. The most common complaint by teachers regarding including nutrition education was time because normally the students focus was on nutrition education alone. They have found that these combined efforts not only increased students nutritional knowledge but also increased their science and math knowledge. The nutrition education literature looks at nutrition status rather than nutrition education.

This seems to help with teacher's barrier's; How does this affect the student population?

- This is where the literature is lacking. There is a huge opportunity to begin research. What you find in the literature is that adults are lacking the "basic" skills. You are unable to teach them or it is difficult to teach these recommendations because they are lacking these skills. When you are young, food is engaging and gives you the ability to engage in critical analysis. Students need to be able to practice this skills on these own because it needs to be sustainable. They need to learn the critical thinking piece. The knowledge aspect adds to which direction you want to go toward teaching your clients.

Tracey: We work with 5 institutions where we have student mentoring programs. We start students with diabetes 101 where they have to talk to someone who currently has diabetes and share their experience.

- We also practice with the lab work, testing glucose levels, etc. We teach children the difference between type 1 and type 2 diabetes. Most of the children know someone with diabetes and therefore are not only learning the information for their own benefit, but also on behalf of their family members and other associates. We encourage the students to expand their palate by having them try a variety of fruits and vegetables.

Would like to have a common resource and guidelines for the students to practice.

- **Ann:** Believes the guidelines are clear. Most of the individuals are from low-income areas and food deserts. They may understand the guidelines, but they are unable to practice the guidelines because they do not have access to the proper food, money, and other resources. She believes the issues are along being able to implement the guidelines.
- When dealing with kids from 2 different areas, it was like night or day. In one area they weren't as knowledgeable of the healthy food practices.

Is there a way to list the various challenges and answers to these issues so we have a document for those who do not know where to begin?

- **Toby:** Decided to merge with other organizations and schools to teach kids math and science. They have a number of projects that are working on diabetes and work together to understand diabetes and develop resources.
- They are developing a curriculum for middle school grades; the first module will be on diabetes. They are using diseases to translate math and science. Each module ask questions the kids may have asked; such as, why does my area smell bad?
- What do you do in the mean time for projects who are not able to or aren't able to collaborate or just need a starting point? Is it possible to create a document with this information?

- How about trying to look at a common behavior model and then modify it for specific projects? For example, the cognitive behavior theory model. Could pull together information to create a module and people can adapt the module to fit their needs. Would like a SEPA-branded model that investigators can refer to for their projects.

Can there be a tangible model, not just the behavioral aspect? For example, what fruits and vegetables are available in certain areas?

- Teaching the community how to buy a cheap meal from local stores, or perhaps an app to teach these concepts. However, must remember this involves math and making sure people have the skills to complete this task.
- So much of the information from past SEPA projects is gone, and their format and phase are so different it is difficult to go through the materials. It would be beneficial to have a matrix of information from all SEPA projects, ideally in the same format. This will allow people to delve into the materials.
- Behavioral challenges: Must start with the constructs that you want the behaviors to be, for example, then you go into other constructs such as environment. Believe it needs to be a step by step process.

Interested in grocery store (meal planning and access to food) and physical activity concept:

- Cleveland opened a series of Farmers Markets and allowed people to use food stamps at the farmers Markets. They provided incentives to encourage consumers to go to the farmers Markets.
- This is a piece of data that can be added to this possible model. Also, perhaps can include in this model possible barriers and data to demonstrate how to address these barriers.

Does any of this exist?

- Yes, there are models....But we need to include the information. If we have this nice model with key messages and key behaviors it can really help the projects overall and the target population.
- In addition, increased nutritional status can increase academic performance. However this would require a huge budget.

Challenges:

- Culture, access, geographic reasons, season, and physical activity.
- Creating a Google doc or something that can be shared with everyone. Is it possible for everyone to communicate to begin this diagram and begin to add in information?
- Developing a socially cognitive model diagram with various challenges and include barriers and possible interventions and then include various data points.

Should SEPA be doing this or a public Health organization? Are there some partners to assist and possibly to take over the project?

- This is only the beginning; if it does take off then we can find partners. Also as discussed science and math can be used to teach the concepts. So don't want to focus on behavior changes, but more so academic achievement and career choices. Do not lose your focus.
- Wording is key, how your message is presented. Perhaps the Social Cognitive Science Career Theory.

Participants

Allender Lynch, East Carolina University
Antoinette Hillian, University Hospital Case Medical Center
Jason Dupuis, Museum of Science and Industry Chicago
Kaitlyn Okrusch, Montana State University
Maureen Munn, University of Washington
Toby Citrin, University of Michigan
Tracey Meilander, Great Lakes Science Center
Virginia Carraway-Stage, East Carolina University

Digital Education

Facilitator: Adam Hott, *HudsonAlpha Institute for Biotechnology*
Reporter: Elliot Lee, *University of Utah*

Connecting SEPA Projects

Currently, there is no way for SEPA groups to find each other, their projects, or the assets they generate. This makes it needlessly difficult for SEPA groups to build on the progress of older projects or highlight past projects which are still relevant.

We decided that a database should be created which allows SEPA groups to find one another in order to see what has already been created and find potential collaborators. We were uncertain, however, if the NIH would need to raise money for this database, or if we could fit it inside an existing system.

Finally, we believe there should be a system that allows successful technology-focused project managers to mentor other researchers. This program could most likely be added to the current SEPA Mentor-Mentee program without much difficulty. Partnerships with private technology companies could also provide valuable advice or services to SEPA research groups.

Long Term Maintenance

Keeping materials available to students and teachers is a major issue for many digital SEPA projects. We discussed a number of projects that are either already defunct, or will fall into disrepair after their grant funding ends. We believe it is a shame that these projects, which the NIH has already spent millions of dollars on, will simply disappear.

In addition to a potential SEPA database which archives projects, we thought of a few ways these projects could continue to operate after their funding periods end. Firstly, in order to maintain accessibility for as long as possible, one of our more experienced group members simply suggested listening to the programmers. Software programmers likely have the best sense of technological trends. He referenced his experience of using HTML5 instead of Flash, which will allow students on iPads to use his website for the foreseeable future. A project can also seek alternate avenues of funding. A University or nonprofit can potentially support a project after its SEPA funding has run out, or, if it is of high enough quality, the project can be monetized to cover its operating costs.

