



# STEM Smart: Lessons Learned From Successful Schools

March 22, 2013 | University of Maryland, Baltimore



## PRESENTER BIOGRAPHICAL INFORMATION

### PLENARY SPEAKERS

#### **Joan Ferrini-Mundy**

*Assistant Director, National Science Foundation*

Joan Ferrini-Mundy is the National Science Foundation's assistant director who leads NSF's Directorate for Education and Human Resources (EHR), a position she has held since February 2011. Ferrini-Mundy is responsible for setting the vision and establishing the mission of EHR, whose budget in FY2012 was more than \$800 million, with a staff of more than 150 people. She serves as a member of the NSF senior management team and is involved in strategic planning and direction for the scientific and education mission of the NSF. Ferrini-Mundy's current activities include a government-wide performance management effort; a leadership role in defining the NSF's budget priorities for FY 2013 and 2014; and an ongoing collaboration with the White House Office of Science and Technology Policy in developing a government-wide strategic plan for science, technology, engineering, and mathematics (STEM) education and workforce development. From 2007 through January 2011, she was an NSF member of the National Science and Technology Council's (NSTC) Subcommittee on Education of the Committee on Science, and currently serves on two task forces of the new NSTC Committee on STEM Education. Ferrini-Mundy is currently a member of the Mathematics Expert Group of the Programme for International Student Assessment (PISA). In 2007–2008, representing the NSF, she served as an ex-officio member of the President's National Mathematics Advisory Panel. She has served on the Board of Directors of the National Council of Teachers of Mathematics (NCTM) and on the Board of Governors of the Mathematical Association of America. Ferrini-Mundy holds a PhD in Mathematics Education from the University of New Hampshire. Ferrini-Mundy holds an appointment at Michigan State University (MSU) as a University Distinguished Professor of Mathematics Education in the Departments of Mathematics and Teacher Education.

#### **Heather Gonzalez**

*Specialist in Science and Technology Policy, Congressional Research Service, Library of Congress*

Heather Gonzalez's work at the Congressional Research Service (CRS) focuses on the National Science Foundation; Science, Technology, Engineering, and Mathematics (STEM) education; and the America COMPETES Act. Her current research interests also include innovation in educational technologies. Before joining CRS, Gonzalez spent over a decade serving the U.S. Congress and California State Legislature in legislative staff positions. While with the California State Legislature, Gonzalez was principal consultant to three select committees. She focused on various education, budget, and science and technology policy issues while serving those committees. She also served as assistant secretary of the Division of Science, Technology, and Innovation at the California Technology, Trade, and Commerce Agency, and as a California fellow with the New America Foundation. She taught courses on U.S. government and women in politics at Sacramento City College. Gonzalez graduated Phi Beta Kappa from

the University of California, Santa Cruz, with a bachelor's degree in Anthropology, and holds a master's degree in Public Policy from the School of Public Policy at Pepperdine University.

### **Bruce Jarrell**

*Chief Academic and Research Officer, and Senior Vice President, University of Maryland, Baltimore;  
Dean, University of Maryland Graduate School*

As the chief academic and research officer (CARO) since April 2012, Bruce Jarrell is the focal point for all academic matters at the University of Maryland, Baltimore (UMB). In his CARO role, Jarrell is responsible for facilitating the research mission of the university by working closely with UMB administrators, the deans, the research leadership of the schools, and other individuals. Jarrell is dean of the Graduate School and also provides leadership for and direction to the Health Sciences and Human Services Library, Campus Life Services, and Academic Services. Jarrell also functions as the university's provost in matters related to University of Maryland: MPowering the State, UMB's innovative and structured collaboration with the University of Maryland, College Park, and in building and maintaining academic interactions with all University System of Maryland institutions. Recruited by the University of Maryland School of Medicine to chair the Department of Surgery, Jarrell came to UMB in 1997. Under Jarrell's leadership, the Department of Surgery expanded its surgical programs and developed innovative research studies and clinical trials, and was ranked 11th nationally in total research funding from the National Institutes of Health. In 2003, Jarrell moved to the Dean's Office of the School of Medicine, where he served as the executive vice dean, directing the school's education and research enterprises. Jarrell also served as the institutional official for human research protection and animal research protection. He has remained actively involved in research and medical student education throughout his career. Jarrell received his undergraduate degree in Chemical Engineering from the University of Delaware in 1969 and his medical degree from Jefferson Medical College in 1973. He completed a surgical residency and transplantation fellowship at the Medical College of Virginia and practiced general and vascular surgery in Dover, Del., for two years. In 1980, he joined the faculty at Thomas Jefferson University in Philadelphia, where he performed kidney and liver transplantation and hepatobiliary surgery for 10 years. Jarrell was recruited to the University of Arizona in 1990 to chair its Department of Surgery, before coming to UMB in 1997. In 1999, 2000, 2001, and 2003, he received the student council faculty teaching award from students at the University of Maryland School of Medicine. In 2002, Jarrell received the "Golden Apple" award for best clinical faculty member.

