



Network for Academic Renewal

ENGAGED STEM LEARNING: From Promising to Pervasive Practices

**Hilton Downtown | Miami, Florida
March 24-26, 2011**

Project Kaleidoscope (PKAL) and AAC&U are pleased to partner on this Network for Academic Renewal conference, *Engaged STEM Learning: From Promising to Pervasive Practices*. It is our first official joint endeavor since PKAL joined AAC&U in January 2010. Since its founding in 1989, PKAL has been one of the leading advocates in the United States for building and sustaining strong undergraduate programs in the fields of science, technology, engineering, and mathematics (STEM). Through its work with an extensive network of faculty members and campus leaders, PKAL has developed a far-reaching influence in shaping undergraduate STEM learning environments that attract and retain undergraduate students. The complex nature of contemporary careers and community issues, both local and global, require students across all majors to graduate with a sound understanding of math and science as well as the skills to use this knowledge to advance the common good. PKAL and AAC&U share a strong conviction that science and mathematics understanding is essential to liberal education in the 21st century and that liberal education is essential for all students, including those pursuing degrees in STEM fields.

There is now overwhelming evidence from research in cognitive psychology, neuroscience, and discipline-based science education research that engaged learning practices and instructional models (e.g., problem-based learning, just-in-time teaching) help students learn much more effectively. Moreover, these active learning approaches enable the success of all students, in particular those from historically underrepresented populations. Despite this evidence, such practices are not widely implemented in undergraduate STEM classrooms around the country. This issue is highlighted in multiple national reports, from both the recent and distant past (going back to the late 1980s!!), and is the motivation behind the subtitle for this conference – *From Promising to Pervasive Practices*. We know what kinds of teaching and learning strategies work best; we must now work to expand implementation of these strategies across more institutions and more classrooms around the country.

Thus, we hope you will find this conference useful in sharing and learning from each other about promising practices and how to make them more pervasive on your campus. The conference themes have been designed for participants who wish to make changes in courses, programs, and major institutional priorities; broaden student participation and success in STEM fields; better assess engaged STEM learning in both the majors and general education; and connect the revitalization of STEM learning with ongoing campus work in Liberal Education and America's Promise (LEAP).

Susan Albertine
Vice President, Engagement, Inclusion, and Success

Susan Elrod
Executive Director, Project Kaleidoscope

PLANNING COMMITTEE

AAC&U extends a special note of appreciation to these individuals and campuses for their many contributions to the conference program.

Florida Gulf Coast University

Donna P. Henry
Dean, College of Arts & Sciences

Douglas Spencer
Director, Whitaker Center for STEM Education

Sharon Isern
Associate Professor of Biology

Florida International University

Claudius Augustus Carnegie
Professor, Mechanical and Materials Engineering

Douglas L. Robertson
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Jacksonville University

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Alina Coronel
Endowed Teaching Chair of Mathematics, Kendall Campus

Miami Dade College, continued

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Pamela G. Menke
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Lenore Rodicio
Academic Dean and Former Chair, Natural Sciences, Kendall Campus

Jakeisha Thompson
Professor of Mathematics and Leader of the Collegewide Math Project, Wolfson Campus

Rollins College

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President

Saint Leo University

Laura Blasi
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Associate Provost of Research

University of Tampa

Stephen Kucera
Associate Professor of Biology

SPONSOR

AAC&U thanks the **Burroughs Wellcome Fund** for their generous contribution supporting the conference participation of five teams from North Carolina. Each team consists of a K-12 educator and a college/university science or mathematics educator. These grants are designed to strengthen the K-16 pipeline by encouraging conversation and cooperation between schools and post-secondary education. Grant recipients include teams from: Wake North Carolina State University STEM Early College High School and North Carolina State University; A.C. Reynolds High School and University of North Carolina Asheville; Cranberry Middle School and Appalachian State University; Montlieu Elementary School and University of North Carolina Greensboro; and St. Paul's High School and Robeson Community College.

FEATURED SESSIONS

Liberal Education and America's Promise

Throughout the conference program, sessions noted with the *Liberal Education and America's Promise* (LEAP) designation highlight the innovative work of colleges and universities that are members of AAC&U's LEAP Campus Action Network. The LEAP Campus Action Network brings together campuses and organizations committed to liberal education; helps them to improve their efforts to ensure that all students achieve essential liberal education outcomes, and shines a spotlight on educational practices that work. Participants in these sessions will learn how members of the network are using the LEAP framework and resources to advance their educational improvement efforts. Stop by the poster session or conference registration desk for information about LEAP or visit www.aacu.org/LEAP.

Project Kaleidoscope

Project Kaleidoscope (PKAL) is a leading advocate in the United States for building and sustaining strong undergraduate programs in the fields of science, technology, engineering, and mathematics (STEM). PKAL accomplishes its goal of advancing what works in undergraduate STEM education by engaging faculty and campus leaders in funded projects, national and regional conferences, leadership development programs, and publications. Three current examples of PKAL projects are the *Keck/PKAL Facilitating Interdisciplinary Learning* project, *Summer Leadership Institutes* for STEM faculty leaders, and *Regional PKAL Networks*. Sessions that feature work from campus teams that have participated in these projects are noted with the *Project Kaleidoscope* designation. For more information on PKAL and these projects, visit www.aacu.org/pkal.

FUTURE NETWORK FOR ACADEMIC RENEWAL CONFERENCES

October 13-15, 2011 ♦ Long Beach, California

Educating for Personal and Social Responsibility: A Twenty-First-Century Imperative

November 3-5, 2011 ♦ Providence, Rhode Island

Arts & Humanities: Toward a Flourishing State?

February 23-25, 2012 ♦ New Orleans, Louisiana

General Education & Assessment

March 22-24, 2012 ♦ Seattle, Washington

Student Success & Engagement

For more information, visit www.aacu.org/meetings/network

SCHEDULE AT A GLANCE

Thursday, March 24, 2011

- 10:00 A.M. – 7:00 P.M.** **Conference Registration, Membership Information**
- 2:00 – 5:00 P.M.** **Pre-conference Workshops** *separate registration and fee required*
- 7:00 – 8:30 P.M.** **Keynote Address**
Science Education in an “Age of Engagement”
Matthew C. Nisbet, Associate Professor, School of Communications—American University
- 8:30 – 9:30 P.M.** **Poster Sessions and Reception**

Friday, March 25, 2011

- 7:30 – 8:30 A.M.** **Continental Breakfast**
- 8:00 – 9:00 A.M.** **Concurrent Sessions**
- 9:15 – 10:15 A.M.** **Plenary**
Examining the Intersections of Race, Gender, Science, Society, and Politics in the United States
Evelynn Hammonds, Dean of Harvard College, Barbara Gutmann Rosenkrantz, Professor of the History of Science and of African and African American Studies—Harvard University
- 10:45 A.M. - 12:15 P.M.** **Concurrent Sessions**
- 12:30 – 2:15 P.M.** **Luncheon and PKAL Workshop** *separate registration and fee required*
Connecting Scientific Trends and Student Learning
Susan Elrod, Executive Director, PKAL—AAC&U; and James M. Gentile, President—Research Corporation for Science Advancement
- 2:30 – 3:45 P.M.** **Concurrent Sessions**
- 4:00 – 5:15 P.M.** **Concurrent Sessions**

Saturday, March 26, 2011

- 7:30 – 8:30 A.M.** **Continental Breakfast**
- 8:00 – 9:00 A.M.** **Concurrent Sessions**
- 9:15 – 10:45 A.M.** **Concurrent Sessions**
- 11:00 A.M. – NOON** **Closing Plenary**
STEM and the Liberated Mind
Lewis Duncan, President—Rollins College

For Information about Network for Academic Renewal conferences, please see www.aacu.org/meetings/network or contact Karen Kalla and Siah Annand at 202.387.3760

PROGRAM OF EVENTS

THURSDAY, MARCH 24, 2011

10:00 A.M. – 7:00 P.M. CONFERENCE REGISTRATION, MEMBERSHIP INFORMATION *Overture Foyer*

2:00 – 5:00 P.M. PRE-CONFERENCE WORKSHOPS *(separate registration and fee required)*

Workshop 1: Implementing Interdisciplinary STEM Programs: Connecting Leadership to Learning

Concerto Room A

As this century unfolds, it is imperative that students be competent and confident in their abilities to integrate and apply their knowledge across disciplines. Through case study analysis from PKAL's Interdisciplinary Learning Project and small group discussion, participants will gain insight into institutional strategies for strengthening interdisciplinary learning, including program structures, learning outcomes, assessment methods, and leadership actions required for implementation and success. Participants will leave with an action plan for creating more meaningful interdisciplinary learning experiences for their students in STEM disciplines.

Susan Elrod, *Executive Director, PKAL—AAC&U; and Michael Kerchner*, *Associate Professor of Psychology—Washington College* **Project Kaleidoscope**

Workshop 2: Debating Science: A New Model for Ethics Education for Science and Engineering Students

Concerto Room D

Ethics instruction for students in science and engineering largely focuses on standards of practice. However, scientific research and emerging technologies have far-reaching moral implications. While these implications are increasingly the subject of public debate, by most accounts, these debates have gone poorly. There is a pressing need for coursework to help students become more informed and reflective deliberators on the ethical and moral issues arising from science and technology. In this workshop, the facilitator will describe a National Science Foundation program, Debating Science that is designed to help fill this need. Participants will examine: 1) a model for ethics education through deliberation; 2) the ethical theory grounding the model; and 3) the online environment used to support these deliberations.

Dane Scott, *Director, Center for Ethics and Associate Professor, Department of Society and Conservation—The University of Montana*

Workshop 3: Facilitating Teaching and Learning: Concept Inventories

Picasso Room

Concept inventories are tools that can foster constructive conversations about what and how students are learning. Participants will examine effective uses and misuses of concept inventories, learn how to access existing concept inventories, and become active members in a growing community of users.

Teri Reed-Rhoads, *Assistant Dean of Engineering in Undergraduate Education—Purdue University; and Julie Libarkin*, *Associate Professor and Director, Geocognition Research Lab—Michigan State University*

Workshop 4: PKAL Learning Spaces Collaboratory Workshop

Concerto Room B

This workshop will link contemporary learning theory to best practices for shaping environments that facilitate deep, integrative learning in STEM. Participants will examine spaces, and the process for designing spaces, that enable constructivist, experiential, and real-world experiences that lead to lifelong learning. They will better understand the parallels between a collaborative planning process and resulting collaborative learning environments.

Terence Farrell, *Professor of Biology, and Project Shepherd for Science Space—Stetson University; Jeanne L. Narum*, *Principal—PKAL Learning Spaces Collaboratory; and Susan Whitmer*, *Strategic Education Consultant—Herman Miller*

Workshop 5: Scientific Teaching: A Framework for Engaged Learning

Concerto Room C

This workshop will feature evidence-based practices in undergraduate science education and highlight how “scientific teaching” can bring the rigor and spirit of research to the classroom. Participants will discuss active learning, effective assessment, and classroom diversity issues and apply scientific teaching principles to their own work.