Measuring Impact

Digital projects are often expensive (the average app costs about $250,000 to develop), so it can be incredibly difficult to budget for evaluations. Digital projects are also difficult to evaluate. Many groups only begin evaluating their website or app after it is nearly complete, at which point it is virtually impossible to go back and correct issues. Our veteran group members suggested a process called “Iterative Design” where the project is tested at every stage. The very first tests give the group members insights into the usability of their project- its functionality and the ease with which users learn the User Interface. Later tests focus on both usability and efficacy- still tweaking the UI, but also ensuring the project helps students achieve their learning goals. In this way, researchers can identify and solve potential problems early on.

Participants

Tania Jarosevich, Censeo Group
Julie Yu, Exploratorium
Kristina Yu, Exploratorium
Diane Johns, Pacific Science Center
Candice Etson, Tufts University
Chris Vanagh, Vanderbilt University
Patrice Saab, University of Miami
Leonard Munstermann, Yale University
Elliot Lee, University of Utah
Kelley Withy, University of Hawaii
Darrell Porcello, University of California, Berkeley
Tim Herman, Milwaukee School of Engineering
Melinda Gibbons, University of Tennessee
Ginger Cross, Mississippi State University

Environmental History Performed: Using Performing Arts to Educate and Engage Audiences of All Ages

Facilitator: Lisa Jacobs, *University of Pennsylvania*
Reporter: Lisa Jacobs, *University of Pennsylvania*

- Storytelling as a way to communicate scientific information. Conveying information, emotion, humanity.
- Stories as cultural artifacts (oral history)
  - deconstruct/understand point of view
  - understand human experience
- Amber, PA- near Philadelphia. 96 acres of asbestos waste remain from asbestos industry. Amber is now a Superfund community
- Multi-media project. Collaboration between U Penn, Chemical Heritage Foundation
- Conducted oral histories with members of many different constituencies
  - preserve experience
  - use information as teaching materials
- Theater as a tool for science education
  - use of metaphor
  - making abstract concrete
  - revealing the collision of ideas and faces
  - sharing processes over time
- Building the White Mountains
  - plays built on oral histories
  - wanted to reflect multiple voices
  - hired writers for 12 plays

Participants

Ann Chester, West Virginia University
Marisa Pedulla, Montana Tech
Rayelynn Connor, Montana Tech
Toby Citrin, University of Michigan
Tracey Meilander, Great Lakes Science Center
Donna Loden, HealthWorks
Katura Reynolds, Oregon Museum of Science Industry
Barbara Baumstark, Georgia State University
Michelle Ventura, Georgia State University
John Fraser, New Knowledge

Project Evaluation:
Sharing Evaluation Instruments and Designs

Facilitators: Kristen Bass, *Rockman et al.*
J. Michael Wyss, *University of Alabama, Birmingham*
Reporters: Robin Taylor & Erin Burr, *Oak Ridge Associated Universities*

The session began with facilitators asking attendees to introduce themselves and their interest for attending the session. Attendees represented a diverse background of evaluators, project managers, and other stakeholders with a laundry list of interests. Interests of attendees included learning more about conducting longitudinal studies, identifying metrics of interest for individual SEPA projects and metrics of interest across SEPA projects, questions regarding IRB, constructing randomized control trials, evaluating formal and informal educational experiences, being inclusive of diverse and multicultural perspectives within evaluations, and evaluating the evaluators.

A suggestion was made to form a working group to identify metrics for SEPA grants that would cultivate into a toolbox of instruments to be shared across projects. Although there was some minor concern with the suggestion, the majority of attendees seemed to prefer the working group idea. Attendees were also encouraged to explore resources on the web including CADRE (University of Colorado) and the Evaluation Center (Western Michigan University). Attendees were also asked to submit any instruments or tools to [Nancy Moreno, nmoreno@bcm.edu].

Participants

Jawed Alam, Ochsner Health System
Nicole Weber, Lesley University
Kenneth Rath, SageFox Consulting Group
Camellia Sanford, Rockman et al.
Jessica Preleski, University of Chicago
Shanita Brown, Meharry Medical College
Elizabeth Tuck, ASHG/NHGRI
Christopher Villa, Helix Solutions
Maggie Ryan Sanford, Science Museum of Minnesota
Valence Davillier, Great Lakes Science Center
Kristine Chadwick, Independent Consultant
Virginia Carraway-Stage, East Carolina University
Maureen Cullins, Duke University
Matthew Fierman, Tufts University
Kristi Straus, University of Washington
Christopher Burnett, Baylor College
Sally Davis, University of New Mexico
Alana O'Reilly, Fox Chase Cancer Center
Sarah Boyd, SageFox Consulting Group
Agnieszka Rykaczewska, Claremont Graduate University
Renee Bayer, Michigan State University
Julia McQuillan, University of Nebraska-Lincoln
Erin Burr, Oak Ridge Associated Universities
Ivel Gontan, Oregon Museum of Science and Industry
Lisa Marriott, Oregon Health & Science University
Kelley Withy, University of Hawaii
Debra Burkey-Piecka, Wheeling Jesuit University
Kelly East, HudsonAlpha Institute for Biotechnology
Revati Masilamani, Tufts University
Robin Taylor, Oak Ridge Associated Universities

Sustainability: Capitalize on Your Intellectual Property!

Presenter: David Miklos, *Cold Spring Harbor Laboratory*
Reporter: Brett Taylor, *Sentinel High School*

Dave Miklos discussed ideas for parlaying intellectual property into products and concepts that companies and institutions will pay for. He emphasized that the myriad of curriculum ideas generated through the SEPA projects represent intellectual property. One of the primary goals of most of these projects is sustainability and large scale dissemination. Establishing business relationships with organizations that can distribute your educational materials is mutually beneficial for all parties involved.

There are a variety of strategies for disseminating and sustaining intellectual property. The Cold Spring Harbor Laboratory DNA Learning Center, DNALC, entered into a partnership with Carolina Biological in 1986 to sell lab kits developed by the DNALC. The DNALC estimates that approximately 200,000 students per year use their genetics related kits. In addition to the learning kits, Cold Spring Harbor Laboratory currently markets their intellectual property through websites, apps, published curriculum materials, and licensing agreements with science learning centers. These licensing agreements benefit the licensee through more rapid development times; monetary savings through using intellectual property that has already been developed and evaluated; and through detailed training and support from the licenser. Most licensees want to establish a formal relationship with the licenser because it helps with securing additional funding. Cold Spring Harbor Laboratory currently has licensing agreements with learning centers in the United States, Austria, China, Japan, and Mexico.