### **William Kirwan**

*Chancellor, University System of Maryland*

William E. "Brit" Kirwan has served as chancellor of the 12-institution University System of Maryland since 2002. He is a former president of Ohio State University (1998–2002) and of the University of Maryland, College Park (1988–1998). Kirwan is a sought-after speaker and consultant on a wide range of topics, including access, affordability, and completion; academic transformation; economic competitiveness and innovation; and increasing the number of students majoring in STEM fields. On the national level, Kirwan chairs the National Research Council Board on Higher Education and Workforce, chairs The College Board Advocacy and Policy Center Advisory Committee, and co-chairs the Knight Commission on Intercollegiate Athletics. He also serves on the Business-Higher Education Forum and the National Advisory Committee on Institutional Quality and Integrity. Regionally, Kirwan is a member of the Governor's P-20 Leadership Council of Maryland, the Governor's International Advisory Board, and the Maryland Economic Development Commission. He co-chaired the Governor's P-20 STEM Task Force, and also serves on the board of several organizations, including the Greater Baltimore Committee and the Maryland Chamber of Commerce. A fellow of the American Academy of Arts and Sciences, Kirwan has received many awards, including the 2010 TIAA-CREF Theodore M. Hesburgh Award for Leadership

Excellence and the 2009 Carnegie Corporation Leadership Award. Kirwan holds a bachelor's degree from the University of Kentucky and master's and doctoral degrees from Rutgers, The State University of New Jersey, all in Mathematics.

### **Alan Leshner**

*Chief Executive Officer, American Association for the Advancement of Science; Executive Publisher, Science*

Alan Leshner is the chief executive officer of the American Association for the Advancement of Science (AAAS) and executive publisher of the journal *Science*. Before this position, Leshner was director of the National Institute on Drug Abuse at the National Institutes of Health. He also served as deputy director and acting director of the National Institute of Mental Health, and in several roles at the National Science Foundation. Before joining the government, Leshner was professor of psychology at Bucknell University. He also has held visiting appointments at the Wisconsin Regional Primate Research Center; and as a Fulbright Scholar at the Weizmann Institute of Science. Leshner is an elected fellow of AAAS, the American Academy of Arts and Sciences, the National Academy of Public Administration, and many other professional societies. He is a member and served on the governing council of the Institute of Medicine of the National Academies of Science. He was appointed by President Bush to the National Science Board in 2004, and then reappointed by President Obama in 2011. Leshner received PhD and MS degrees in Physiological Psychology from Rutgers University and an AB in Psychology from Franklin and Marshall College. He has been awarded six honorary Doctor of Science degrees.

### **Lillian Lowery**

*State Superintendent of Schools, Maryland Department of Education*

In 2012, the Maryland State Board of Education appointed Lillian Lowery to take the helm of the nation's number-one ranked state school system. As Maryland state superintendent of schools, Lowery is working to take Maryland's education system to the next level—implementing the initiatives of the state's third wave of education reform, supported by the federal Race to the Top (RTTT) grant. Prior to coming to Maryland, Lowery was appointed secretary of education for the State of Delaware, where she facilitated a statewide strategic planning and grant application process, which resulted in Delaware being selected as the "First State" awarded the RTTT grant to put aggressive systemic education reform in practice. Lowery's career in education began in middle school as an English teacher in North Carolina and Virginia, moving into high school and subsequently serving as a high school assistant principal, a minority student achievement monitor, a high school principal, an assistant superintendent in Fairfax County Public Schools, and a superintendent of Christina School District in Delaware. As superintendent of the Christina School District, she enhanced the educational programs of students, improving student achievement, and administering district policies for a K–12 district, where approximately 15 percent of students spoke a language other than English at home. Lowery identified and closed a \$17.5 million year-over-year fiscal deficit and led the district back to solvency. She was a fellow in the Broad Foundation's Urban Superintendents Academy in 2004. Her awards include Second Mile Award, 2008, University of Delaware; Junior Achievement Award, 2007, Wilmington, Del.; Outstanding Service Award, 2006, Fairfax County Public Schools Board of Education; Mayor's Service Award, 2002, City of Fairfax, Va.; Outstanding Service Award and Proclamation, 2002, City of Fairfax School Board; Outstanding School Representative, 2002, Fairfax Youth Community Alliance; and Citizenship Award, 2001, City of Fairfax Police Department. Lowery received her DEd in Education and Policy Studies from Virginia Polytechnic Institute and State University, an MEd in Curriculum and Instruction from the University of North Carolina at Charlotte, and a BA in English Education from North Carolina Central University.

**Cora Marrett**

*Deputy Director, National Science Foundation*

Cora Marrett is deputy director of the National Science Foundation. Since January 2009, she has served as NSF's acting director, acting deputy director, and senior advisor, until her confirmation as deputy director in May 2011. Before her appointment as acting director, Marrett was the assistant director for Education and Human Resources (EHR). In EHR, she led the NSF's mission to achieve excellence in U.S. science, technology, engineering, and mathematics (STEM) education at all levels, in both formal and informal settings. From 1992 to 1996, she served as the first assistant director for the Social, Behavioral, and Economic Sciences (SBE) directorate. Marrett earned NSF's Distinguished Service Award for her groundbreaking leadership of the new directorate. From 2001 to 2007, Marrett was the University of Wisconsin System's senior vice president for academic affairs. She also served concurrently as professor of sociology at the University of Wisconsin, Madison. Before joining the University of Wisconsin, she was the senior vice chancellor for academic affairs and provost at the University of Massachusetts, Amherst. Marrett holds a BA from Virginia Union University, an MA and a doctorate from the University of Wisconsin, Madison, all in Sociology. She received an honorary doctorate from Wake Forest University in 1996 and was elected a fellow of the American Academy of Arts and Sciences in 1998 and the American Association for the Advancement of Science in 1996. In May 2011, Virginia Union University awarded Marrett an honorary degree as a distinguished alumna.