Jennifer Frederick, Associate Director, Graduate Teaching Center and Center for Scientific Teaching—
Yale University **Offered as part of the PKAL Regional Network Program**

7:00 – 8:30 P.M.

KEYNOTE ADDRESS

Symphony Room III & IV

Science Education in an “Age of Engagement”

In a quickly changing technological and media landscape, universities and colleges have a responsibility to prepare students to be active participants in societal decisions involving science, culture, and values. Dr. Nisbet will identify challenges and questions shaping the future of science education, spotlighting curriculum initiatives and innovations that promote dimensions of “civic science” knowledge and civic participation, media literacy, and communication skills among students.

Matthew C. Nisbet, Associate Professor, School of Communication—American University

8:30– 9:30 P.M.

POSTER SESSION AND RECEPTION

Symphony Room I & II

Expanding the STEM Pipeline

P 1: Changing the STEM Experience through Early Inquiry-Based Seminars and Research

Many entering college students have some form of laboratory experience, but few have had any research experience. Typically research experiences are for upper-class students who have already made a decision about career options in the sciences. Early exposure to exciting, hands-on experiences can be transformative, and this is especially true for women. This poster will highlight the Alma College PRISM project (Positive Routes into Science and Mathematics), a program that focuses on engaging students early through undergraduate research and an enhanced introductory STEM curriculum. The project is funded by an NSF-STEP grant, and participants will learn about the three components of the project and review data documenting the effectiveness of each component.

John E. Davis, Charles A. Dana Professor of Health Science and **David Clark**, Charles A. Dana Professor of Biology—all of Alma College

Expanding the STEM Pipeline

P 2: Expanding the STEM Pipeline

The University of Southern Indiana and its Pott College of Science and Engineering have developed multiple programs to increase student interest, participation, retention, and achievement in the STEM disciplines. Through four component programs, the initiative has increased the number and quality of students selecting STEM majors and provided opportunities to engage students early in hands-on research opportunities. Facilitators will discuss how these programs have developed a more nurturing and team-oriented approach to STEM education and share insights about the component programs and resultant data.

Shelly B. Blunt, Associate Dean and **Scott Gordon**, Dean—both of University of Southern Indiana

Expanding the STEM Pipeline

P 3: Requiring Undergraduate Research: Retaining Underrepresented Students in the Sciences

African Americans and women historically have been underrepresented in the sciences, and this issue persists today. There is significant evidence that undergraduate research increases retention in undergraduate science degree programs, yet underrepresented groups are less likely to participate in research. Mandatory research experiences may be a viable means for engaging underrepresented students. University of South Carolina-Aiken requires all biology students to conduct one semester of research. This poster will feature 1) evidence to support undergraduate participation in research as a

means for science retention; 2) strategies for implementing a program of required undergraduate research; and 3) evidence of the success of this program, particularly for African-American females. **Michelle L. Vieyra**, Assistant Professor of Biology and **Joanna Gilmore**, Graduate Student—both of University of South Carolina-Aiken

Expanding the STEM Pipeline

P 4: Building the STEM Pipeline: Connecting K-6 Teachers with Inquiry-Based Science

In 2007 as part of outreach for a National Science Foundation grant, faculty at Nazareth College conducted a four-day summer workshop for K-6 teachers. Professors representing chemistry, biology and mathematics presented an inquiry-based workshop where teachers created an inquiry-based lesson plan that they could implement during the following school year. Small grants were also available to help teachers implement their lesson plans. Nazareth faculty have continued using this model of outreach, and teachers from the first summer workshop have developed into teacher-leaders in ongoing summer workshops and at their schools. The model has led to greater enthusiasm among teachers and students for STEM topics; increased the accuracy and depth of STEM content presented in classes; and created bridges between the K-6 community and the college. Participants will learn how the ultimate goal of enhanced exposure to STEM topics in the K-6 classroom is engaging and encouraging students to continue on STEM career trajectories.

Beverly J. Brown, Associate Professor of Biology and **Nicole Juersivich**, Assistant Professor of Mathematics—both of Nazareth College of Rochester

Expanding the STEM Pipeline

P 5: First-Year Persistence in STEM

Every fall, thousands of entering first-year students arrive on campus with the expectation that they will major in a STEM field. Yet many of these students (particularly students of color) will not persist to graduation in a STEM field. This poster will focus on three factors that are important for understanding persistence: student background, entering student expectations, and student experiences. The session will use longitudinal data from the Beginning College Survey of Student Engagement (BCSSE) and the National Survey of Student Engagement to highlight the importance of first-year persistence in the major as well as teaching practices and institutional initiatives that supports persistence.

James S. Cole, Assistant Scientist/BCSSE Project Manager and **Ali Korkmaz**, Assistant Scientist—both of Indiana University Bloomington

Expanding the STEM Pipeline

P 6: Using Technology to Engage Students in Inter-Curriculum Physics Courses

The poster will present the results of incorporating technologies and high-impact strategies in physics courses at an open-admission, minority-serving community college. The presenters will describe the development, implementation, and outcomes of the strategies in both introductory and advanced physics courses. Approaches include incorporating ePortfolios to enhance students' problem-solving and meta-cognitive skills as well as incorporating RealTime Physics active learning laboratories, collaborative group work, and scientific lab report rubrics. The model can be adapted for use at a variety of institutions.

Vazgen Shekoyan, Assistant Professor of Physics—City University of New York Queensborough Community College

Expanding the STEM Pipeline

P 7: Profiles of Successful Women in STEM

Models of successful women in STEM disciplines are critical to improving retention of women in academic science. With this poster, the presenters will share the findings of their recent study of 41 successful women academic scientists. The critical role of faculty mentors and research collaborators on the ultimate career success of these scientists will be presented. Participants will learn about the ways in which higher education institutions can proactively work as facilitators for women's academic careers in STEM disciplines.

Christine M. de Denus, Associate Dean of Faculty and **Lisa Kaenzig**, Associate Dean of William Smith College—both of Hobart and William Smith Colleges

Expanding the STEM Pipeline

P 8: Engaging STEM: A Campus Model for Service-Learning and K-12 Partnership

This poster will describe the presenters' experience creating a service-learning collaboration between college students in the STEM disciplines and their counterparts at a local high school via the use of web-conferencing tools, video production, and computer modeling. The presenters will address topics ranging from the nuts-and-bolts of managing this kind of collaboration to the complex measures required to assess and sustain it. University and high school student perspectives will be featured.

Melody A. Bowdon, *Director of the Faculty Center for Teaching and Learning and Associate Professor of Writing and Rhetoric*, and **Linda J. Walters**, *Professor of Biology*—all of *University of Central Florida*

Expanding the STEM Pipeline

P 9: Supporting Engaged Pedagogies in STEM at a Predominantly Transfer Institution

Predominantly transfer institutions play a critical role in the promotion of STEM literacy. These institutions also face challenges such as dealing with large populations of students at risk for attrition from STEM fields. At Gainesville State College, campus leaders have encouraged and supported faculty members' use of pedagogies of engagement in STEM and in turn fostered innovative teaching. The poster will share strategies for creating a culture supportive of engaged pedagogy in STEM and associated programmatic issues.

Al M. Panu, *Interim Vice President for Academic Affairs*—*Gainesville State College*

Expanding the STEM Pipeline

P 10: AAC&U's Liberal Education and America's Promise

AAC&U's Liberal Education and America's Promise (LEAP) initiative is designed to champion the value of a 21st century liberal education for all students. Participants are invited to visit this poster to learn more about the LEAP vision and the many activities of the LEAP campaign. The presentation will also include information on Excelencia in Education's new campaign: Roadmap for Ensuring America's Future by Increasing Latino College Completion, which AAC&U has joined as partner.

Susan Albertine, *Vice President, Office of Engagement, Inclusion, and Success* and **Karen Kalla**, *Co-Director, Network for Academic Renewal*—both of *AAC&U*

Creating Integrative and Interdisciplinary Environments

P 11: Transforming the First Year Curriculum in Biology

The Wofford College Biology Department dramatically transformed the first-year curriculum with support from the National Science Foundation. "Biological Inquiry" is the first in a four-course sequence required of all biology majors, and it is taken by approximately half of all entering students, regardless of future major. The course de-emphasizes traditional content coverage in favor of the development of skills and competencies used by scientists. Students analyze primary literature, design and conduct experiments, graph and interpret results, communicate findings through the creation of research posters, and critique and revise work in a formal peer-review process. This poster will highlight course activities and the direct and indirect assessment evidence from the first two years of implementation.

John F. Moeller, *Associate Professor of Biology* and **Ellen S. Goldey**, *William R. Kenan Jr. Professor and Chair of Biology*—both of *Wofford College*

Creating Integrative and Interdisciplinary Environments

P 12: Building Student and Faculty Cultures that Promote Robust Interdisciplinary Science

Social interactions are an important determinant of success in STEM disciplines, and students may leave STEM majors due to a sense of isolation. Interdisciplinary projects encourage a healthy STEM culture by forging bonds among students and faculty across disciplinary boundaries. This poster will describe a set of programs and practices that together have contributed to a vigorous interdisciplinary culture at a liberal arts college. The facilitators will highlight the general principles underpinning these initiatives and discuss how these principles might be applied at other institutions.

Chris Gillen, *Professor of Biology*, **Robin Cash**, *Director of Special Projects in Enrollment and Student Affairs*, and **Karen Hicks**, *Associate Professor of Biology*—all of *Kenyon College*

Creating Integrative and Interdisciplinary Environments

P 13: Putting BIO2010 into Practice: A New Course on the Research Process for STEM Majors

The 2003 National Research Council publication *BIO2010: Transforming Undergraduate Education for Future Research Biologists* recommends a new curriculum in biology that provides a “strong foundation in mathematics, physical and information sciences to prepare students for research that is increasingly interdisciplinary in character.” The report was a response to changes in biological research that impact how biologists design, perform and analyze experiments and included specific recommendations for the inclusion of mathematics, computer science, and quantitative principles in the biology curriculum. In this poster, the presenters will describe a new interdisciplinary course on the research process that prepares students for participating in undergraduate research. The course addresses the *BIO2010* recommendations as well as AAC&U’s LEAP Essential Learning Outcomes and High-Impact Practices by focusing on 1) writing a research proposal; 2) data analysis methods; 3) collaborative assignments; and 4) analyzing and describing research outcomes to prepare students for designing and conducting their own research. The poster will share course materials and describe how the course has evolved.

Debra L. Hydorn, Professor of Mathematics and **Kathryn E. Loesser-Casey**, Professor of Biology—both of University of Mary Washington *Liberal Education and America’s Promise*

Creating Integrative and Interdisciplinary Environments

P 14: Engaging Students in the Learning of Science beyond the Science Requirement

A quick glance at a daily newspaper provides ample evidence to support the assertion that accurately interpreting current events and scientific discoveries requires the ability to integrate understandings across a range of disciplines. Learning in general education however, is often compartmentalized into discreet silos within the curriculum. This poster will share the presenters’ efforts to integrate the natural sciences, social sciences, visual arts, and humanities in one institution’s general education capstone course, called *Exploring Public Issues through Writing*. The presenters will discuss the specifics of the interdisciplinary model, review student learning outcomes, and share lessons learned that may benefit others seeking to infuse scientific learning throughout the curriculum.