Dave stressed several times that the last five percent of materials development, the five percent required to edit and polish materials for publication or distribution, is often more difficult than the 95% required to actually develop materials. The percentage of the budget required for the refinement process is relatively low but the work is very detail oriented and time consuming. The DNALC employed graphic specialists early in their material development and that has served them well from a distribution standpoint. Dave added that curriculum developers should not be intimidated by the publication process as the barriers for this type of publishing are generally lower than for trying to publish mass market materials.

The final marketing strategy that was presented was app development. Cold Spring Harbor Laboratory recently published and app called The 3-D Brain. The initial version of the app is free and has already been downloaded over 3 million times. There is a nominal fee for the upgrade, $0.99, and this upgrade has generated over $25,000.00 in income. Dave believes it is important to translate the apps into languages used in rapidly expanding markets. The 3-D Brain has already been translated into Japanese and a Chinese version is in development.

Dave concluded his presentation by summarizing important lessons he has learned through marketing the intellectual property developed by Cold Spring Harbor Laboratory and the DNALC:

- There is value associated with accumulated wisdom.
- Marketing curriculum materials is not like making hamburgers.
- Don't feel bad about selling good or free stuff because people are already buying worse stuff.
- Licensing agreements are like gym memberships. If the new member uses the gym, then they get fit and the membership is worthwhile. Correspondingly, if a licensee uses the materials as they were designed and heeds the advice of the licenser, they will most likely succeed in their endeavor.

Cold Spring Harbor Laboratory and the DNALC have benefited from their nearly 30 years of sustainably disseminating their intellectual property. The annual gross income from all of their distribution strategies is well over $1 million and much of this revenue is unrestricted funds. Dave finished by pointing out that sustainability of intellectual property is important because of the continually shifting tapestry associated with federal funding.

Participants

Brett Taylor, Sentinel High School
Antonia Florio, Cold Spring Harbor Laboratory
Tiffany Farmer, Vanderbilt University
Gail Fletcher, CSTHI
Virginia Shepherd, Vanderbilt University
Greg Doctor, Montana State University
Linda Morell, University of California, Berkeley
Karina Meiri, Tufts University
Berri Jacque, Tufts University
Celia Besore, National Association of Hispanic Nurses
Kathy Hoppe, Einstein Fellow at NSF
Maria Isabel Leeder, Patricia and Phillip Frost Museum of Science
Judy Brown, Patricia and Phillip Frost Museum of Science
Dina Markowitz, University of Rochester
Danielle Alcena, University of Rochester
Stephen Kaury, University of Buffalo

Using the EQuIP Rubric to Evaluate the Alignment of Educational Materials to the Three Dimensions of the Next Generation Science Standards (NGSS): Applications to Curriculum Development and Selection

Presenters: Barbara Hug, *Professor, University of Illinois*
Nicola Barber, *University of Utah*
Louisa Stark, *University of Utah*
Reporter: Susan Hershberger, *Miami University*

Barbara Hug began the session with a brief history of the Next Generation Science Standards (NGSS) from their beginning in the Framework for K-12 Science Education later developed Standards, and the emerging NGSS Resources available from NSTA today. Next the conceptual shifts in the NGSS were addressed which include emphasis on:

- Interconnected nature of science standards
- Student performance expectations
- Progression from K to Grade 12
- Deeper understanding as well as applications
- Integration of science and engineering
- Alignment to preparation for college and careers
- Alignment to the Common Core (Math and Language Arts)

Following the introduction of the NGSS, the Achieve EQuIP (Educators Evaluating the Quality of Instructional Products) Rubric was introduced and discussed. The Rubric for Lesson & Units: Science included:

- Alignment to NGSS
- Instructional Supports
- Monitoring Student Progress

The group was split into two groups to gain greater familiarity and look deeper into the rubric categories while applying the EQuIP rubric to two life science lessons. One middle school level lesson on Reproductive Strategies and another high school lesson on Pedigrees and the Inheritance of Lactose Intolerance were distributed. The middle school lesson group worked mostly as one large group, but the high school lesson was analyzed by three to four groups. The rubric categories 1) alignment to the NGSS stressed alignment to the three dimensions of the NGSS, practices, disciplinary core ideas, and crosscutting concepts to make sense of phenomena, also included 2) evaluation of instructional support and 3) monitoring student progress.

The following comments were reported out to the larger group following the smaller discussions. Both groups felt the lessons nicely addressed the practices of the NGSS in making sense of phenomena. The crosscutting concept elements were also supported but some felt the distributed lessons were short on support of the disciplinary core ideas. One group and participant volunteered that the rubric was lacking in their idea of a rubric and felt it needed to be more explicit about the extent to which the practices, disciplinary core ideas and cross cutting concepts were addressed in the lesson. The EQuIP rubric also addresses a "lesson," "longer lesson" and a "unit" and some participants pointed out ambiguities arising from looking at a single lesson out of context. One group voiced that the lesson lacked "student centeredness" because it was a student worksheet, and pointed out the inherent tension between a lesson that is teacher knowledge driven and student question driven. It was felt the lesson needed to be more explicit on helping students make meaning of the phenomena. The question was raised how much of the EQuIP rubric should be visible to students, with the idea that the more "meta" cognitive students are, the greater attainment of learning goals and performance expectations.

The concluding slides of the session drew the participants back to the resources available in the NGSS with vetted new classroom resources. For example: the two lessons studied in this session are available at: ngss.nsta.org. By accessing the Standards tab, the standards are organized and accessing the MS, or HS topics, the NSTA analysis of their alignment of these lesson was observed. The ngss@nsta site may become a resource of exemplary lessons.