**Martin Storksdieck**

*Director, Board on Science Education, National Research Council, National Academy of Sciences*

Martin Storksdieck is the director of the Board on Science Education at the National Research Council of the National Academy of Sciences, where he oversees studies that address a wide range of issues related to science education and science learning across the lifespan. These include the recent *Framework for K–12 Science Education* that forms the blueprint for the development of the *Next Generation Science Standards*, and the *Successful K–12 STEM Schools* and subsequent *Monitoring Progress Towards Successful K–12 Education* reports. Storksdieck previously served as director of project development and senior researcher at the not-for-profit Institute for Learning Innovation (ILI), where he studied science learning in immersive environments; models of involving researchers and scientists in science museums and science centers; understanding the impact of science hobbyists, such as amateur astronomers, on the public understanding of science; or ways to better connect science learning in and out of schools. At ILI, Storksdieck also conducted front-end formative and summative project evaluations in the area of informal and environmental science education. Before his involvement in science education and learning research, Storksdieck developed shows and programs on global environmental change for a planetarium in Germany; served as editor, host, and producer for a weekly environmental news broadcast; and worked on local environmental management systems and sustainability for the International Council for Local Environmental Initiatives' European office. Storksdieck holds a master's in Biology from the Albert-Ludwigs University (Freiburg, Germany), a master's in Public Administration from Harvard University, and a Ph.D. in Education from Leuphana University (Lüneburg, Germany).

## **BREAKOUT SESSION PRESENTERS**

### **Eric Banilower**

*Senior Researcher, Horizon Research, Inc.*

Eric Banilower is the PI of the 2012 National Survey of Science and Mathematics Education (NSSME), the fifth in a series of surveys dating back to 1977. The 2012 NSSME provides data on the current status, as well as changes over time, of the K–12 science and mathematics education system in the United States. He is also the PI of Assessing the Impact of the MSPs: K–8 Science, which has developed instruments and is conducting research to better understand how different approaches to professional development affect teacher content knowledge, classroom practice, and student learning. Banilower worked with the California Scope, Sequence, and Coordination project developing curriculum and assessment materials for the California science reform project, in addition to teaching high school science. He has worked on a number of research and evaluation projects, including the 2000 NSSME and the Inside the Classroom study. He also supervised a study of the impact of the National Science Foundation's Local Systemic Change Through Teacher Enhancement (LSC) program on student achievement and directed a longitudinal study of the impact of the Connected Mathematics Program, 2nd edition, on student achievement. Banilower received a BS in Physics from Haverford College and has completed his doctoral coursework in Curriculum and Instruction at the University of North Carolina at Chapel Hill.

### **Deborah Boisvert**

*Executive Director, BATEC, University of Massachusetts, Boston*

Deborah Boisvert is the PI and executive director of the Broadening Advanced Technological Education Connections (BATEC). She also leads the Synergy Collaboratory for Research, Practice, and Transformation project. Both are NSF-funded and headquartered at the University of Massachusetts, Boston. With experience in both the corporate and educational arenas, she has focused her efforts in the development and implementation of initiatives to advance the educational and professional objectives of area high school, community college, and university students and faculty. Boisvert is also a PI for an NSF CPATH grant on computational thinking and co-PI for a Broadening Participation in Computing Initiative based at the University of Massachusetts, Amherst. She was a founding partner in Camp Telecom, a summer camp for high school students and teachers sponsored by Massachusetts Network Communications Council. In 2006, she was honored as their Workforce Development Leader of the Year. Boisvert wrote the curriculum for the Technology Goes Home@School initiative, which bridges the digital divide by equipping fourth graders' families in the Boston Public Schools with beginning technology skills and a new computer for their homes. She founded the Bridge to Community College Program, a partnership with local community-based organizations, which provides adult learners with credit-bearing technology courses combined with English and mathematics tutoring to prepare them for matriculation into a technology degree program. Boisvert serves on the Mass. K–12 Technology Standards Revision Team, the Mass. Board of Higher Education's Transfer Task Force, Mass. TechHub, National Advisory Board of IWITTS, and the ACM SIGITE Education Board.

### **Carol Brandt**

*Assistant Professor, Temple University*

Carol Brandt's research explores the sociocultural dimensions of learning math and science beyond the classroom and the ways that language structures participation, as youth and adults move between home, community, and school. Brandt's expertise focuses on problem-based learning, the design studio as a learning environment, and scaffolding discussion and inquiry through questioning. She is especially interested in innovative learning environments that foster engagement in STEM for students from underserved communities. She has published her research in the journals *Science Education*,

*Interdisciplinary Journal of Problem-based Learning, Education Technology Research & Development, and Cultural Studies in Science Education.* This last year she was editor of a special issue in the journal *Ethnography & Education* focused on science education. Brandt completed her PhD in Educational Thought & Sociocultural Studies at the University of New Mexico and conducted her postdoctoral research with the Center for Informal Learning and Schools at the University of California, Santa Cruz.

### **Eric Bredder**

*Graduate Fellow, University of Virginia*

Eric Bredder is a graduate fellow in the Commonwealth Engineering Design (CED) Academy for Advanced Manufacturing in K–12 education. The CED academy is a collaboration among the University of Virginia and the Charlottesville and Albemarle Schools. Eric serves as co-director and engineering education advisor for the CED K–12 Fabrication Laboratory. He is developer of a mixed-reality science simulation for the FabLab Classroom initiative.