Alix D. Fink, Associate Professor of Biology and **Carl M. Riden**, Associate Professor of Sociology—both of Longwood University

Creating Integrative and Interdisciplinary Environments

P 15: Creating an Integrative Learning Environment for Mathematics, Computer Science, and Physics

This poster will share the presenters’ experiences creating an integrative learning environment for mathematics, computer science, and physics. The University of San Diego’s commitment to teaching and learning innovations in STEM is supported by an NSF S-STEM grant. An interdisciplinary group of faculty recruited a cohort of first-year students and developed a novel program that includes a specially designed course, first-year co-housing, intensive mentoring, emphasis on undergraduate research, and a capstone experience. This poster will demonstrate how the main goals of the program are maximizing retention of students and their academic success.

Eric Page, Assistant Professor of Physics—University of San Diego

Creating Integrative and Interdisciplinary Environments

P 16: Interdisciplinary Field Courses and their Impact on Students

Field courses provide a unique opportunity for engaged learning. Including a team concept adds a social component, which in itself provides opportunities for learning how to work with others, to think critically, solve real-world problems, communicate effectively, and efficiently collect data. This poster will highlight examples of successful interdisciplinary field experiences for science majors, elementary and secondary education majors, and current K-12 teachers.

Melinda A. Coogan, Assistant Professor of Biology and Science Outreach Coordinator—Buena Vista University

Creating Integrative and Interdisciplinary Environments

P 17: Using Problem-Based Learning in Science Education Training of Pre-Service Teachers

Supported by grants from the Howard Hughes Medical Institute, Benedictine University developed an integrated, problem-based science curriculum for elementary education majors. An interdisciplinary

group of faculty brainstormed with elementary educators to generate ideas for the creation of the model curriculum. This poster will examine a set of four content courses with integrated laboratories, which were piloted and evaluated by an external assessment group. Participants will discuss how these findings have supported the use of problem-based learning in science classrooms.

Donald B. Taylor, Provost and Vice President, Academic Affairs and Professor of Biochemistry and Molecular Biology—Benedictine University

Creating Integrative and Interdisciplinary Environments

P 18: Becoming Modern: How Science Works in the Modern World

The newly-revised core curriculum at Emory & Henry College includes a course which actively reintegrates the study of science into the college's liberal arts program. This required sophomore-level course, entitled "Becoming Modern," explores how the shift from primarily received knowledge to empirical knowledge informed by direct inquiry profoundly altered Western culture. The course, organized around four leading questions, focuses primarily on how science works in the modern world and includes the historical development and the application of the scientific method. The poster will demonstrate how students are engaged in the scientific process through "Mythbuster"-style videos which advance their understanding of the relationship between the individual and society. Participants will discuss how such activities demonstrate both the power and the limitations of scientific investigations.

Melissa P. Taverner, Associate Professor of Biology and Chair of the Division of Natural Sciences—Emory & Henry College

Creating Integrative and Interdisciplinary Environments

P 19: Preparing Undergraduates to Work at the Intersection of Biology and Mathematics

The workforce need for STEM majors who are trained in interdisciplinary methods is rapidly increasing. In response to this need, Truman State University leveraged its expertise in undergraduate research and its commitment to interdisciplinary learning to develop an undergraduate program in mathematical biology. This poster will feature high-quality faculty-mentored interdisciplinary research experiences that are supplemented by coursework consisting of interdisciplinary electives that count towards majors in Biology, Mathematics, and Computer Science.

Jason E. Miller, Professor of Mathematics, **Timothy Walston**, Assistant Professor of Biology, and **Barbara Kramer**, Associate Professor of Chemistry—all of Truman State University

Creating Integrative and Interdisciplinary Environments

P 20: The Dance of Art and Science

Using graphics and video, this poster will describe a series of events designed to be a stimulating intellectual and social experience for students. As part of their orientation to James Madison University, 4,000 first-year students discussed "The DNA Age," a series of articles published in *The New York Times*. The next day, they donned bright t-shirts in four colors representing the different nucleotides of DNA and did a mass dance that was developed and choreographed by the Liz Lerman Dance Exchange. Additional events included performances of the dance "Furious Beauty: Genome" and a lecture by NIH Director Francis Collins on the language of life. An article and video are available at www.jmu.edu/bethechange/stories/opentopossibility.shtml.

David F. Brakke, Dean College of Science and Mathematics, **Judith Dilts**, Associate Dean, College of Science and Mathematics, and **Carol Hurney**, Director, Center for Faculty Innovation—all of James Madison University

Creating Integrative and Interdisciplinary Environments

P 21: Reacting to the Past: Can Students Learn the Process of Science through Role-Playing?

The Reacting to the Past (RTTP) pedagogy has proven to engage students at a deep level by having them debate big questions as part of elaborate role-playing games. RTTP has been applied successfully in a variety of institutional contexts and with students of every level of preparation for college, including ESL students. With the support of National Science Foundation, the RTTP collaborative is developing six chapter-length RTTP games suitable for inclusion in traditional STEM courses. These will complement

the four existing book-length RTTP games related to science. This poster will present an overview and learning outcomes of the RTTP games.

David E. Henderson, Professor of Chemistry—Trinity College; and **Susan K. Henderson**, Professor of Chemistry—Quinnipiac University

Assessing STEM Learning

P 22: Computerized Analysis of Student Writing and Student Ideas about Scientific Concepts

Assessment of constructed responses, in which students write their own response to prompts, can provide critical insight into student thinking, but are sometimes challenging to use and evaluate. A faculty team at Michigan State University has successfully developed automated techniques to evaluate student writing using commercially available lexical analysis software. These analyses can reveal richer patterns in student thinking than do multiple choice assessments and may be applied in multiple scientific disciplines (e.g. biology, geology). This poster session will introduce the assessments and automated analyses and provide an overview of some results.

Joyce Parker, Assistant Professor, Division of Science and Mathematics Education—Michigan State University

Assessing STEM Learning

P 23: Assessing the Quality of State Science Standards in Genetics

Science education in the U.S. is driven by the testing and accountability requirements of the No Child Left Behind (NCLB) Act. Implementation of NCLB relies heavily on learning outcomes, or standards, which are currently developed on a state-by-state basis. Standards, in turn, drive curriculum and instruction, yet they have never been evaluated for scientific accuracy and completeness. Staff members at the American Society of Human Genetics (ASHG) investigated the quality of the standards in genetics for all 50 states and the District of Columbia and found them to be poor, with more than half the states receiving overall grades of D or F. Only five states rated a B, and no state earned an A. The deficiencies identified by the ASHG may adversely affect genetics instruction and learning, the preparation of students for college, and the genetic literacy of the U.S. citizenry. Participants will be encouraged to explore these issues and possible responses.

Michael Dougherty, Director of Education—American Society of Human Genetics

Assessing STEM Learning

P 24: Authentic Assessment in Environmental Science Education

This poster will feature an assessment process for a professional Master of Arts in Environmental Science Education program. Program goals for this M.A. include 1) growth in teachers' environmental science content mastery; 2) growth in teachers' abilities to incorporate their enhanced content knowledge into effective, inquiry-based instruction and to document the efficacy of that instruction; and 3) increases in students' environmental science content mastery. Assessment of these wide-ranging goals requires the application of a variety of instruments, some of which have not yet been developed for the specific groups of learners (i.e., teachers or their students) involved. The presenters will describe the assessment tools, their validity and reliability with the study's subjects; and how the data obtained has informed the M.A. program.

Kelly McConnaughay, Associate Dean of Liberal Arts and Sciences, **Sherri Morris**, Associate Professor of Biology, and **Michelle Edgcomb**, Lecturer and Science 101 Coordinator—all of Bradley University
Project Kaleidoscope

Assessing STEM Learning

P 25: Implementation of a Theory-Based Integrative Model for Motivation and Learning

Enhancing the links among research, theory, and practice can strengthen the impact of STEM student learning assessment. These links can also help educators develop learning environments that foster strong positive motivation for learning; create active engagement for deep learning; and develop capacities for reflection and self-regulation. This poster will help advance participants' understanding of a theory-based, empirically supported model for integrating STEM teaching practices with research and theory. The poster will provide examples of how this model has been successfully applied to selected

STEM disciplines in university and high-school settings. Participants will discuss how to implement the assessment tools that are to be used in tandem with this model.

James A. Zimmerman, Director, Christian A. Johnson Institute for Effective Teaching—Rollins College

Assessing STEM Learning

P 26: Assessment-Driven Revision of a Biology Curriculum

This poster will highlight examples of assessment for program-level evaluation and modification. Consistent with LEAP High-Impact Practices, the biology department at Westminster College recently introduced a research-based senior capstone. Faculty review of early capstone presentations revealed deficiencies in the capacity of students to develop projects independently and in their analysis of experimental data—practical skills identified as LEAP Essential Learning Outcomes. In addition, the department began administering the ETS Major Field Test to seniors. When ETS exam scores were correlated with student coursework history it became evident that the structure of the biology curriculum permitted students to sidestep critical content areas. The facilitators will discuss specific curricular revisions implemented to address these issues, as well as ongoing assessment of program outcomes and design.

John Robertson, Associate Professor of Biology, **Joseph Balczon**, Associate Professor of Biology, and **Joshua Corrette-Bennett**, Associate Professor of Biology—all of Westminster College

Liberal Education and America's Promise

Enhancing Student Learning with Technology

P 27: Using Integrated Technology to Improve Classroom Participation and Student Learning in STEM

It is a challenge in many science courses to alleviate the potential monotony of lectures. This poster will highlight a variety of contemporary technologies used across diverse STEM courses to keep students motivated and engaged. Creative use of these technologies contributes to environments that facilitate learning and help students achieve their educational goals. Examples include clickers, online problem-based learning tools, and short video clips. Participants will see how the use of course management software permits incorporation of these technologies in one place; affords the opportunity for student collaboration; and provides an integral assessment tool to measure student learning outcomes.

Robert B. Erdman, Associate Professor of Biological Sciences, **Michael Fauerbach**, Professor of Physics and Astronomy, and **Joseph P. Kakareka**, Associate Professor of Chemistry—all of Florida Gulf Coast University

Enhancing Student Learning with Technology

P 28: Intensive Technology Use in High School Dual Enrollment: The Impact on College-Level STEM Programs

The Geospatial Semester is a unique dual enrollment partnership between James Madison University and selected Virginia K-12 school districts. High school seniors learn about geospatial technologies (e.g., GIS, GPS, and remote sensing) and apply them to local problems of interest. The student experience is very different from more traditional dual enrollment programs, as is the impact on higher education. The presenter will discuss the program, show student work, describe different faculty mentoring roles, and explore how this model of dual enrollment might be of value to other higher education STEM programs.