Participants

Billy Roden, Seattle Children's Research Institute
Julie Ho, Seattle Children's Research Institute
Susan Hershberger, Miami University
Kara Pezzi, Einstein Fellow at Department of Energy
Mary Patterson, National Science Foundation
Ben Stambaugh, National Science Foundation
Judy Brown, Frost Science Museum
Susan DeRiemer, Meharry Medical College
Monroe Duboise, University of Southern Maine
Melani Duffrin, East Carolina University
Kristi Bowling, Rice University
Maurice Godfrey, University of Nebraska
Kim Soper, University of Nebraska Medical Center
Allender Lynch, East Carolina University
Danielle Yancey, University of Alabama,Birmingham
Tony Beck, National Institutes of Health
Jeniffer Trygstad, University of Washington
Suzanne Kirk, Virginia Commonwealth University
Chuck Wood, Wheeling Jesuit University
Maureen Munn, University of Washington
Margery Anderson, Walter Reed Army Institute of Research
Sandra San Miguel, Purdue University College of Veterinary Medicine
Margaret Shain Stieben, American Physiological Society
Diane Munzenmuler, Milwaukee School of Engineering
Rebecca Sanchez Pitre, Ochsner Clinic Foundations
Allison Sharai, Ochsner Clinic Foundation
Neil Lamb, HudsonAlpha Institute for Biotechnology
Emily Kalnicky, Phipps Conservatory and Botanical Gardens

POSTER SESSIONS

Posters are listed alphabetically by Institution within the following topic areas

Authentic Research Experiences for Students and Teachers

Poster	Project Name/ Poster Title	Institution	PI(s)/Poster Authors	Funder
1	NeuroLab	Coastal Marine Biolabs	Ralph Imondi, Linda Santschi	SEPA
2	Barcode Long Island: Exploring Biodiversity in a Unique Urban Landscape	Cold Spring Harbor Laboratory	Dave Micklos	SEPA
3	Immersion Science Laboratory Research Training for High School Students	Fox Chase Cancer Center	Alana O'Reilly	
4	BioStart: Research Intensive Internship and Education Experience for High School Students	Louisiana State University Health Sciences Center - Shreveport	Kenneth McMartin	SEPA
5	Meharry Health Sciences Leadership Academy	Meharry Medical College	Susan A. DeRiemer	SEPA
6	Bringing Research into the Classroom	Montana Tech	Marisa Pedulla, Rayelynn Connole	SEPA
7	Let's Get Healthy!: Community Health Interactive Data Resource	Oregon Health & Science University	Lisa Marriott, Jackilen Shannon	SEPA
8 A	Ethanol and Cocaine: Environmental Place Conditioning, Sterotypy, and Synergism in Planarians	Temple University	Scott Rawls	SEDAPA
8 B	Addiction and Regeneration: Rewarding Effects of Sugar and Cocaine are Transmitted and Maintained During Regeneration of Planarians	Temple University	Scott Rawls	SEPA, SEDAPA
9	Teaching the Genome Generation	The Jackson Laboratory	Charles Wray	Jane's Trust Foundation
10	Bioinformatics Inquiry Through Sequencing	Tufts University	David R. Walt, Donna K. Slonim	SEPA
11	The school for Science and Math at UAB (SSM-UAB): Diversifying a Proven STEM Education Model	University of Alabama at Birmingham, Vanderbilt University	J. Michael Wyss, Virginia L. Shepherd	SEPA
12	Translating Translation and Scientific Questioning in the Global K-12 Community	University of Arizona College of Medicine	Marlys H. Witte, Francisco Garcia	SEPA, NIAID
13	San Francisco Health Investigators	University of California San Francisco	Rebecca Smith, Katherine Nielsen	SEPA

14	Virtual Sprouts: Web-Based Gardening Games	University of Southern California	Donna Spruijt-Metz, Gisele Ragusa	SEPA
15	Biology-Environmental Health Science Nexus: Inquiry, Content and Communication	University of Wisconsin-Madison	David Petering, Craig Berg	SEPA
16	Teaching to Learn: WV-HSTA Students Take CBPR to Their Community	West Virginia University	Ann Chester	SEPA

Curriculum Development

Poster	Project Name/ Poster Title	Institution	PI(s)/Poster Authors	Funder
17	Science and Health Teaching Resources	Baylor College of Medicine	Nancy P. Moreno	SEPA, NIAID, Blueprint for Neuroscience
18	Being Me	Children's National Medical Center	Naomi L. C. Luban	SEPA
19	City of Hope and the San Gabriel Valley SEPA Collaborative	City of Hope	Marisa Bowers, Alexandra Race, Susan Kane	SEPA
20	SYNAPSE	Cogent Education [IS3D LLC]	Jared Jackson	SEPA
21	Sharing ASSETs: Expanding Science Opportunities in K-12 Classrooms	Cornell University	Ted Clark	SEPA
22	Bringing Real Experiments (REX) About Substance Abuse to High School Students	Duke University Medical Center	Rochelle Schwartz-Bloom	SEDAPA
23	Touching Triton	HudsonAlpha Institute for Biotechnology	Neil Lamb	SEPA
24	Engaging Families to Enhance Science Learning and Interest in STEM Careers	Seattle Children's Research Institute	William H. Roden, John Daniel, Julie Ho, Rebecca Howsmon, Amanda L. Jones	SEPA
25	Neuroscience in Your World	The Franklin Institute and University of Pennsylvania	Jayatri Das, Martha Farah	Blueprint for Neuroscience
26	The Great Diseases: A Collaborative Approach to Real World Science in the Classroom	Tufts University School of Medicine	Karina Meiri	SEPA
27	Project NEURON	University of Illinois	Barbara Hug, Donna Korol, George Reese	SEPA

28	Neuroscience Activities for Hands-on Learning	University of Rochester	Dina Markowitz	Blueprint for Neuroscience
29 A	Inside Your Body: Web-Based Curricula for Secondary Science	University of Utah	Louisa A. Stark, Kevin Pompei	SEPA
29 B	The Neuroscience of Our Senses	University of Utah	Louisa A. Stark, Kevin Pompei	Blueprint for Neuroscience
29 C	Your Body's Microbial Ecosystem: Web-Based Curricula for Secondary Science	University of Utah	Louisa A. Stark, Kevin Pompei	NIAID
30	Sowing the Seeds of Neuroscience	University of Washington	Eric H. Chudler	Blueprint for Neuroscience
31	Genes, the Environment, and Me	University of Washington	Maureen Munn	SEPA
32	Transforming STEM Learning in Urban Schools Using the SSMV Model	Vanderbilt University	Virginia Shepherd, Tiffany Farmer	SEPA
33	Pandem-Sim: Fighting Infectious Diseases Everywhere	Wheeling Jesuit University	Charles A. Wood	SEPA