### **Glen Bull**

*Professor and co-Director for the Center for Technology & Teacher Education, University of Virginia*

Glen Bull is coordinator of STEM education at the Curry School of Education, where Bull is the current recipient of the Samuel Braley Gray Professorship in Mathematics Education. Bull is PI of The FabLab Classroom, which is exploring the use of digital fabrication to allow middle school students to create digital designs that are realized as physical objects such as model satellites (in collaboration with NASA), working wind turbines, and speaker systems. This serves as a springboard for teaching middle school science through engineering design in the context of advanced manufacturing technologies. Bull developed, with Tim Sigmon, one of the nation's first statewide K–12 Internet systems, Virginia's Public Education Network, which linked all 2,000 schools in Virginia. He established the K–12 Advanced Manufacturing Lab in the School of Engineering and Applied Sciences at the University of Virginia, and developed, with Hod Lipson, the Fab@School Fabricator, the first 3D printer designed specifically for K–12 schools. Bull is a founding member and past president of the Society for Information Technology and Teacher Education (SITE), and a recipient of the Willis Award for Outstanding Lifetime Achievement in Technology and Teacher Education. He currently provides leadership for the National Technology Leadership Coalition, a consortium of national teacher educator associations and national educational technology associations. He serves as editor of *Contemporary Issues in Technology and Teacher Education*, a peer-reviewed journal jointly sponsored by five professional associations representing science education (ASTE), mathematics education (AMTE), English education (CEE), social studies (CUFA), and educational technology (SITE). Bull earned his MA and PhD from the Ohio State University.

### **Marilyn Carlson**

*Professor, Arizona State University*

Marilyn Carlson is currently a professor in the School of Mathematical and Statistical Sciences at Arizona State University. She has published over 40 research articles about student learning of key ideas of precalculus and beginning calculus. Recently, she created professional development materials to leverage this knowledge in order to write student curriculum and teacher support tools for teaching precalculus and calculus. Carlson has received funding from the National Science Foundation for her research and outreach work with teachers. Her current NSF grant, Project Pathways, is working in over 20 secondary schools, community colleges, and universities to support improvements in curriculum and student learning in precalculus and calculus. Carlson was the coordinator of the Mathematical Association of America (MAA) Special Interest Group for Research in Mathematics Education, and edited the MAA Volume, *Making the Connection: Research to Practice in Mathematics Education*. She received an NSF CAREER award to study student learning in calculus. In 2007, she received the MAA Selden

Award for Research in Undergraduate Mathematics Education. Carlson holds a BS in Mathematics Education from Central Missouri State University, an MS in Computer Science from the University of Kansas, and a PhD in Mathematics Education from the University of Kansas.

### **Svetlana Darche**

*Senior Research Associate and Director of Career Education, WestEd*

Svetlana Darche is partnering with WestEd STEM staff and the Career Academy Support Network at the University of California, Berkeley, to implement an NSF ITEST-funded STEM program, embedding GLOBE into “green academies” in California. She also focuses on college and career readiness through policy work, assessment projects, and direct support to schools. Her primary research interest is in work-based learning—hands-on learning that has purpose beyond the classroom. Darche began her career at the U.S. General Accounting Office. She has extensive experience in evaluation, strategic planning, program design, and the building of cross-sectoral collaborations for system change and program improvement. She worked closely with the California Department of Education and the California Community Colleges Chancellor’s Office in developing California’s State Plan for Career Technical Education and co-directed a state feasibility study on expanding “Linked Learning.” Darche completed a statewide study on opportunities and models for expanding work-based learning in California. She also collaborates with the Career Academy Support Network, the National Academy Foundation, and ConnectEd in defining and measuring college and career readiness, and shaping strategies to promote student engagement and success. Darche has provided career development services in private practice, and has worked extensively with immigrant populations. She currently serves on the California Community College Chancellor’s State Advisory Committee on Work-based Learning and Employment Services. Darche received a BA in Anthropology from the University of California, Los Angeles (UCLA), where she was awarded Phi Beta Kappa. She also holds an MBA from UCLA’s Anderson School of Management where she concentrated on the public/not-for-profit sector.

### **Andrew Elby**

*Associate Professor, University of Maryland at College Park*

Andrew Elby is an associate professor in the Department of Teaching, Learning, Policy & Leadership at the University of Maryland at College Park. Elby’s current research explores science students’ and teachers’ epistemologies—their views about what counts as knowledge and knowing in various contexts—and the effects of those epistemologies on their teaching and learning. Elby has a long record of teaching, teacher professional development, and education research. He taught high school physics for several years in California and Virginia. He is currently co-chair of the AP Physics Curriculum Development and Assessment Committee. Elby earned his MA in Education and his PhD in Physics from the University of California, Berkeley.

### **Michael Evans**

*Associate Professor, Virginia Polytechnic Institute and State University (Virginia Tech)*

Michael Evans is PI on two current NSF-sponsored projects. The GAMES project proposes to develop serious mathematical games for tablets and other mobile devices, focusing on pre-algebra readiness and states of engagement. Studio STEM proposes to engage middle school students in science and engineering in an after-school setting. His current research focuses on the design, development, and evaluation of instructional multimedia for interactive surfaces (personal media devices, smartphones, tablets, tables, and whiteboards) to support collaborative learning as well as the adoption of video game elements for instructional design, particularly for informal settings. Current research projects include (1) examining the effects of physical and virtual manipulatives on the mathematical reasoning of elementary students; (2) designing educational simulations and games for middle school students in

STEM areas; and (3) developing instructional multimedia for mobile and wireless devices. He has been published in journals including the *Journal of Computing for Higher Education*, *Innovate: Journal of Online Education*, and *Technology, Pedagogy, & Education*. Evans received his BA in Psychology and his MA in Cognitive Psychology from the University of West Florida, and earned his PhD in Instructional Systems Technology from Indiana University, Bloomington.