Bob Kolvoord, Professor, *Integrated Science and Technology*—James Madison University

Enhancing Student Learning with Technology

P 29: Science at a Distance: The Effectiveness of Experimentation in Online Courses

Laboratory experiments are often considered the cornerstone of science courses. Experimentation allows students to apply scientific concepts while also developing critical thinking skills and promoting scientific literacy. Increasingly, campuses have moved their instruction to an online learning environment, creating a growing need to develop best practices related to lab-based activities with online science coursework. In a research study, the presenters explored how experimentation can be integrated with scientific content in an online environment. The study investigated the ways in which online students engaged in scientific processes as they conducted relevant and real-world experiments. This poster will

provide analysis of three online science courses and demonstrate that distance learning students can successfully perform lab experiments from their own locations.

Mary Mawn, Assistant Professor and Science and Math Coordinator—State University of New York Empire State College

Scaling Up and Sustaining Pedagogies of Engagement

P 30: Promoting Sustainable STEM Education Change through Faculty Learning Communities

Faculty instructional development is a critical component of STEM education reform efforts. The design and implementation of these programs should be based on research regarding strategies that best promote engaged teaching attitudes and behavior, and, significantly, help faculty sustain these changes. In contrast to short-term workshops, scientific teaching faculty learning communities (STLCs) provide STEM faculty with a one-year, structured forum for learning about high-impact teaching practices. Sustained support from disciplinary colleagues facilitates a cultural change within STEM departments, enabling institutionalization of STEM education reforms and creating more positive student learning environments. The STLC theoretical model, format, and strategy for the assessment of its impact will be shared in the context of the research on STEM faculty instructional development programs.

Karen Sirum, Assistant Professor—Bowling Green State University

Scaling Up and Sustaining Pedagogies of Engagement

P 31: The Impact of Disciplinary Teaching and Learning Center Activities on Faculty Development

In recent years there has been a national call for enhancing professional development among university faculty. For example, faculty members in research-intensive universities report that they have almost no formal preparation for their teaching responsibilities. This poster will describe the development and evaluation of a disciplinary Teaching and Learning Center (TLC) that serves faculty in the chemical and life science disciplines. The goals of the center are to: 1) make training in teaching science part of the standard graduate program; 2) provide opportunities for science faculty to collaborate and consult with science education experts; and 3) create a structured environment of teaching and learning communities to support faculty in their efforts to adopt effective pedagogies. The poster will provide examples of the different activities offered by the TLC and describe assessment tools developed to evaluate the success of the professional development activities.

Gili Marbach-Ad, Director of the Chemical and Life Sciences Teaching and Learning Center and **Katerina V. Thompson**, Director of Undergraduate Research and Internship Programs—both of University of Maryland College Park

Scaling Up and Sustaining Pedagogies of Engagement

P 32: Addressing the Challenges in Expanding Engaged STEM Learning

Beginning in fall 2006, a small subset of physics faculty at the University of San Diego (USD) began heavy use of engaged learning techniques. These techniques include guided inquiry, process-based learning, and Tutorials in Introductory Physics, to increase student content gains and course enjoyment. Despite assessment data suggesting strong content knowledge gains as well as gains in understanding the nature of science, the instigators of this change have had difficulties expanding the use of these techniques to the rest of the physics department as well as to the USD STEM community at large. This poster will present the underlying data supporting the use of engaged learning at USD, comparison data for USD physics courses taught with traditional methods, difficulties encountered in propagating engaged learning in STEM courses, as well as planned future efforts to address these difficulties. Participants will be invited to discuss strategies for scaling up the use of engaged learning techniques.

Eric J. Page, Assistant Professor of Physics—University of San Diego

Scaling Up and Sustaining Pedagogies of Engagement

P 33: Creating a Sustainable Professional Network of K-16 Science Faculty

This poster will present the results of social network analysis (SNA) undertaken by the presenter to characterize the professional collaboration among participants of a large-scale K-16 partnership program in science. The participants were primarily high-school teachers and higher education faculty, and the study focused on three qualitative measures by which to examine the program's evolving collaborative structure—the emergence of new professional connections, the extent to which the network was

sustained after the program ended, and the role of program leadership in integrating network participants. The study examined four core program-related areas—inquiry-based teaching and learning, mentoring relationships, exposing undergraduates to science teaching as a career option, and planning and managing program activities. The findings provide evidence that a professional network of teachers can be substantially sustained beyond the end of funded grant activities. This poster will help broaden participants' understanding of how to foster, strengthen, and evaluate networks of sustained collaboration among science faculty on issues of teaching and learning.

David May, Project Manager, P-20 Partnerships—University System of Maryland

Scaling Up and Sustaining Pedagogies of Engagement

P 34: Building Strong STEM Programs and Student Cohorts

Following a campus-wide academic planning process, Wellesley College implemented curricular innovations designed to attract and retain students in STEM. This poster will provide an overview of efforts to create and scale up a first-year seminar program intended to attract students to science and a group approach to student research intended to retain students in science. Features of the seminar program include 1) classes that can either fulfill major or non-major requirements while attracting them to the sciences; 2) integration of science-related activities into campus-wide programs at all levels of the curriculum; and 3) the promotion of science as a core liberal arts subject. The group approach to student research enables more students to engage in research activity early in their academic careers and addresses pressure on faculty time. The poster will describe current progress and resource-allocation challenges that will be applicable to a wide range of institutions.

Nolan Flynn, Associate Professor of Chemistry, **Kim McLeod**, Professor of Astronomy, and **Dan Brabander**, Associate Professor of Geosciences—all of Wellesley College

Scaling Up and Sustaining Pedagogies of Engagement

P 35: Enhancing STEM Learning through Technology and Pedagogies of Engagement

This poster will present the design and outcomes from a three-year NSF/PKAL project in partnership with faculty from 52 community colleges in 27 states. In the project, faculty employed neuroscience technology and pedagogies of engagement in psychology, including active inquiry. Faculty passions for “big ideas” in psychological neuroscience, such as the mind-body interaction, were explored by students using electroencephalography and electrocardiography, electromyography, or electrooculography. The poster will provide the pedagogical model and assessment data from faculty and student participants.

Howard Iver Thorsheim, Professor of Psychology and Neuroscience—St. Olaf College, and **Barbara Van Horn**, Professor of Psychology—Indian River State College

FRIDAY, MARCH 25, 2011

7:30 – 8:30 A.M.

CONTINENTAL BREAKFAST

Overture Foyer

Participants may visit the continental buffet and take their breakfast to the session of their choice.

8:00 – 9:00 A.M.

CONCURRENT SESSIONS

Expanding the STEM Pipeline

CS 1: Comprehensive Changes to STEM Education: Reform to Better Serve the Underserved

Concerto Room C

Created in 1992, the Grinnell Science Project (GSP) addressed the college's failure to retain and graduate students of color, women students, and first-generation college students in STEM, despite their avowed interest in pursuing these majors. Armed with local statistical and qualitative data, faculty, student life professionals, and academic administrators developed a program to address barriers to success in the sciences, including: 1) a pre-orientation to address social barriers and begin mentoring; 2) interactive science/mathematics courses to address learning style differences; and 3) early exposure to research inside and outside the classroom to provide context and role models. Since GSP's inception, the number of students of color graduating from Grinnell in STEM has increased nearly threefold and the number of women graduating in STEM has more than doubled. The presenters will reflect on the

transformations GSP has brought to facilities, pedagogy, and attitudes toward inclusivity, and the key elements that created long-term success.

Jim E. Swartz, Dack Professor of Chemistry and Director, Center for Science in the Liberal Arts; **Mark Schneider**, Professor of Physics; and **Leslie Gregg-Jolly**, Associate Dean and Professor of Biology—all of Grinnell College

Creating Integrative and Interdisciplinary Environments

CS 2: Re-Envisioning Interdisciplinary Learning: Developing Environmental Literacy and Citizenship

Concerto Room A

As participants in the Keck-PKAL initiative on Facilitating Interdisciplinary Learning for the past two years, Moravian College and Bradley University have been developing interdisciplinary, environmentally-themed courses and programs as models for enhancing interdisciplinarity across the STEM disciplines and beyond. The projects have led participants to re-envision interdisciplinary learning on their campuses. A key finding is that experiential learning opportunities, authentic and diverse partnerships, and communication with multiple constituencies are important prerequisites for students (and faculty) to learn to work effectively both within and across disciplinary boundaries. In this session, the presenters will share a suite of promising practices and strategies—including student research and work aimed at solving real-world environmental problems—and facilitate themed small-group discussions on how these models may be applied on participants' campuses. The session will conclude with a large-group discussion about "meta-interdisciplinarity" initiatives that involve communication and citizen action across disciplinary boundaries, differing levels of STEM literacy, and diverse goals.

Diane Husic, Chair and Professor, Department of Biological Sciences—Moravian College, and Immediate Past-President—Council on Undergraduate Research; **Frank Kuserk**, Director, Environmental Studies and Sciences Program—Moravian College; and **Kelly McConnaughay**, Associate Dean of Liberal Arts and Sciences, **Sherri Morris**, Associate Professor of Biology, and **Michelle Edgcomb**, Instructor of Biology—all of Bradley University **Project Kaleidoscope**

Creating Integrative and Interdisciplinary Environments

CS 3: Building the Mathematical and Statistical Skills of Undergraduate Students

Concerto Room B

There is widespread agreement that quantitative skills (QS) are essential for graduate competence and preparedness in science. Entering college students typically have weak foundations in, and strong negative beliefs toward, mathematics, so science curricula must evolve to ensure the quantitative preparedness of university graduates. In this session, participants will discuss 1) the challenges associated with integrating QS into courses and the broader undergraduate science curriculum; 2) models and strategies to build QS in science students; and 3) resources to support innovations in embedding QS into science curricula. This discussion is situated within the context of funded projects in which the facilitators are involved both in the U.S. and Australia.

Kelly E. Matthews, Lecturer of Higher Education—University of Queensland; **Katerina Thompson**, Instructor in Biology and Director of Undergraduate Research and Internship Programs—University of Maryland; **Shaun Belward**, Senior Lecturer and Discipline Head, Mathematics—James Cook University; and **Carmel Coady**, Senior Lecturer and Associate Head of School of Mathematics—University of Western Sydney

Creating Integrative and Interdisciplinary Environments

CS 4: Preparing STEM Teachers Using LEAP Principles and Practices

Picasso Room

The *Science and Math Education in ACTION* program is an innovative scholarship program for undergraduates interested in becoming math or science teachers in grades 4-12. Funded by the State of Ohio and the College of Education and Human Development and the College of Arts and Sciences at Bowling Green State University, the program has been a model of successful collaboration among faculty from across the university. The overarching goals of the program align with several AAC&U LEAP principles with specific attention to teaching the arts of inquiry, engaging in the "big questions," connecting knowledge with choices and action, and assessing students' ability to apply learning to complex problems. In this session, the presenters will provide details about the program and preliminary data from

two cohorts of students in the program. Session facilitators will engage participants in discussion about strategies for collaborating across colleges within a university; modifying courses to allow for inquiry-based, problem-based learning; and addressing challenges that participants have encountered at their own institutions.