Early STEM

Poster	Project Name/ Poster Title	Institution	PI(s)/Poster Authors	Funder
34	Partnerships to Promote Healthy Lifestyles for Children and Communities	Mississippi State University	Ginger W. Cross	SEPA
35	Fat Dogs and Coughing Horses	Purdue University College of Veterinary Medicine	Sandra San Miguel, Timothy Ratliff	SEPA, Blueprint for Neuroscience
36	SYSTEMS: Stimulating Young Scientists to Engage, Motivate & Synthesize	University of Georgia	Georgia W. Hodges	SEPA

Informal Science Education

Poster	Project Name/ Poster Title	Institution	PI(s)/Poster Authors	Funder
37	Human Health, Biodiversity, and Microbial Ecology: Strategies to Educate	American Museum of Natural History	Monique Scott	SEPA
38	Nurbits	Cogent Education [IS3D LLC]	Stephen Borden	Blueprint for Neuroscience
39	Partnership in Neuroscience Education	Duquesne University	John A. Pollock	SEPA
40	FoodMASTER: Impacting Middle Grade Learning Environments	East Carolina University	Melani Duffrin, Virginia Carraway-Stage, Allender Lynch	SEPA

41	DNA: All in the Family	Georgia State University	Barbara Baumstark	SEPA
42	BioMedTech: Students Translating and Exploring Medicine	Great Lakes Science Center, Cleveland Clinical and Translational Science Collaborative	Valence Davillier, Sarah MacLeish	SEPA
43	A New Genomic Framework for Schools and Communities	Michigan State University, University of Michigan	Joseph Krajcik, Toby Citrin, Laura Rozek	SEPA
44	Teachers FIRST: From Interesting Research to Scientific Teaching	Milwaukee School of Engineering	Tim Herman	SEPA, SEDAPA
45	SimLab: Using Patient Simulation for Student Exploration of Community Health Issues	Museum of Science and Industry, Chicago	Rabiah Mayas, Patricia Ward	SEPA
46	Role Models in Health Care Careers	National Association of Hispanic Nurses	Angie Millan	SEPA
47	Science Club: Building a Science Community Partnership with the Boys & Girls Club	Northwestern University	Michael Kennedy	SEPA
48	Zoo in You: Exploring the Human Microbiome	Oregon Museum of Science and Industry (OMSI)	Victoria Coats	SEPA
49	Classroom, Home and Community Connections: Developing a Research Institute that Complements Informal Educational Programming	Phipps Conservatory and Botanical Gardens	Emily Kalnicky	UPMC, Grable Foundation, Pennsylvania's Education Improvement Tax Credit Program
50	Discover Health/Descubre la Salud: A Bilingual Healthy Living Program for Colorado Libraries and Their Communities	Space Science Institute	Paul Dusenbery	SEPA, Blueprint for Neuroscience
51	Western New York Genetics in Research and Health Care Partnership	University at Buffalo	Stephen T. Koury, Shannon Carlin-Menter	SEPA
52	PlayPads: Mobile Educational Health Science Activities for Children in Hospitals	University of California Berkeley, Lawrence Hall of Science	Darrell Porcello, Sherry Hsi	SEPA
53	Get in the GROOVE	University of Miami, Frost Science Museum	Patrice Saab, Judy Brown	SEPA

54	Grossology and You: Addressing the Science of Really Gross Things	University of North Carolina Morehead Planetarium and Science Center	Denise Young	SEPA
55	Biology of Human	University of Nebraska	Judy Diamond, Julia McQuillan, Charles Wood	SEPA
56	Resources for Education and Action for Community Health in Ambler	University of Pennsylvania, Chemical Heritage Foundation	Fran Barg, Edward Emmett, Jody Roberts	SEPA

Rural STEM

Poster	Project Name/ Poster Title	Institution	PI(s)/Poster Authors	Funder
57	BioScience Montana	Montana State University	Kim Obbink, John Miller, Jill Martz	SEPA
58	Training Rural/Underserved Youth to Understand and Pursue Scientific Careers	University of Montana	Andrij Holian, Tony Ward	SEPA
59	Building Bridges: Health Science Education in Native American Communities	University of Nebraska Medical Center	Maurice Godfrey	SEPA
60	SEPA in New Mexico –The Science Around Us	University of New Mexico	Sally M. Davis, Shiraz Mishra	SEPA
61	PIPES: Possibilities in Postsecondary Education and Science Among Rural Appalachian Youth	University of Tennessee	Melinda M. Gibbons, Erin Hardin	SEPA

Student Science Enrichment

Poster	Project Name/ Poster Title	Institution	PI(s)/Poster Authors	Funder
62	Duke Med Activated, also known as BOOST (Building Opportunities and Overtures in Science and Technology	Duke School of Medicine	Brenda E. Armstrong	SEPA
63	Virtual Clinical Trials: Advances in Neuroscience	Rice University	Leslie Miller, Kristi Bowling	Blueprint for Neuroscience
64	In-Classroom Biology Internships for Students and Teachers in Underserved Schools	Walter Reed Army Institute of Research	Debra Yourick	SEPA
65	Middle School Students: Effects of Caffeine and Sucrose on Planarian Motility	Temple University	Scott Rawls	SEPA, SEDAPA

Teacher Professional Development

Poster	Project Name/ Poster Title	Institution	PI(s)/Poster Authors	Funder
66	Frontiers in Physiology: Integrating Programs to Build Communities of Practice	American Physiological Society	Marsha Lakes Matyas	SEPA
67	Digital Teaching Boxes	Exploratorium	Kristina Yu	SEPA
68	Fighting With Food: Battling Chemical Toxicity With Good Nutrition	Miami University, University of Cincinnati, University of Kentucky	Susan Hershberger	SEPA
69	STC: Science Tools in the Classroom	New Mexico State University	Michele Shuster	SEPA
70	BEST Science!	Clinic Foundation, Louisiana State University Health Sciences Center	Jawed Alam, Paula Gregory	SEPA
71	Modeling for Fidelity: Mentored Dissemination of a Novel Curriculum About Infectious Disease	Tufts University School of Medicine	Karina Meiri, Berri Jacque	NIAID
72	Bench to Bedside, Phase II	University of Florida	Mary Jo Koroly, Kent Crippen, Wayne McCormack, Richard Snyder	SEPA
73	Micro- and Nano-Space Explorations of Health and Disease	University of Southern Maine	S. Monroe Duboise	SEPA
74	Positively Aging: Maximizing the Healthspan	University of Texas Health Science Center at San Antonio	Michael Lichtenstein	SEPA
75	How Do I Learn: Neuroscience Advances Inform Learning (HDIL)	University of Washington, Puget Sound Educational Service District	Susanna L Cunningham, Kieran O'Mahony, Conn McQuin	Blueprint for Neuroscience
76	Climate Change and Patterns of Vector-Borne Disease: Development of Translational Science Curricula	Yale University School of Public Health	Leonard Munstermann	SEPA
77	CRESST: Clinical Research Education for Secondary Students and Teachers	Virginia Commonwealth University	Lisa M. Abrams	SEPA