### **Mary Fries**

*Curriculum and Instructional Materials Design Associate, Education Development Center, Inc.*

Mary Fries designs student and teacher materials for the *Transition to Algebra* project, a full-year algebra intervention program designed to run concurrently with Algebra 1. She has conducted presentations and professional development trainings on the use of these materials and on cultivating mathematical habits of mind, selected overarching strategies for good mathematical thinking that are in alignment with the *Common Core* Standards for Mathematical Practice. Fries also writes for the *Implementing the Mathematical Practice Standards* project, which assists mathematics teachers in understanding and eliciting effective mathematical thinking. She is also helping to design an iPad app extending the mathematical puzzles from the *Transition to Algebra* curriculum to the digital environment for use in both formal and informal settings. In addition to her work on the above projects, Fries' interests include "Mathematics Trauma"; the work of Critical Mathematics Education, especially the normalization of mathematics as a "neutral" field; and the role of mathematics education in the perpetuation of racism. Fries is a former high school dean of mathematics, science, and technology and a former mathematics teacher. She has served on the School Board of the New Hampshire Academy for Science and Design, where she chaired the Curriculum Committee. She also served on the Windham Initiative for Renewable Energy, where she supported the installation of a wind turbine and photovoltaic panels at Windham High School, as well as the integration of renewable energy science and engineering into the curriculum. Fries received her BS in Mathematics at Mary Baldwin College, her MA in Philosophy and Religion at California Institute of Integral Studies, and her CAGS in Mathematics Education at Boston University. She is currently studying Mathematics at Harvard University.

### **E. Paul Goldenberg**

*Distinguished Scholar, Education Development Center, Inc.*

Paul Goldenberg has over 45 years of experience in elementary, secondary, and post-secondary teaching, teacher education, teacher enhancement, and education research. Throughout, he has focused on developing students' and teachers' mathematical habits of mind, and their curiosity, along with their ideas, skills, and understanding. He is widely published and has conducted workshops and seminars on K–12 mathematics and mathematics education, often emphasizing problem-posing as a route to problem solving and more in-depth understanding of the mathematics. He has been the PI of many NSF-funded materials development projects including *Transition to Algebra*, a habits of mind approach to algebra for at-risk high school students; *Think Math!*, a comprehensive K–5 mathematics program that supports teachers' learning as they teach by building their curiosity about math; materials for secondary teacher professional development; a Web-accessible, searchable resource of problem sets "with a point" for secondary-level mathematics; and an innovative high-school geometry curriculum. Goldenberg has spent nearly two decades in classroom teaching—from a second-grade classroom through high school and university. He has also directed research on learning with technologies, including geometry software, graphing software, and programming; research on college students' learning of linear algebra; and research on the principles for developing curriculum materials (for students) that promote the professional development of teachers. Goldenberg received his BA in Psychology at Brandeis University and his EdM in both Elementary Education and Curriculum and Supervision at Harvard University.

**Brett Jones**

*Associate Professor, Virginia Polytechnic Institute and State University (Virginia Tech)*

Brett Jones is currently investigating how students' beliefs impact their motivation and is examining methods instructors can use to design instructional environments that support students' motivation and learning. He is involved in three ongoing NSF-funded projects that focus on student motivation in the STEM fields, including a project intended to motivate middle school students to engage in STEM fields, a project investigating the impacts of instruction on undergraduate students' identification with engineering, and a project related to improving the structural engineering education of architecture students. Jones developed the MUSIC Model of Academic Motivation to help instructors in STEM and other fields to intentionally design instruction that can engage students and foster their identification with STEM fields by (1) eMpowering students, (2) demonstrating the Usefulness of the subject, (3) supporting students' Success, (4) triggering students' Interests, and (5) fostering a sense of Caring (MUSIC is an acronym for these five principles). Jones has published more than 50 refereed journal articles and presented at more than 80 regional, national, and international conferences. For his research, Jones received the North Carolina Association for Research in Education's Distinguished Paper Award in 2000 and the Best Paper Award from the American Society for Engineering Education, K–12 Engineering Division in 2010. He serves as a member of the Academic Advisory Board for Annual Editions: Educational Psychology. Jones received his BAE from The Pennsylvania State University and his MA and PhD in Educational Psychology from the University of North Carolina at Chapel Hill.

**Matt Krehbiel**

*Lead Science Education Program Consultant, Kansas State Department of Education*

Matt Krehbiel is overseeing Kansas' participation in writing the national *Next Generation Science Standards* (NGSS). Together with the other lead states, the Kansas team—including representation from K–12 and post-secondary educators and business and industry in Kansas—will be working toward developing standards-based on the National Research Council's report, *A Framework for K–12 Science Education*. The goal of the NGSS development process is to develop standards that will be rich in content and practice, and arranged in a coherent manner across disciplines and grades to provide all students with an internationally benchmarked science education. Krehbiel is also a member of the Kansas *Common Core State Standards* implementation team and the Career and Technical Education Agriculture and STEM pathway teams. Before taking the position at the Kansas State Department of Education, Krehbiel spent 10 years teaching high school science in Kansas. He has taught a wide variety of science courses and was the Science, Engineering, Technology Academy leader at Junction City High School. Krehbiel serves on the Board of Directors for the Council of State Science Supervisors and the Kansas State Science and Engineering Fair. He is also an ex-officio member of the Kansas Association for Conservation and Environmental Education and Kansas Association for Teachers of Science for the Kansas State Department of Education. In 2010, he received the Award for Excellence in Conservation and Environmental Education from the Kansas Association for Environmental Education. Krehbiel earned his BA in Biology and Natural Sciences and his secondary teacher certification in General Science, Biology, and Physics from Bethel College. He received his MS in Curriculum and Instruction from Kansas State University.