Barbara Moses, *Director, Science and Math Education in ACTION; Professor and Bailey Endowed Chair in Mathematics—Bowling Green State University* **Liberal Education and America's Promise**

Enhancing Student Learning with Technology

CS 5: Enhancing STEM Learning for Women and Students of Color through Technology

Tenor Room

Enhancing student learning in STEM is a critical challenge for our nation and represents an ongoing challenge at liberal arts colleges. At Spelman College, a historically black college for women, approximately one-third of all students graduate in STEM, and the college has been ranked by NSF as the number four baccalaureate producer of African Americans who earn doctorates in STEM. One important component of Spelman's success in STEM is related to the continuous enhancement of academic programs through the use of technology in the classroom and coursework. The goals of this session are to 1) discuss the ways in which STEM faculty actively integrate technology into their classes to enhance student learning; 2) address the significance of these innovations for student retention in the STEM disciplines; and 3) discuss implications of increased use of technology in the classroom for increasing the numbers of underrepresented students in the STEM pipeline.

Lily D. McNair, *Associate Provost of Research*, **Terezinha C. Galvao**, *Associate Professor of Environmental Sciences and Studies*, and **Leyte Winfield**, *Associate Professor of Chemistry—all of Spelman College*

Enhancing Student Learning with Technology

CS 6: Take Out Your Cell Phones—It's Time for Class!

Soprano Room

The question of what to do about cell phone use in the classroom can vex even the most experienced educator. With 99.7% of students now owning cell phones and bringing them to class, technology bans are no longer effective at maintaining the integrity of our learning environments. The good news? Using the services of PollEverywhere, a web-based audience response system, educators can now engage and survey students during classroom discussion using their cell phones. In this session, attendees will: 1) learn about PollEverywhere; 2) participate in a live demonstration; 3) help create a new online survey; and 4) discover pros and cons to this strategy so they can determine how and when to try the technology in their own learning environments. This alternative to traditional clickers answers student complaints about buying, carrying, or losing the devices.

Beverly E. Amer, *Principal Lecturer, Accounting and Computer Information Systems—Northern Arizona University*

Scaling Up and Sustaining Pedagogies of Engagement

CS 7: The Role of Professional Development in STEM Teaching to Expand the STEM Pipeline

Symphony Room 1

STEM faculty members often teach as they were taught, yet most became dedicated to science through high-quality, context-specific interactions outside of traditional classrooms. This discussion will focus on ways to increase STEM faculty's use of high-impact practices. The presenters will share two professional development strategies that have been successful at their institution. The first is a "Fire-Up Week" that encourages faculty to adopt high-impact practices and assists them in doing so. The second is a professional development model connected to a sophomore-level undergraduate research program, which includes strategies for staffing and organization of research labs. Participants will consider how to adapt both programs to their home campuses.

Judith Kirkpatrick, *Professor of English*, **John Berestecky**, *Professor of Microbiology*, and **Kathleen Ogata**, *Professor of Chemistry—all of Kapi'olani Community College*

CS 8: LEAP: Turning Ideas into Action with AAC&U Resources

Concerto Room D

Liberal Education and America's Promise (LEAP) is AAC&U's campus action and public advocacy initiative designed to engage campus colleagues and the larger public in meaningful conversations about what really matters in college. In this session, the facilitator will review LEAP resources, principles, and practices guiding the campus action component of the campaign. Participants will discuss LEAP's goals and activities, with particular attention to efforts to ensure that all students—including those historically underserved by higher education—achieve essential learning outcomes. The conversation will include how institutions can use the campaign and the emerging national consensus around liberal education outcomes to guide educational planning and practice.

Susan Albertine, *Vice President, Office of Engagement, Inclusion, and Success—AAC&U*

9:15 – 10:15 A.M.

PLENARY SESSION

Symphony Room III & IV

Examining the Intersections of Race, Gender, Science, Society, and Politics in the United States

What roles do identity, culture, and politics play in the study of science, technology, engineering, and math on today's campuses? How do historical contexts and current campus climates influence hiring and support of faculty, student success, and production of knowledge in STEM fields? As a scientist; scholar; founding director of the MIT Center for the Study of Diversity in Science, Technology, and Medicine; and former Senior Vice Provost for Faculty Development and Diversity at Harvard University, Dr. Hammonds will offer reflections on these larger contexts and share findings and promising practices for creating campus cultures that support and advance faculty innovation and student success in STEM.

Evelynn Hammonds, *Dean of Harvard College, Barbara Gutmann Rosenkrantz Professor of the History of Science and of African and African American Studies—Harvard University*

10:15 A.M. – 10:45 A.M.

REFRESHMENT BREAK

10:45 A.M. – 12:15 P.M.

CONCURRENT SESSIONS

Expanding the STEM Pipeline

CS 9: A First-Year Experience Program for Transfer Students in STEM Majors

Picasso Room

Students who transfer from community colleges to STEM majors at four-year institutions face unique academic and developmental challenges including an accelerated timeline to become competitive for admission into the workforce or graduate school. Unfortunately, most traditional first-year experience (FYE) programs at four-year institutions do not address the needs of this population. This workshop will provide insight into how four-year colleges and universities can design, implement, and assess a transfer-student FYE program for STEM majors. The presenters will share Virginia Tech's example of this high-impact educational practice, highlighting the use of a SCALE-UP (student-centered active learning environment for undergraduate programs) design. They will also discuss assessment that has been undertaken based on the AAC&U VALUE rubrics to capture evidence of student learning, specifically transfer students' proficiency in problem-solving, information literacy, and integration of learning across fields. Participants will engage in a team-based, active-learning activity that simulates the experience with the outcome of identifying strategies that meet their own STEM transfer students' needs.

Jill C. Sible, *Associate Dean for Curriculum Instruction and Advising*, **Debbie Wilson**, *College Career Coordinator*, and **Gary Kinder**, *Coordinator of Transfer Student Programs—all of Virginia Polytechnic Institute and State University*

Creating Integrative and Interdisciplinary Environments

CS 10: Constructing an Effective Interdisciplinary, Inquiry-Based Science Course

Concerto Room A

Integrative science courses have the potential to attract and energize students in cross-disciplinary research and education at the beginning of their college career. Over the past two years, the presenters have developed inquiry-driven introductory courses for STEM students that incorporate mathematics, computing, biology, chemistry, and physics. These courses are constructed of stand-alone modules that

present the students with locally relevant research questions in a “laddered” curriculum, providing them with multiple opportunities to practice LEAP principles of excellence of inquiry and analysis, teamwork, and problem solving. The presenters will 1) describe their experience initiating a novel integrative science curriculum; 2) identify strategies for generating cooperation across disciplinary boundaries; 3) present models for designing inquiry-based courses reflecting the local academic culture; and 4) discuss strategies for overcoming institutional and historical barriers to interdisciplinary education. Participants will develop a framework for creating and implementing inquiry-based integrative science courses that complement existing academic programs on their home campuses.

Marcus D. Webster, Professor of Biology, **Adam Whitten**, Assistant Professor of Physics, and **Barbara May**, Assistant Professor of Biology—all of St. John's University and the College of St. Benedict
Liberal Education and America's Promise & Project Kaleidoscope

Creating Integrative and Interdisciplinary Environments

CS 11: Reacting to the Past: The Pluto Debate

Concerto Room C

The Reacting to the Past pedagogy, pioneered by Barnard College, consists of elaborate role-playing games set in the past and informed by classic texts. A well-tested tool for achieving the first LEAP essential learning outcome, knowledge of human cultures and the physical and natural world, Reacting to the Past is commonly used in writing-intensive, first-year seminars where students collaborate in factions to debate a “big question.” This pedagogy is now being expanded and modified for use in science classes. During this workshop, participants will play *The Pluto Debate: The International Astronomical Union Defines a Planet*. Participants may register in advance online (<http://bit.ly/PlutoPKAL2011>) to be assigned roles as astronomers arguing over Pluto's status as a planet and the definition of what constitutes a planet. They will then re-stage a 1999 debate that took place at the American Museum of Natural History. Finally, they will vote on the four resolutions proposed by the International Astronomical Union in 2006.

Tony Crider, Chair, Department of Physics, and **Megan Squire**, Associate Professor of Computing Science—both of Elon University
Liberal Education and America's Promise

Creating Integrative and Interdisciplinary Environments

CS 12: The Integration of Science and Art in the Core Curriculum

Concerto Room D

An integrative approach to STEM learning is central to Wheaton College's core curriculum, which connects numerous science courses to classes in the humanities and social sciences. This session will share an established model for an integrative studies program specific to STEM learning and its connection to the arts: the “Wheaton Connections” Curriculum, introduced in 2003. The facilitator will 1) describe several examples of connected courses in science and art; 2) recommend strategies for generating these integrated classes; 3) present learning goals for these connected courses; 4) lead participants through a simulated connected class; and 5) provide assessment tools.

Evelyn Staudinger, Associate Provost and Professor of Art History—Wheaton College, MA

Assessing STEM Learning

CS 13: The Role of Motivational Planning and Assessment in Creating Effective STEM Programs

Concerto Room B

Facilitators will showcase a professional development program on the importance of motivational planning and assessment in creating effective STEM coursework and programs. The workshop will begin with an introduction and review of motivational theories and constructs that matter the most in shaping student motivation and engagement. Participants will take part in an exercise addressing major motivational challenges that they face with students in their STEM courses and programs. The workshop will include motivational assessment tools used to evaluate the effectiveness of STEM interventions.

Kenneth Barron, Associate Professor of Psychology and Co-Coordinator, Motivation Research Institute, **Robert Kolvoord**, Professor of Integrated Science and Technology and Co-Director, Center for STEM Education Outreach, and **Chris Hulleman**, Assistant Professor of Graduate Psychology and Co-Coordinator, Motivation Research Institute—all of James Madison University

Assessing STEM Learning

CS 14: What are They Thinking and Why? Assessing Students' Ability to Use Scientific Principles

Symphony Room 1

Most educators have encountered students with persistent misconceptions about science. How can a list of common misconceptions be useful to an instructor? Workshop participants will work with a framework that utilizes student responses around a few key scientific principles to improve instruction. The framework organizes misconceptions and conceptual barriers (and thus, potential instructional breakthroughs) around three practices that biologists and other scientists often take for granted: tracing information, matter, and energy in systems. Participants will engage the framework in three ways: 1) to examine assessment items; 2) interpret student responses; and 3) organize content. This approach to assessment has been used in introductory biology courses across a range of institutions, from community colleges to research universities. Examples from chemistry and geology will also be provided.

Joyce M. Parker, Assistant Professor, Division of Science and Mathematics Education and **John Merrill**, Director of the Biological Sciences Program—both of Michigan State University

Scaling Up and Sustaining Pedagogies of Engagement

CS 15: Creating Highly Interactive Learning Environments for 10 or 1,000 Students

Tenor Room

The overarching goal of this session is to help participants learn to implement interactive learning strategies into their existing classrooms, whatever the size. For the past decade, members of the Center for Astronomy Education (CAE) have been conducting research on the effectiveness of classroom activities and instructional strategies designed to intellectually engage learners in introductory STEM classrooms. CAE's *Teaching Excellence Workshops*, developed through funding from NASA and the NSF, focus on improving the implementation skills and pedagogical content knowledge of college instructors. In this workshop, participants will work through research-validated interactive learning techniques ranging from questioning in the classroom to small-group collaborative activities. Interactive teaching methods will be modeled by both workshop leaders and participants. Active audience participation will be required—no, really, it will be fun!!