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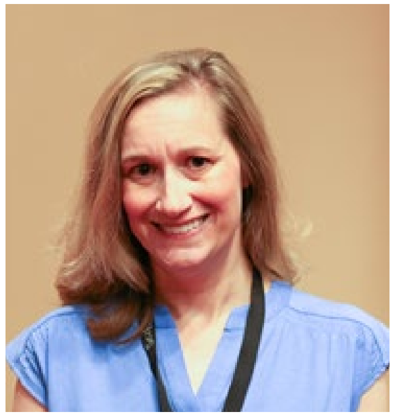

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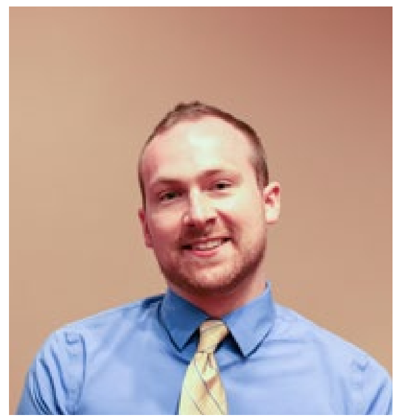

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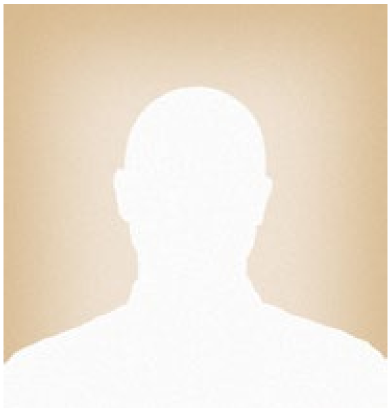

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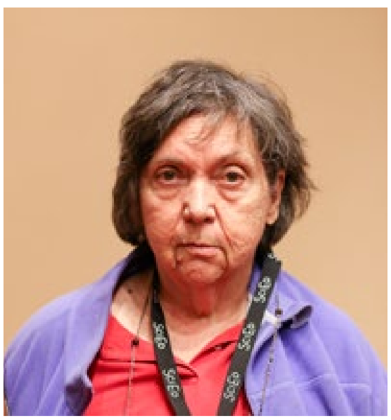

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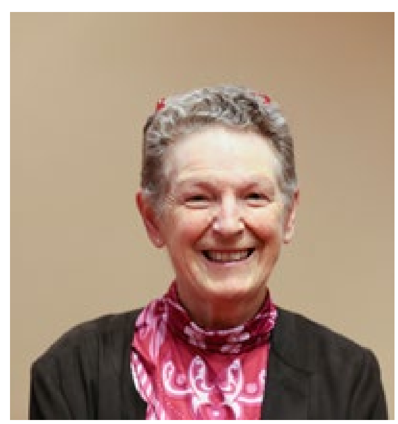

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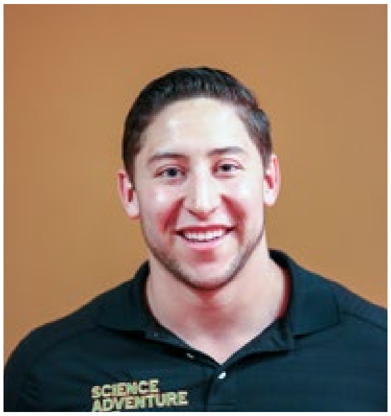

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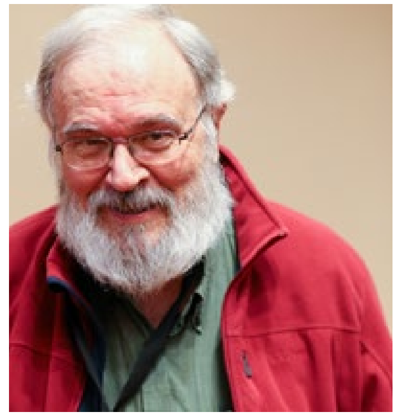

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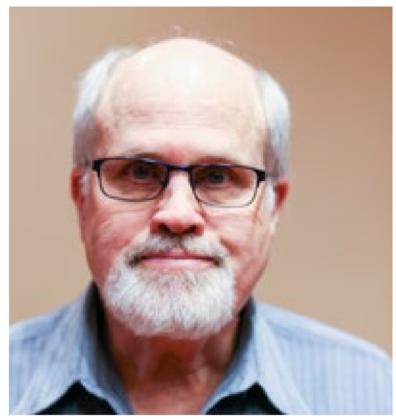

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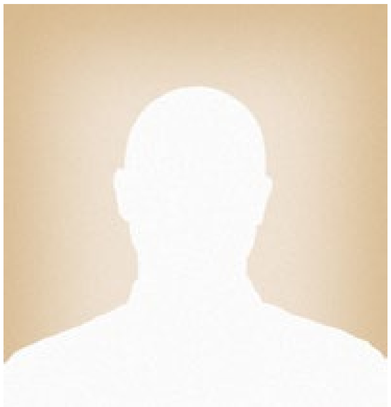

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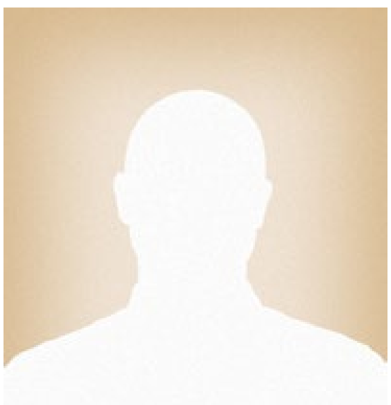