**Serena Magrogan**

*Director, AP Chemistry and AP Statistics Curriculum and Content Development, College Board*

At the College Board, Serena Magrogan has worked on preserving and improving the quality and validity of the AP Program's core deliverables, which are the course curriculum, the exam, and the professional development content. Magrogan has created these deliverables by leading committees of subject-matter experts (typically college professors and secondary school teachers), holding trainings on

curriculum and assessment development protocols, and serving as an intermediary between academics and technical experts. Previously, Magrogan held several roles within the Fort Bend Independent School District, including working as an AP Biology and AP Chemistry teacher, secondary science instructional specialist, science department head, and professional development facilitator. At Northside Urban Pathways Charter School, she developed a four-year science curriculum plan and associated documents, and led and implemented the textbook and curriculum document adoption cycle for the high school science program. She has also served as the head of the Science Department at the Montgomery School and Fondren Middle School. Magrogan was awarded the 2007–2008 Hightower High School Teacher of the Year (Missouri City, Texas) and the 2007 MIT Leadership in Education Award. Magrogan received her BS in Biology and Chemistry from Centenary College of Louisiana. She received her MEd in Science Education from the University of Phoenix. Magrogan is currently working on her EdD in Educational Leadership/Curriculum and Instruction from the University of Phoenix.

### **Peter Malcolm**

*Graduate Research Fellow, University of Virginia*

Peter Malcolm is a PhD candidate in the Instructional Technology Program at the Curry School of Education at the University of Virginia. He has developed and done research on software for STEM teaching on various platforms in K–12 classrooms. His projects have included a mathematical app for iOS (iEstimation) and mathematics and science virtual manipulatives designed for use on SMARTboards. Malcolm has collaborated on building an NSF-funded whole-classroom science simulation called WallCology, as part of the Embedded Phenomenon initiative, where simulated creatures "migrated" across multiple devices. He has helped develop and contributed research for WISEngineering.org, the first open-source engineering learning management system for K–12 schools. His doctoral research focuses on middle school geometry and rapid prototyping. This work centers on the way students learn to tackle new geometric concepts as they design products and then see them created on 3D printers. The broad theme of his research is in developing software to help elementary and middle school students visualize, understand, and interact with STEM concepts. Malcolm holds a master's degree in Computer Science from the University of Illinois at Chicago.

### **Adam Maltese**

*Assistant Professor, Indiana University*

Adam Maltese is currently working on research involving analysis of both quantitative and qualitative data regarding student experiences, performance, and engagement in science education from middle school through graduate school. One ongoing project in this area is measuring the evolution in student interests over grades 3–12, while another NSF-funded project is looking at the effect undergraduate research experiences have on plans to pursue degrees and careers in STEM. Recently, he has also been involved in work that uses eye tracking technologies to study the interpretation of data by students and scientists in classroom and field-based settings. Maltese also teaches courses in secondary science methods and doctoral seminars at the School of Education at Indiana University. In the past, Maltese taught middle school science in Connecticut. Maltese received his BA in Geology from Hamilton College, his MS in Geology from the University of Connecticut, and his PhD in Science Education from the University of Virginia.

### **David May**

*Project Director, P-20 Partnerships and STEM Initiatives, University System of Maryland*

As the director of the Minority Student Pipeline Math Science Partnership (MSP)<sup>2</sup>, David May works with K–12 schools, several institutions of the University System of Maryland, and a two-year college to strengthen the pipeline of underrepresented minorities into science fields. (MSP)<sup>2</sup> offers opportunities

and special programs for K–12 teachers, university faculty, and students across the educational spectrum. Over the past nine years, May has been a co-PI and project director for several NSF partnership projects that address improving science education in Maryland at the K–12 and higher education levels. Prior to his work at the University System, May was a science education researcher and instructor at the University of Maryland, College Park, and at The Ohio State University. May was on the Planning Committee for NSF’s Math Science Partnership Learning Network Conference in 2008. He also was a peer review panelist for *Science Education*, *Physical Review Special Topics—Physics Education Research*, and several professional conference proceedings. May graduated from Earlham College, earned an MA in Physics and Astronomy at the University of Rochester, and holds a PhD in Physics from The Ohio State University, where he specialized in physics education research.

### **James Pellegrino**

*Professor and co-Director of Learning Sciences Research Institute, University of Illinois at Chicago*

James Pellegrino’s work is focused on analyses of STEM learning and instructional environments with the goal of better understanding the nature of student learning and the conditions that enhance deep understanding. He also serves on technical advisory committees (TAC) overseeing state assessment programs, as well as the state consortia funded under the Race to the Top assessment initiative (SBAC, PARCC, DLM, and NCSC). Pellegrino has received multiple grants from the National Science Foundation and Institute of Education Sciences for projects focused on STEM education across K–16, including leadership of a major NSF-funded project to redesign Advanced Placement courses and exams in biology, chemistry, and physics. He has headed several National Academy of Science/National Research Council study committees focused on issues of teaching, learning, and assessment. Pellegrino chaired the Study Committee on the *Foundations of Assessment* and the Study Committee on *Deeper Learning and 21st Century Skills*. He currently co-chairs the Study Committee on *Developing Assessments of Science Proficiency in K–12*. He was a member of the Study Committee on *Test Design for K–12 Science Achievement*; the Study Committee on *Science Learning: Games, Simulations and Education*; and the Study Committee on *Conceptual Framework for New Science Education Standards*. He is a fellow of AERA, a past member of the NRC Board on Testing and Assessment, and an elected member of the National Academy of Education. Pellegrino received his BA from Colgate University and his PhD in Experimental and Quantitative Psychology from the University of Colorado.