Edward E. Prather, Executive Director, Center for Astronomy Education and Associate Professor of Astronomy—University of Arizona

Scaling Up and Sustaining Pedagogies of Engagement

CS 16: The Role of Centers for Teaching and Learning in Improving Engineering Education

Soprano Room

Many higher education institutions have a center for teaching and learning whose mission is to advance teaching excellence, foster innovation, and translate educational research into practice. However, those centers may be underutilized by the faculty and schools they serve, due in part to strong allegiance to disciplinary societies. The presenters will report on recommendations from an NSF-funded project and national workshop on the role of teaching and learning centers in improving undergraduate engineering education. The session will offer insights and strategies gained from the project and include discussion on implementing the recommendations and applying them to other contexts and disciplines.

Terri A. Tarr, Associate Director of the Center for Teaching and Learning and **Stephen P. Hundley**, Associate Dean for Academic Affairs and Undergraduate Programs, Purdue School of Engineering and Technology—both of Indiana University-Purdue University Indianapolis

12:30 – 2:15 P.M.

LUNCHEON AND PKAL WORKSHOP

Symphony III & IV

separate registration and fee required

Connecting Scientific Trends and Student Learning

How are current trends in scientific research connected to student learning in and out of the classroom? Connecting the curriculum and co-curriculum to the latest discoveries in science is critical to effectively preparing students for work and life in this complex, technology-driven world. Participants will discuss how the latest advances in STEM can enhance undergraduate student learning and then develop a plan to connect their conference experiences to improving STEM education on their campuses.

Susan Elrod, Executive Director, PKAL—AAC&U; and **James M. Gentile**, President—Research Corporation for Science Advancement

*Expanding the STEM Pipeline***CS 17: Improving Science Education at the High School and Introductory College Levels***Concerto Room C*

Session facilitators will outline two projects designed to improve science education: the College Board's revision of Advanced Placement (AP) science courses and the NSF-funded Introductory Biology Project (IBP). AP science courses in biology, chemistry, physics, and environmental science are currently being redesigned using a knowledge-domain paradigm that emphasizes conceptual understanding and focuses on opportunities for students to develop and apply science practices through inquiry and reasoning. Using the redesigned 2012-2013 AP Biology curriculum as a model, the session facilitators will focus on the development of the new curriculum framework, the laboratories, and the AP exam. The IBP brings together instructors of basic college biology courses and those who teach subsequent courses in the curriculum to discuss how best to prepare future science students. Discussion will focus on how the lessons learned in redesigning the AP Biology curriculum and exam can be used to redesign college and university STEM curricula, inform the teaching of science, and improve alignment of high school and college courses.

Spencer A. Benson, Director, Center for Teaching Excellence—University of Maryland College Park; and **Gordon Uno**, Professor and Chair, Botany and Microbiology—University of Oklahoma Norman

*Expanding the STEM Pipeline***CS 18: Community Colleges: Paving the Way to STEM Success for Underrepresented Minorities***Soprano Room*

Sixty percent of the U.S. gross domestic product is driven by STEM-related occupations, and community colleges are at the center of two data points of critical importance to the economic future of the U.S. First, 44% of STEM baccalaureate-degree holders attend community college at some point in their careers. Second, the pathway to college degree completion for most underrepresented minority students begins at a community college. Session facilitators will guide a discussion regarding the current status of underrepresented minorities pursuing STEM degrees through two-year institutions. Models will include the Louis Stokes Alliance for Minority Participation at Georgia Perimeter College and the Tools for Success project at Miami Dade College. The facilitators will share several successful practices for improving the transfer rate of educationally disadvantaged students in STEM fields from two- to four-year universities. Participants will exchange ideas regarding institutional strategies, challenges, best practices, and lessons learned.

Guillermina Damas, Chair of the Department of Natural Science, Health and Wellness and **Cynthia Z. Conteh**, Project Director, Tools for Success—both of Miami Dade College; **Margaret H. Major**, Associate Professor of Biology, **Kouok K. Law**, Professor of Mathematics, and **Elizabeth A. Molloy**, Assistant Vice President of Academic Affairs—all of Georgia Perimeter College

*Expanding the STEM Pipeline***CS 19: A Transformative Paradigm of STEM Education***Picasso Room*

In order to increase the participation and graduation of students, especially from groups that are underrepresented in STEM professions, the University of Hawaii at Hilo has implemented a host of new programs and creative practices that widely promote student success. Session facilitators will provide accounts of actions, processes, and lessons learned from the successful implementation of faculty development, curriculum improvement, and faculty-mentored student research programs. Together with other administrative and facilities improvements, these programs have created dramatic institutional change and significant growth in the number of STEM majors over the past ten years. The facilitators will illustrate how these changes have occurred within an evolving campus climate that is more open to diverse cultural traditions, especially the Native Hawaiian culture.

Sonia Juvik, Professor of Geography and Environmental Studies and **Reni Ivanova**, Professor of Mathematics—both of University of Hawaii at Hilo

Creating Integrative and Interdisciplinary Environments

CS 20: Arts and Sciences, Sciences and Arts: The Mutual Integration of STEM and the Humanities

Concerto Room B

The Scientific Literacy curriculum at Lynn University was designed to encourage the integration of STEM disciplines with the humanities, arts, business, and the social sciences. This integration allows the curriculum to meet many of the AAC&U LEAP Essential Learning Outcomes and Principles of Excellence in an organic fashion. Courses focus on the interrelationship between the natural sciences and human social issues, such as intercultural issues and global interdependence. They do this by applying scientific method and knowledge to a set of societal “big questions.” The facilitators will present a curriculum model that encourages interaction across the disciplines, along with concrete examples of how this model produces interdisciplinary approaches to the sciences and opportunities to include STEM in other disciplines. Participants will workshop possible course offerings that combine STEM and non-STEM disciplines as well as strategies for overcoming barriers to implementation.

Katrina Carter-Tellison, Chair, *Dialogues of Learning and Chair, Center for Liberal Education*, **Gary Villa**, Associate Professor, *Biology*, and **Joseph Hall**, Associate Professor, *Anthropology*—all of Lynn University
Liberal Education and America’s Promise

Creating Integrative and Interdisciplinary Environments

CS 21: Evidence-Based Practices for Developing and Sustaining Interdisciplinary Learning

Concerto Room A

Session facilitators will describe the use of evidence-based practices in developing and sustaining an interdisciplinary undergraduate degree program in Human Biology. The facilitators will share the processes and evidence used to guide faculty in developing and implementing the program as well as assessment tools that have provided evidence of student learning and further delineated learning differences from students in strictly discipline-based programs. Participants will have the opportunity to collaboratively develop ideas for how to 1) make use of an evidence-based approach for course and curricular innovation; 2) employ assessment tools that support and inspire intentional and integrative learning; and 3) establish potential partnerships to support interdisciplinary teaching and learning objectives. The Human Biology Program’s inclusion in the PKAL/Keck Facilitating Interdisciplinary STEM Learning project and its use of the LEAP Essential Learning Outcomes to support and guide its evidence-based practices will also be discussed.

Whitney M. Schlegel, Associate Professor of *Biology and Founding Director Human Biology*, and **Craig E. Nelson**, Professor Emeritus of *Biology*—both of *Indiana University Bloomington*; **Jennifer L. Eastwood**, Postdoctoral Associate in *Science Education*—*University of Florida* **Project Kaleidoscope**

Assessing STEM Learning

CS 22: Teaching-as-Research Fellows: Encouraging Scientific Teaching

Tenor Room

The Teaching-as-Research Fellows program at Vanderbilt University, sponsored by the Center for the Integration of Research, Teaching, and Learning (CIRTL), has helped current and future STEM faculty develop their abilities to assess and evaluate student learning. Supported by faculty mentors and CIRTL-affiliated staff, graduate student fellows conduct “teaching-as-research” (TAR) projects that explore aspects of undergraduate education. The fellows gain assessment skills useful in their future faculty work, the undergraduate curriculum benefits from the innovations developed through the fellows’ projects, and the faculty mentors learn more about assessment practices along the way. Participants will learn about the program and discuss how to develop similar programs on their campuses.

Derek Bruff, Assistant Director, *Center for Teaching and Lily Claiborne*, Graduate Student, *Earth and Environmental Science*—both of *Vanderbilt University*

Assessing STEM Learning

CS 23: Creating a Common Assessment for an Interdisciplinary Science Program

Symphony Room 1

Session facilitators will share performance outcomes of and approaches to assessing an interdisciplinary science program at a small liberal arts college. The presentation will focus on the challenges of creating universal outcomes that apply across the scientific disciplines and describe the process for assessing students’ interdisciplinary thinking. Participants will be asked to reflect on the role that interdisciplinarity

plays in their own courses and to work in small groups to discuss ways in which interdisciplinary thinking might be assessed within more traditional course frameworks.

David L. Morgan, Assistant Professor of Physics, **Bhawani Venkataraman**, Chair, Department of Natural Sciences and Mathematics, and **Jennifer Wilson**, Assistant Professor of Mathematics—all of Eugene Lang College at The New School

Scaling Up and Sustaining Pedagogies of Engagement

CS 24: Designing Faculty Development Workshops to Enhance STEM Student Learning

Concerto Room D

New faculty members in both two-year and four-year institutions face a number of obstacles to being effective teachers, including high research demands and low expectations for professional growth in teaching. This session will highlight two faculty development workshops sponsored in part by the American Association of Physics Teachers (AAPT) that are specifically designed to improve undergraduate STEM education. The presenters will disseminate models designed to improve the way that physics and astronomy are taught at the undergraduate level. The presenters will also highlight ways in which the workshops expose participants to successful pedagogies through sessions on instructional strategies and materials related to promoting student engagement.

Beth A. Cunningham, Executive Officer—American Association of Physics Teachers; **Robert Hilborn**, Professor and Program Head—University of Texas at Dallas; and **Mary Beth Monroe**, Department Chair—Southwest Texas Junior College

4:00 – 5:15 P.M. CONCURRENT SESSIONS

Expanding the STEM Pipeline

CS 25: Advancing Careers in Teaching STEM through Multi-Institution Partnerships

Soprano Room

This session explores a partnership between seven institutions to offer an alternative teacher licensure program. The Alternative Careers in Teaching program (Act!) focuses on increasing the number of math and science teachers in Northeastern Wisconsin. Act! recruits non-traditional, highly qualified individuals with a bachelor's degree or higher to transition from careers as mathematicians and scientists to careers as K-12 educators. The presenters will share administrative challenges faced by the partner institutions in designing and implementing this program. They will discuss how the program addresses AAC&U LEAP Essential Learning Outcomes and Principles of Excellence, including connecting knowledge with choices and actions and applying learning to complex problems. Participants will be invited to share experiences from other alternative licensure programs and work through challenges faced by these programs and the students who participate in them.