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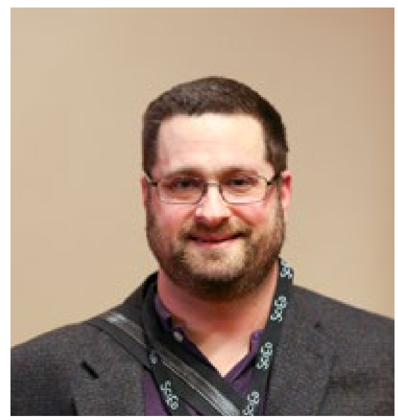

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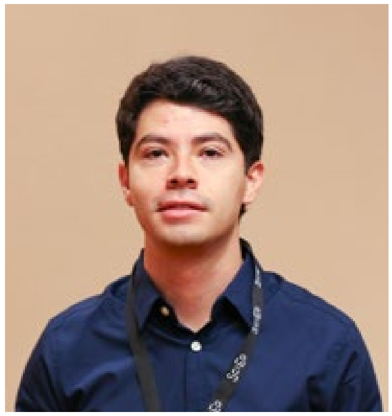

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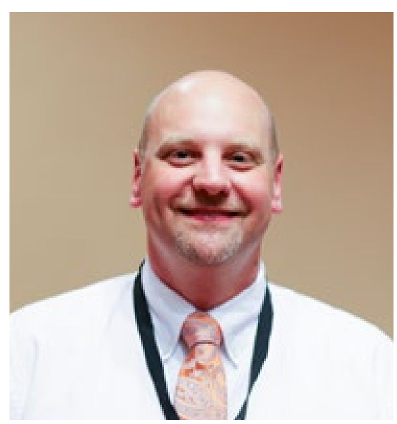

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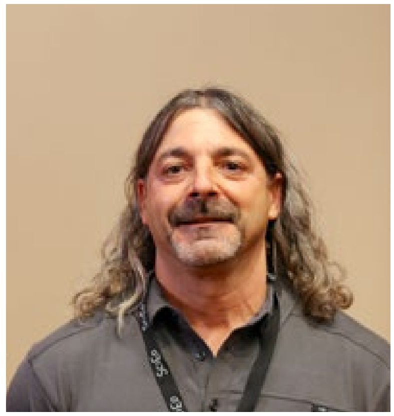

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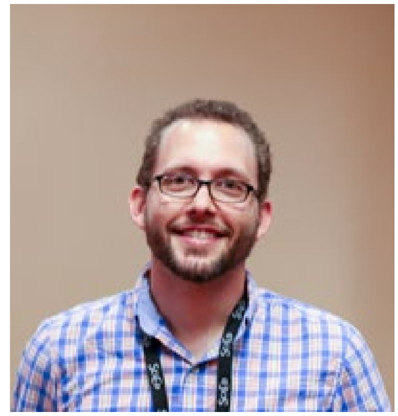

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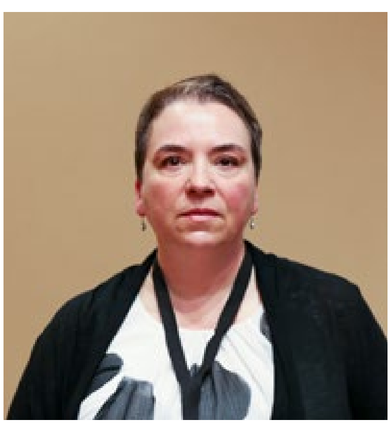

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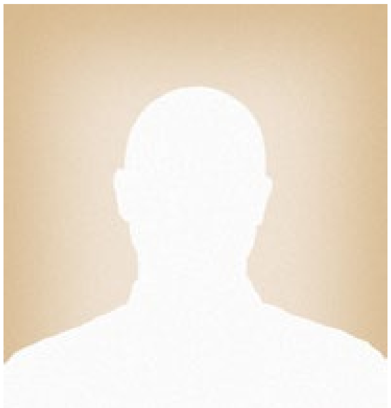

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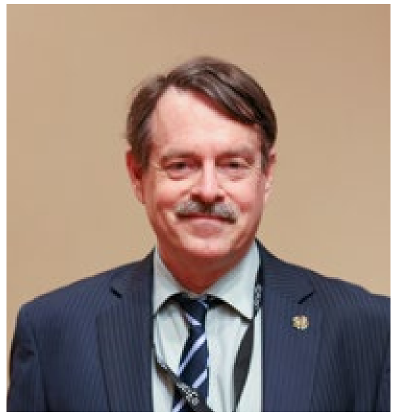

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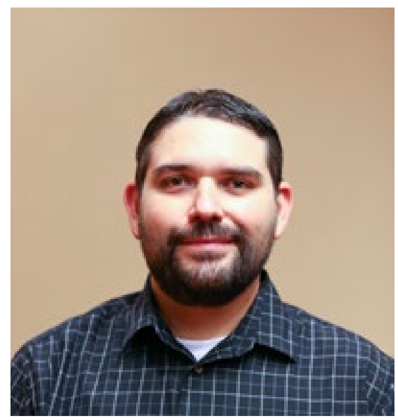

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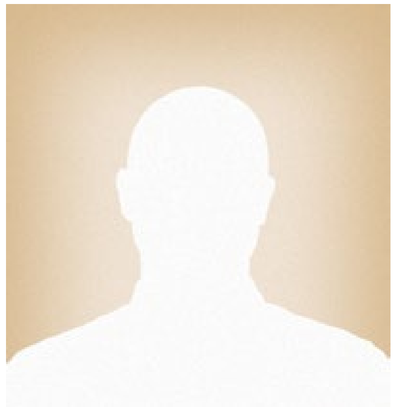

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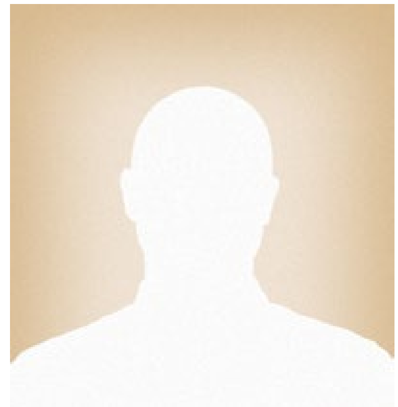

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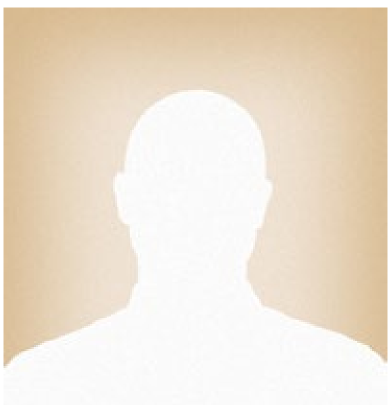