### **Philip Sadler**

*Senior Lecturer and Director of the Science Education Department, Harvard Smithsonian Center for Astrophysics*

Philip Sadler’s varied background spans authoring mathematics and science textbooks; teaching middle school science, engineering, and mathematics; and offering science and education courses to Harvard’s undergraduate and graduate students. As director of the Harvard-Smithsonian Center for Astrophysics’ Science Education Department, his research program includes assessment of students’ scientific misconceptions and how they change with instruction, computer technologies that allow students to engage in research, curriculum development, the transition to college of students pursuing STEM careers, and enhancement of the skills of teachers. Sadler won the *Journal of Research in Science Teaching* Award for work on assessing student understanding in science, given yearly for “the most significant contribution to science education research.” He won the Astronomical Society of the Pacific’s Brennan Prize for contributions to astronomy teaching in 2002 and has been awarded the Computers in Physics Prize by the American Institute of Physics three times. Sadler was awarded the 2010 American Astronomical Society Education Prize. In 2012, he won the Millikan Medal of the American Association of Physics Teachers for his “notable and intellectually creative contributions to the teaching of physics.” He is the originator of the MicroObservatory network of robotic telescopes, with which nearly a million

pictures have been taken by pre-college students for their projects. He is the executive producer of A Private Universe. He is the inventor of the Starlab Portable Planetarium and many other devices used for the teaching of science worldwide. Materials and curricula developed by Sadler are used by an estimated 15 million students every year. Sadler received his BS in Physics from MIT and earned his EdD from Harvard University.

### **Christian Schunn**

*Professor, University of Pittsburgh*

Christian Schunn is a senior scientist at the Learning Research and Development Center and a professor of psychology, learning sciences and policy, and intelligent systems at the University of Pittsburgh. He directs a number of research projects in science, mathematics, and engineering education. One of his current NSF-funded grants, BLOOM (Biology Levers Out Of Mathematics), brings mathematics as a thinking and learning tool into high school biology instruction through the use of engineering-based modules focused on core biology topics. The modules, designed for large-scale urban settings, will be developed by a collaborative team that brings expertise in learning sciences, mathematics education, and biology. The project studies the ways in which teacher materials and various Web-based tools can support high-quality implementation at scale. In the past, Schunn has developed curriculum materials that used engineering design projects to teach core high school science concepts for use in urban middle schools and high schools, including biology, chemistry, and physics. He has also worked for many years with the Robotics Academy at Carnegie Mellon University on the design and evaluation of robotics curricula. Schunn was made a fellow of the American Association for the Advancement of Science in 2011, and served on the National Research Council/National Academy of Engineering committees for *K–12 Engineering Education* and *K–12 Engineering Education Standards*. He is also the current chair of the executive of the *International Society for Design and Development in Education*. Schunn received his BS in Psychology from McGill University and both his MS and PhD in Psychology from Carnegie Mellon University.

### **Odette Scovel**

*Science Supervisor, Loudoun County Public Schools*

Odette D. Scovel is the science instructional supervisor (K–12) for Loudoun County Public Schools (LCPS) in Virginia, one of the fastest growing jurisdictions in the nation, with over 70,000 students. The goal of STEM education at LCPS is to deepen students' knowledge, skills, and habits of mind that characterize science, technology, engineering, and mathematics. Loudoun County Public Schools has many exemplary programs designed to answer the call for STEM education. LCPS offers students a variety of STEM courses and opportunities that are rigorous, demanding, and help students develop skills required for the 21st century. Scovel began her teaching career in Norfolk City Public Schools and taught in the Department of Defense Dependent Schools (Italy) before coming to Loudoun as a classroom teacher. She has been supervisor of Loudoun's science programs since 2001. Scovel has a BS in Biology from Old Dominion University and an MEd from George Mason University.

### **Nancy Shapiro**

*Associate Vice Chancellor of Academic Affairs and Special Assistant to the Chancellor for P-20 Education, University System of Maryland*

As the University System of Maryland (USM) director of preK-16 partnerships, Nancy Shapiro works with K–12 schools, two-year colleges, and 11 degree-granting institutions of the University System of Maryland to foster critical partnerships and learning communities to improve the quality of teaching and learning in Maryland. Over the past five years, she has been the PI and project director for several federal projects funded by the U.S. Department of Education and the National Science Foundation that

address teacher quality issues. Prior to her work at the University System of Maryland, Shapiro directed the freshman writing program and served as the founding executive director of the College Park Scholars Program at the University of Maryland, a community of 12 special living-learning programs for academically talented first-year and second-year students. She has served on the NCATE Board of Examiners, the Fielding Graduate Institute Board, and the editorial board of both *Liberal Education* and *Communication Education*. She was also a fellow in the National Learning Communities Project. Shapiro graduated from Brandeis University and earned her PhD in Curriculum and Instruction from the University of Maryland.

### **Jim Short**

*Director, Gottesman Center for Science Teaching and Learning, American Museum of Natural History*

Jim Short is the director of the Gottesman Center for Science Teaching and Learning in the Education Department of the American Museum of Natural History. He is the PI of Urban Advantage, a formal/informal partnership program in science education with seven other informal science education institutions and the New York City Department of Education that serves over 120 middle schools and almost 400 science teachers. In the past, Short has worked at Denver Public Schools as a science curriculum coordinator. As a result of his work, the district implemented a new district-wide science program that included several inquiry-oriented, research-based science curricula that were developed for elementary, middle school, and high school science. Short also worked at the Biological Sciences Curriculum Study (BSCS) for five years, after 11 years of working in schools as a teacher and science administrator. He worked in the BSCS Center for Professional Development and was the project director of the Science Curriculum Implementation Center and director of the National Academy for Curriculum Leadership. His work at BSCS helped develop the National Academy for Curriculum Leadership into an intensive professional development and technical assistance program supporting the implementation of K–12 standards-based, inquiry-oriented instructional materials in science education. Short was also the director of science education for Edison Schools and has 10 years of teaching experience at the middle and high school levels. Short received his BS in Biology from Rhodes College, a MEd in Science Education from the Peabody College for Teachers at Vanderbilt University, and his EdD in Curriculum and Teaching with an emphasis on Educational Leadership and Professional Development from Teachers College at Columbia University.