Michael E. Beeth, Professor, Co-Coordinator of the Act! Program—University of Wisconsin-Oshkosh, and **Tammy J. Ladwig**, Assistant Professor, Co-Coordinator of the Act! Program—University of Wisconsin Colleges-Fox Valley

Liberal Education and America's Promise

Expanding the STEM Pipeline

CS 26: Career and Community Connections for STEM Student Success

Symphony Room 1

The robust, adaptable, and innovative science sector of the future depends on strategic approaches that will help a diversity of students successfully enter the workforce. However, students from economically disadvantaged backgrounds and traditionally underrepresented groups 1) often lack the support and guidance needed to explore STEM careers; 2) gain relevant work experience while in college; and 3) secure high-level employment after graduation. CoyoteCareers, a Title V grant-funded program, addresses these needs through an innovative collaboration between service learning (an academic affairs program), career development (student affairs), and alumni affairs (university advancement) offices. This integrated approach has produced measurable results for underrepresented STEM students. Session participants will learn how this program has increased student interest, participation, and achievement in

STEM fields by addressing barriers to student success, and how the Chancellor's Office will replicate the CoyoteCareers program throughout the 23-campus California State University system.

Erika F. Randall, Coordinator, (STEM)2 Learn and Serve Program—California State University System Office; **Rebecca Eddy**, President—Cobblestone Applied Research & Evaluation, Inc.; **Diane Podolske**, Director, Service Learning, **Carol Dixon**, Interim Director, Career Development Center, and **Pamela Langford**, Director, Alumni Affairs—all of California State University-San Bernardino

Creating Integrative and Interdisciplinary Environments

CS 27: A Multi-Institutional Study of Interdisciplinary Teaching and Learning in STEM

Concerto Room A

What does interdisciplinary learning in STEM look like? Aren't there as many goals and pedagogies as there are courses? Session facilitators will present initial results from a five-college (Carleton, Grinnell, Hope, St. Olaf, and Whitman) study of science-rich interdisciplinary courses. Interview data, faculty/student survey results, and scholarship of teaching and learning investigations have led to the first major finding: a framework for thinking about, organizing, and assessing science-rich interdisciplinary learning. The framework will be used to show how very different interdisciplinary courses share common traits. The survey results also show distinctly different characteristics of student learning for disciplinary and interdisciplinary courses. Participants will use their own experiences to analyze the survey that was used in this study and discuss the goals for a consensus framework.

Joanne L. Stewart, Professor of Chemistry—Hope College; **Tricia Ferrett**, Professor of Chemistry—Carleton College; **Jim E. Swartz**, Dack Professor of Chemistry—Grinnell College; and **Whitney M. Schlegel**, Associate Professor of Biology—Indiana University Bloomington **Project Kaleidoscope**

Creating Integrative and Interdisciplinary Environments

CS 28: Integrative and Interdisciplinary STEM Programs for All Undergraduate Students

Concerto Room D

Otterbein University has successfully capitalized on four grant-funded opportunities to develop robust integrative and interdisciplinary STEM programs for all undergraduate students. The presenters will share how these grant funded projects have influenced Otterbein's unique STEM programs. Features include: 1) an Integrative Studies program with linked interdisciplinary courses for all students (majors and non-majors); 2) an established summer interdisciplinary undergraduate research program funded through the Merck foundation; and 3) targeted scholarships combined with an enhanced interdisciplinary co-curricular program for incoming students. These efforts have yielded a rich STEM curriculum and co-curriculum that impacts every student at Otterbein. Participants will discuss how to create programs that are competitive for external funding and how to use these funds to build faculty and administrative support for collaborative projects.

Amy Jessen-Marshall, Dean of University Programs, Interim Provost and Vice President for Academic Affairs, Associate Professor of Biology and Earth Sciences and **Joan Esson**, Associate Professor of Chemistry—both of Otterbein University

Creating Integrative and Interdisciplinary Environments

CS 29: Implications of the Scientific Foundations for Future Physicians Report

Concerto Room B

This session will explore the implications for undergraduate education of the competency-based curriculum framework presented in the Howard Hughes Medical Institute-American Association of Medical Colleges Scientific Foundations for Future Physicians Report (SFFP) report. The discussion is intended to inform, identify questions and concerns, as well as build collaborations across institutions interested in responding to the report. Copies of the report will be available.

Katerina V. Thompson, Director of Undergraduate Research and Internship Programs—University of Maryland College Park; **Michael Gaines**, Professor and Assistant Provost of Undergraduate Research and Community Outreach—University of Miami; and **Susan Elrod**, Executive Director, PKAL—AAC&U

Assessing STEM Learning

CS 30: Improving STEM Learning: Promising Practices for Assessing Teaching and Learning

Concerto Room C

This session examines three complimentary and effective instruments for assessing and improving STEM teaching and learning. The past several decades of research on STEM learning have emphasized the importance of active, inquiry-based, and learner-centered pedagogies. Accordingly, instructors need instruments for assessing learning and evaluating teaching that are well aligned with those practices. Participants will learn how knowledge surveys, consisting of detailed learning outcomes for a course (Nuhfer, 1993), provide detailed information to the instructor about student prior knowledge, learning gains, and effectiveness of instructional methods. Participants will also see how these surveys serve as a study guide and self-assessment tool for students. Another instrument that will be discussed is the extensively researched IDEA Student Ratings of Instruction instrument which uses student progress on relevant learning objectives, and the instructional methods that support them, to appraise and improve instructional effectiveness. Finally, participants will see how the classroom-learning environment can also be examined using the RTOP (Reformed Teaching Observation Protocol; Sawanda et al., 2002), which characterizes the degree of pedagogical reform, from lecture and teacher-centered to inquiry-based and student-centered, in STEM courses.

Karl Wirth, Associate Professor of Geology—Macalester College

Assessing STEM Learning

CS 31: Multi-Method and Layered Assessment to Document Learning in New Science Curricula

Tenor Room

Scholars have made the case that student competency in making scientific arguments is best developed by utilizing inquiry-based approaches that allow for the investigation of scientific questions and application of research results. In addition, research-based laboratory courses emphasizing exploration and experimentation as a process of discovery are a necessary and important tool to recruit and retain students into challenging science disciplines (Project Kaleidoscope, 2002; NRC, 1996, 2003). The purpose of this session is to discuss two innovative discovery-based learning courses and the layered assessment strategies used to identify positive changes in knowledge and skill development. Session facilitators will 1) outline innovative science curricula both at the lower- and upper-division levels that utilize inquiry-based approaches; 2) present multiple methods used to assess learning in the inquiry-based courses; 3) discuss how the findings were used to improve the curriculum; and 4) engage participants in thinking about how these efforts could be applied to their own campus contexts.

Marc Levis-Fitzgerald, Director, Center Educational Assessment, **Erin Sanders**, Professor, Department of Microbiology, Immunology, and Molecular Genetics, and **Deb Pires**, Academic Administrator, Life Science Core—all of University of California-Los Angeles

Scaling Up and Sustaining Pedagogies of Engagement

CS 32: Strengthening Institutional Commitment to STEM Teacher Preparation and Education

Picasso Room

This session will focus on lessons about institutional change and commitment to STEM education and STEM teacher preparation that have been learned through The Leadership Collaborative (TLC), an NSF-funded project at the Association of Public and Land-Grant Universities (APLU). The TLC is part of APLU's Science and Mathematics Teacher Imperative, the largest STEM new teacher initiative in the country. Drawing on findings from workshops and retreats, institutional plans, and institutional surveys over the past two years, presenters will share lessons learned about engaging institutional leaders, building institutional infrastructures, improving pedagogical instruction, restructuring faculty appointments, and changing faculty rewards systems to support STEM education. The focus of the session will then broaden to engage participants in identifying their own institutional challenges and strategies associated with STEM education, and the extent to which their own experiences resonate or differ from findings among TLC institutions.

Jennifer Frank, Project Consultant, **Nancy Shapiro**, Project Consultant, and **Jennifer Presley**, Senior Fellow, Science & Mathematics Teacher Imperative, and Co-Principal Investigator, The Leadership Collaborative—all of Association of Public and Land-Grant Universities

6:00-8:00 P.M. PROJECT KALEIDOSCOPE DINNER

Fish Market, Lobby Level

This is a ticketed event, please inquire about availability at the conference registration desk.

SATURDAY, MARCH 26, 2011

7:30 – 8:30 A.M.

CONTINENTAL BREAKFAST

Overture Foyer

Participants may visit the continental buffet and take their breakfast to the session of their choice.

8:00 – 9:00 A.M.

CONCURRENT SESSIONS

Expanding the STEM Pipeline

CS 33: The Douglass Project: 20 Years of Programs of Success for Women in Science

Concerto Room D

Colleges and universities across the country are pursuing initiatives to promote and retain women in STEM majors. The Douglass Project, founded more than 20 years ago, created the first living/learning community in the nation for women interested in the sciences, a pre-college summer science program, a successful outreach program that partners with the local school system, and an undergraduate scholarship/enrichment program. This session will concentrate on best practices for advising and mentoring women in STEM and will include presentation and discussion of data about how the Douglass Project has increased women students' interest, participation, and achievement in STEM fields across the university. The facilitator will highlight how she repositioned the program within the university by creating programs that include networking, increased faculty and alumnae involvement, career workshops, one-on-one advising, and other enrichment programs. The discussion will allow participants to raise questions about generating university and faculty support for these initiatives, obtaining funding for such initiatives, and engaging students in their own academic success.

Regina Riccioni, Assistant Dean/Director of the Douglass Project for Rutgers Women in Math, Science, and Engineering—Rutgers the State University of New Jersey, New Brunswick Campus

Creating Integrative and Interdisciplinary Environments

CS 34: New Views of Integrative Learning and Interdisciplinarity

Tenor Room

The facilitator will lead a discussion of the meanings of integrative and interdisciplinary learning and invite participants to push past their current understanding of these terms to imagine creative and transgressive possibilities for teaching and learning. Examples of emerging work in integrative public health will frame but not delimit the discussion.

Susan Albertine, Vice President of Engagement, Inclusion, and Success—AAC&U

Creating Integrative and Interdisciplinary Environments

CS 35: Developing an Interdepartmental Discipline-Based Educational Research Group

Concerto Room C

As new pedagogical strategies are increasingly employed in STEM classrooms, there is a growing need to evaluate the efficacy of these strategies and to research the ways in which student learning and cognition can be more effectively developed. While a handful of established discipline-based educational research groups can be found within specific notable departments, the creation of a such a group can seem to be beyond the will or means of most individual STEM departments. In this session, the facilitators will discuss the development of a Science and Mathematics Educational Research Collaborative at the Rochester Institute of Technology. Participants will explore the possibilities and barriers that exist on their respective campuses and develop an action plan for development of similar structures at their home institutions. Time will also be allotted for networking opportunities for participants who are personally interested in educational research but may lack broader institutional interest.