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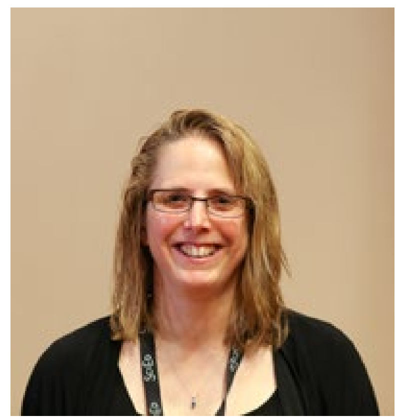

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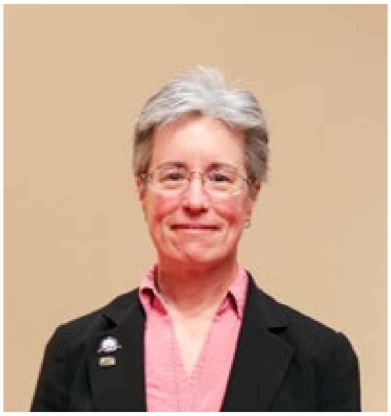

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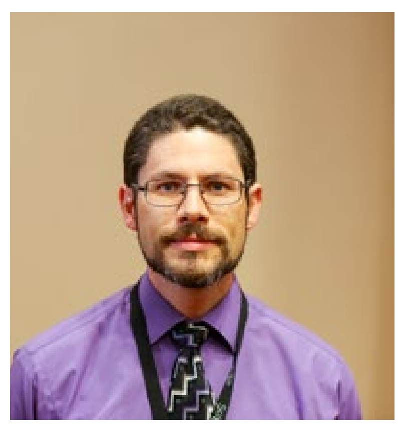

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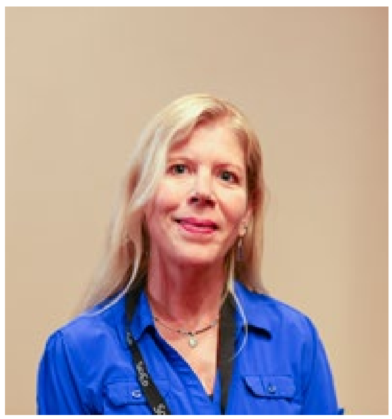

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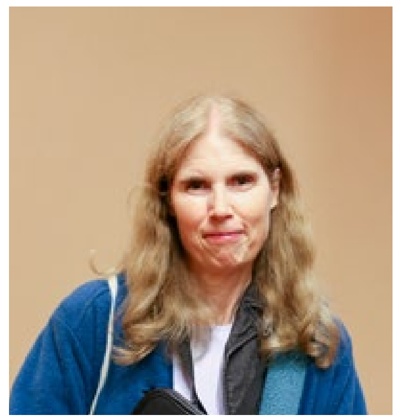

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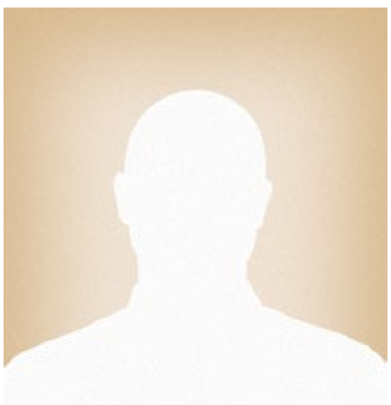

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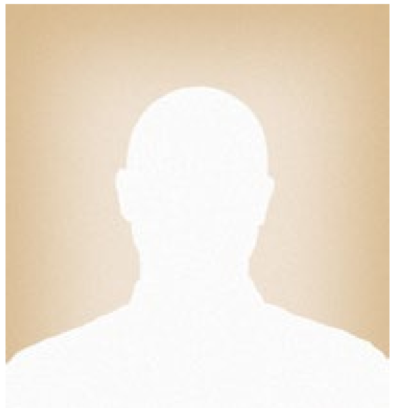

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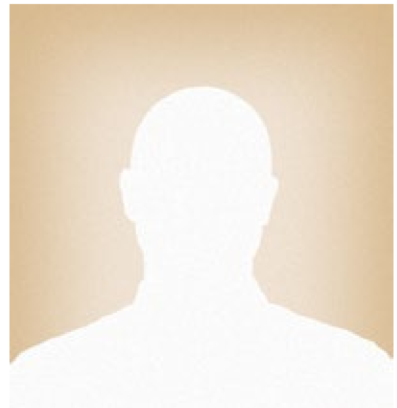

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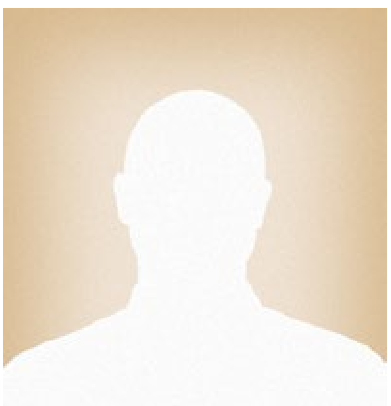

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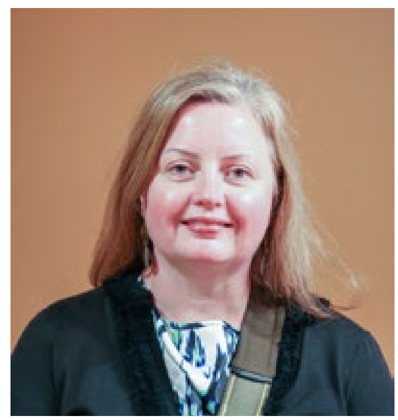

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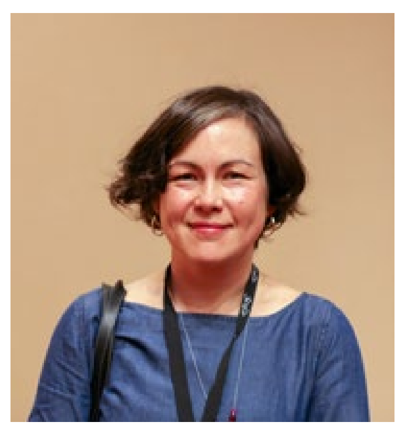

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