### **Nigel Standish**

*Graduate Fellow, University of Virginia*

Nigel Standish is a graduate fellow in the Commonwealth Engineering Design (CED) Academy for Advanced Manufacturing in K–12 education. The CED Academy is a collaboration among the University of Virginia and the Charlottesville and Albemarle Schools. Nigel serves as co-director and science education advisor for the CED K–12 Fabrication Laboratory. He is curriculum developer for a periodic motion unit currently being piloted at Buford Middle School in Charlottesville, Virginia.

### **Kathleen Tinworth**

*Principal, ExposeYourMuseum LLC*

Prior to becoming a principal at *ExposeYourMuseum*, Kathleen Tinworth led the Department of Audience Insights (formerly called Visitor Research & Program Evaluation) at the Denver Museum of Nature & Science (DMNS) since 2007. She is the research lead on grants from the National Science Foundation, NASA, and the Institute of Museum and Library Services (IMLS). Tinworth is PI of the Efficacy Study of Metropolitan Denver's Urban Advantage Program: A Project to Improve Scientific Literacy Among Urban Middle School Students. She also leads the Denver-area Evaluation Network, a collaboration of 12 area cultural institutions committed to measuring audience outcomes across diverse

informal learning settings and supported by IMLS. In addition to Tinworth's role at DMNS, she offers limited research and evaluation consultancy services through ExposeYourMuseum LLC. Her primary areas of research are non-visiting audiences, evaluation capacity building, online/social media/mobile evaluation, and data visualization. Tinworth is a board member of the Visitor Studies Association and co-chair for the Arts, Culture, and Audience group of the American Evaluation Association. She graduated from New York University and holds an MS in Investigative Psychology from the University of Liverpool (England).

### **Audra Ward**

*Science Department Chair and Director of Diversity, Marist School*

Audra Brown Ward is the science department chair and director of diversity at Marist School in Atlanta, where she has taught AP Biology and Anatomy & Physiology for eight years. Ward is a College Board consultant, and a reader and table leader for the AP Biology exam. She has led numerous AP Biology Summer Institutes and one-day workshops, as well as workshops at College Board Teaching and Learning Conferences and NABT (National Association of Biology Teachers) Conferences. She has contributed to various teacher guides and ancillaries for AP Biology textbooks. Recently, she has been involved in the development of the College Board's Materials for Professional Workshops and was a reviewer for the 2012 edition of the AP Biology Lab Manual for Students published by the College Board. Ward received the 2007 NABT Outstanding Biology Teacher Award for Georgia and was a 2009–2010 American Physiological Society Frontiers in Physiology Fellow. She received a 2009–2010 Dobbs Foundation Fellowship from the Center for Teaching at the Westminster Schools in Atlanta, and was nominated for the Siemens Award for Advanced Placement in 2007 and 2008. Ward is involved with several faculty committees and has facilitated professional development workshops on innovative teaching strategies for new teachers at Marist School. She is a member of the National Science Teachers Association, the Georgia Science Teachers Association, and also serves the National Association of Biology Teachers as the OBTA director for Georgia. Ward received a BS in Biochemistry from Spelman College and an MS in Biochemistry from Georgia Tech.

### **George Wolfe**

*Director, Loudoun Academy of Science*

George Wolfe is the founder and director of the Loudoun Academy of Science (AOS) in Virginia. Students attend this STEM magnet on alternate days. The curriculum highlights inquiry and integration, preparing students to complete a two-year independent research project and at least two years of calculus. Wolfe has over 30 years of teaching and curriculum writing experience. His teaching career started in Zaire, Africa, where he taught in the Peace Corps. Wolfe taught in the Rochester City Schools until leaving to start the AOS in 2005. In addition, Wolfe has authored several publications including "The Nasonia Project," a lab series built around the genetics and behaviors of a parasitic wasp, as well as "Thinkwell's Biology," a CD lecture series used in freshman biology courses in many AP and college programs throughout the U.S. Wolfe has also been an Emmy winning television host for the PBS/WXXI production of Homework Hotline, and wrote and performed in "Football Physics" segments for the Buffalo Bills and the Discovery Channel. He has served on multiple advisory boards, including the Cornell Institute of Physics Teachers, the Cornell Institute of Biology Teachers, and the Harvard-Smithsonian Center for Astrophysics SportSmarts curriculum project. He has received numerous awards, including the NSTA Presidential Excellence Award, The National Association of Biology Teachers Outstanding Biology Teacher Award for New York State, and The Shell Award for Outstanding Science Educator. In 2004, he was inducted into the National Teaching Hall of Fame. Wolfe also completed and was awarded National Board Certification by the National Board for Professional Teaching Standards. Wolf holds a BA in

Biological Sciences from the State University of New York, Brockport, and earned his New York State Teacher Certification from the State University of New York, Geneseo.

**Duke Writer**

*Math and Science Teacher, Loudoun Academy of Science*

Duke Writer has been a math and science teacher at the Loudoun Academy of Science (AOS) in Virginia since 2006. Prior to teaching, he worked in econometric and statistical modeling before being driven to rug chewing apoplexy working on the “Y2K bug.” Writer’s time with both freshmen and sophomores integrates physical science inquiry with student-designed lab investigations and predictive/analytical mathematical models using spreadsheets (such as Excel and the TI-83+). As a research and statistical analysis mentor, he takes the experiences gained in 2+ years of introductory modeling to direct students into high level math modeling research projects. Some examples of student-designed projects include modeling the spread and growth of invasive species (viz. the Zebra Mussel), the epidemiology and spread of Lyme disease, and the growth/decay of a cancerous tumor after “magic bullet” treatments. Writer graduated from Bowdoin College and University of Virginia.