Scott V. Franklin, Associate Professor of Physics, **Dina Newman**, Assistant Professor of Biological Sciences, and **Sophia Maggelakis**, Dean of the College of Science—all of Rochester Institute of Technology

Assessing STEM Learning

CS 36: Assessment of Students' Science Learning in Extra-Classroom Settings

Concerto Room A

This facilitated discussion will examine assessment practices in non-traditional, extra-classroom settings, such as intensive field learning, service learning, independent research projects, and internships. Specific focus will be given to how these practices diverge from traditional assessment practices and how the results can be of use in program evaluation. Participants will review assessment and evaluation practices in a variety of extra-classroom settings, including challenges particular to these educational environments. The session will provide an overview of rubric construction in relation to learning goals in extra-classroom settings, with the application of rubrics to field-based learning presented as a case study. The session will facilitate participants' construction or analysis of their own rubrics through roundtable discussions and conclude with a general discussion of the application of these techniques in participants' home settings. The session aligns with several of AAC&U's Principles of Excellence in providing students with detailed information on their personal development of the knowledge, skills and dispositions of their chosen field and in helping them to be in constant discourse with their prior knowledge and development of metacognitive skills that can be applied to novel and changing professional situations.

Eric J. Pyle, Associate Professor of Geology and **Steven J. Whitmeyer**, Associate Professor of Geology—James Madison University **Liberal Education and America's Promise**

Enhancing Student Learning with Technology

CS 37: Creating Global Classrooms: The Center for Global Geography Education Project

Symphony Room I

The Association of American Geographers' Center for Global Geography Education (CGGE) is an innovative, online collection of geography course modules for undergraduate education. CGGE currently offers six modules: Global Economy, Migration, Population and Natural Resources, Global Climate Change, Water Resources, and National Identity. Each CGGE module features a set of regional case studies, student activities, and collaborative projects that use the Moodle e-learning platform to connect geography classes internationally. The facilitators will lead discussion on how these modules may be used in undergraduate curricula and share lessons learned from the development and implementation of the modules.

Kevin Hovland, Director of Global Learning and Curricular Change—AAC&U; and **Michael Solem**, Educational Affairs Director—Association of American Geographers

Scaling Up and Sustaining Pedagogies of Engagement

CS 38: Using Regional Pedagogical Communities to Improve STEM Learning Environments

Concerto Room B

Project Kaleidoscope (PKAL) has created five regional networks to support institutionalization of pedagogical reform in STEM disciplines. This work was based on the hypothesis that regional networks lead to more rapid dissemination and adaptation of research-based STEM pedagogical approaches than isolated efforts. In this session, the facilitators will: 1) share a set of lessons learned from the national pilot study and 2) use a case study to explore challenges encountered in building a regional network. The case study will be based on experiences establishing the Willamette Valley Biological Education Network (WVBEN). WVBEN's goal is for their efforts to be collaborative, based on evidence about students learning, and sustained over time. Participants will apply the national lessons learned to the case study and share their own experiences related to forming sustainable, collaborative communities of practice across institutions.

Marlene Moore, Dean, College of Liberal Arts, and **Barbara Stebbins-Boaz**, Associate Professor of Biology—both of Willamette University; and **Jeanne L. Narum**, Director—Independent Colleges Office **Project Kaleidoscope**

Scaling Up and Sustaining Pedagogies of Engagement

CS 39: Engaging Students in Biotechnology Research

Picasso Room

Twenty-four years ago, chemistry and biology faculty worked as a group to incorporate molecular biology and genetic engineering techniques into California State University classrooms and research laboratories. Today, the CSU Program for Education and Research in Biology (CSUPERB) supports over 250 faculty

and 450 students from 22 campuses annually through its grants programs and meetings. CSUPERB recognizes the best way to engage, retain, and graduate students in biotechnology-related disciplines is to provide access to and opportunities in real-world research settings. In this session, the facilitators will share lessons learned in 1) scaling-up an engaged faculty community at primarily undergraduate institutions and 2) keeping the program both relevant and cutting-edge while also maintaining the infrastructure and administrative leadership needed to sustain the program. Participants will explore the importance of and barriers to involving faculty and administrators from multiple disciplines, along with external industry partners, to engage, retain and graduate STEM students.

Susan Baxter, Executive Director, CSUPERB—California State University System Office; **Robert Koch**, Interim Dean, College of Natural Sciences and Mathematics—California State University-Fullerton; and **Michael Goldman**, Professor and Chair, Biology—San Francisco State University

9:15 – 10:45 A.M. CONCURRENT SESSIONS

Creating Integrative and Interdisciplinary Environments

CS 40: Developing Sustainable STEM Programs One Innovative Course at a Time

Concerto Room B

There are many active national and state-level conversations concerning improving science education in order to better prepare students to be STEM-literate citizens. In response, Georgia College (GC) has implemented the Science to Serve Initiative, a grass-roots, interdisciplinary initiative comprised of activities and programs that connect issues of social relevance to STEM courses. After learning about the GC model, participants will brainstorm strategies for designing sustainable, innovative STEM programs at their institutions through one of four break-out conversations. In the process, they will 1) examine methods for connecting issues of social relevance to STEM courses; 2) address common resource and institutional obstacles; and 3) explore designs that advance their own goals for connecting social issues to STEM courses and programs. The workshop will be tailored to faculty and administrators from community colleges, liberal arts colleges, and comprehensive universities.

Rosalie A. Richards, Director of the Science Education Center and Professor of Chemistry, **Julia K. Metzker**, Associate Professor of Chemistry, and **Caralyn B. Zehnder**, Assistant Professor of Biology, and **Y. Ellen France**, Assistant Professor of Biology—all of Georgia College

Creating Integrative and Interdisciplinary Environments

CS 41: Connecting Science with Society through Interdisciplinary Curricula

Concerto Room A

This workshop will feature an innovative undergraduate degree program in Interdisciplinary Science developed at Eugene Lang College. The objective of the program is to offer an undergraduate degree program that is scientifically and mathematically rigorous yet encourages exploration of STEM principles and methods in the context of current social issues. Students explore the connections between science and society by 1) engaging with contemporary issues such as stem cell research, clean-water access, alternative energies, and nanotechnology; 2) tracing the historical trajectory of scientific fields of study; and 3) connecting science to disciplines such as music and theater. In this session, the facilitators will share the curriculum design and learning objectives as well as examples of courses that demonstrate ways in which fundamental principles in physics, chemistry and biology are taught through interdisciplinary problems and issues. Participants will review samples of student work as evidence of student learning and take part in an exercise where they will integrate relevant, interdisciplinary topics or problems into “traditional” STEM courses in the major.

Bhawani Venkataraman, Associate Professor of Chemistry, **Katayoun Chamany**, Associate Professor of Biology, and **David Morgan**, Assistant Professor of Physics—all of Eugene Lang College at The New School

Assessing STEM Learning

CS 42: Putting Assessment Evidence into Action at the Department and Course Level

Concerto Room C

Many institutions have rich stores of assessment evidence that never make it to the faculty in a form that allows for reflection and action. Facilitators from Wofford College will help participants brainstorm ideas to remedy this all-too-common problem. Participants will work in groups to discuss actual assessment

results from the National Survey of Student Engagement and the Student Assessment of Learning Gains to identify department- and course-level successes and areas of concern. They will then formulate action plans for improvement. At Wofford, such work has generated positive energy and enthusiasm about assessment—a topic that used to generate groans and eye-rolling. When blended with direct assessment evidence, such indirect (survey) data can give educators a more holistic view of students' learning environments and outcomes—and help guide continuous improvement.

Ellen S. Goldey, *William R. Kenan Jr. Professor and Chair of Biology—Wofford College*

Assessing STEM Learning

CS 43: Assessing Complex and Interdisciplinary STEM Majors

Tenor Room

Developing and implementing assessment programs for complex and interdisciplinary STEM programs is challenging because it can be difficult to define specific measurable learning objectives unique to students in these programs. A first step in developing such an assessment program may be to ask the question, “What unique qualities and skills are expected of a student graduating from this program?” This workshop will highlight assessment processes that address these challenges, based on the experience of developing and implementing assessment programs in James Madison University's biology major and interdisciplinary biotechnology major. Participants will write actionable learning objectives, evaluate tools for assessing program goals, and identify potential challenges and strategies to overcome these challenges. Participants will develop assessment strategies for their own STEM programs and leave with an action plan for implementation, including how assessment will support student learning goals.

Marta K. Bechtel, *Assistant Professor of Biology* and **Kyle Seifert**, *Associate Professor of Biology—both of James Madison University*
Project Kaleidoscope

Scaling Up and Sustaining Pedagogies of Engagement

CS 44: Project Kaleidoscope Summer Leadership Institutes: Leaders Preparing Leaders

Picasso Room

This session will present information on the PKAL Summer Leadership Institute (SLI). The SLIs are designed to offer STEM faculty members an extended opportunity to experience “what works” in leadership development as they set a professional course for their future. The facilitators will describe the SLI structure, discuss the way in which the institute has evolved, highlight the institute's impact on faculty careers, and engage participants in shaping future plans. Much of the session will engage the audience in modeling the techniques used during the SLI.

Judith Dilts, *Associate Dean, College of Science and Mathematics, and Interim Head and Professor of Biology* and **Sylvia Nadler**, *Visiting Professor, College of Science and Mathematics—both of James Madison University*; **Jessica Young**, *Associate Vice President for Academic Affairs—Western State College of Colorado*; and **Beth A. Cunningham**, *Executive Officer—American Association of Physics Teachers*
Project Kaleidoscope

Scaling Up and Sustaining Pedagogies of Engagement

CS 45: Reaching and Teaching Students Using Data Visualization

Symphony Room 1

This session will explore how technology can allow students to learn in ways not possible in traditional face-to-face settings. Participants will investigate things up close (with virtual microscopes) and then see the big picture (using GIS software). Tapping into higher-order thinking skills, these approaches to data visualization and analysis have been integrated into college and K-12 STEM teaching. After providing examples of college-level integration, session facilitators will share the ways in which they have collaborated with high school teachers. Participants will learn how to access the tools and will be able to describe at least one related teaching strategy applicable to a course they are teaching or plan to teach. Finally, participants will discuss leadership opportunities available through these projects, both in terms of the development and integration of tools for STEM and in terms of the creation of K-12 partnerships.

Laura Blasi, *Director of Research and Evaluation—Saint Leo University*; and **Bob Kolvoord**, *Professor, Integrated Science and Technology and Educational Technologies—James Madison University*

STEM and the Liberated Mind

From pandemics to pollution, many of the great problems facing us today emerge out of the complex and often competing demands of society, technology, and the natural world. Innovations in STEM, in particular, can both contribute to and help to solve these problems—and innovative solutions can sometimes lead to greater problems in the long run. In this plenary address, Dr. Duncan will argue that a foundational understanding of science and mathematics embedded within a robust liberal education is essential to grapple with both the promise and the potential downsides of STEM innovation in the world. He will discuss opportunities and consequences for STEM education in shifting away from traditional discipline-based instruction toward a revised set of expected learning outcomes and an integrative, “across the disciplines” curricular approach.

Lewis Duncan, *President—Rollins College*