



23rd Biennial Conference on Chemical Education
Grand Valley State University, Allendale MI
August 3 – 7, 2014

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Preliminary Workshop Abstracts and Schedule of Workshops

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2014 BCCE Workshop Program

W1: A cCWCS Miniworkshop on Computational Chemistry for Chemistry Educators

Shawn C. Sendlinger, North Carolina Central University.
Elisabeth Bell-Loncella, University of Pittsburgh at Johnstown.
Clyde R. Metz, College of Charleston.

This workshop will explore various ways that computers can be used to enhance and expand the educational experience of students enrolled in the high school or undergraduate chemistry curriculum. Brief discussions and extensive hands-on laboratory exercises of web-based molecular modeling and visualization software will be presented. No previous expertise with computational chemistry is expected.

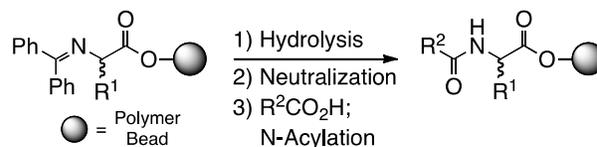
Intended Audience: HS/UG No fee; limit of 24 participants

Monday, August 4, 9:30 AM - 12:30 PM
Monday, August 4, 2:00 PM - 5:00 PM

W2: A Sophomore Organic Lab Research Experience: Distributed Drug Discovery (D3) for Neglected Diseases

Martin O'Donnell, Indiana University Purdue University Indianapolis.
Jacob Durrant, University of California, San Diego.
Ryan Denton, Indiana University Purdue University Indianapolis.
Kathleen Marrs, Indiana University Purdue University Indianapolis.
Geno Samaritoni, Indiana University Purdue University Indianapolis.
William Scott, Indiana University Purdue University Indianapolis.

This workshop will introduce essential elements of Distributed Drug Discovery. D3 labs enable student engagement in the fundamental research process of observation, hypothesis/prediction and experimentation utilizing computational, synthetic and biological testing lab modules. You will consider known drug leads for the possible treatment of Leishmaniasis, form hypotheses, and computationally select new analogs with potential drug activity. You will then carry out the synthetic steps shown to make these six new compounds using simple, robust, reproducible procedures, and inexpensive equipment. The polymer-bound products will be cleaved and analyzed off-site and the results from your six N-acylated unnatural amino acids will be provided following the symposium. You will also conduct a biological assay to screen potential antibacterials made in a student lab at IUPUI.



Intended Audience: UG \$25 fee; limit of 20 participants

Tuesday, August 5, 9:30 AM - 5:00 PM

W3: Adding a Reflective Process to a POGIL Implementation

Daniel Apple, Pacific Crest.

POGIL and Process Education have been in use for over 20 years by the leaders of the POGIL movement. The growth of transferable skills has always been at the heart of why POGIL produces better learning and growth. Pacific Crest has packaged its 25 years of reflective and self-assessment experiences into a Student Success Toolbox. A copy will be handed out to each participant. Workshop participants will discuss and practice ten of these tools contained in the toolbox (50 tools). Some of these tools include: reading methodology and reading log; engaged learner rubric and learning journal; self-assessment form and self-assessment rubric; team assessment form; concept map; Identify and Correct the Errors; Problem Solving Rubric; as well as others selected by the participants. Besides seeing samples of these forms, filling out a few of them, the workshop facilitator will model giving assessment feedback to improve the learner's performance in the use of these forms.

Intended Audience: HS/UG No fee; limit of 50 participants
Thursday, August 7, 9:30 am-12:30 pm

W4: Advanced IONiC/VIPeR: Using and Sharing Inorganic Chemistry Education Resources

Barbara Reisner, James Madison University.

Sheila Smith, University of Michigan-Dearborn.

Hilary J. Eppley, DePauw University.

Looking for a lively community of inorganic chemists who share teaching ideas and materials, support one another in grant writing and professional development, and laugh a lot? Or maybe you've already been to an IONiC workshop (Interactive Online Network of Inorganic Chemists) and want some time to upload new learning objects to the VIPeR site. VIPeR (the Virtual Inorganic Pedagogical Electronic Resource) is a website (www.ionicviper.org) that provides a platform to share content and materials for teaching inorganic chemistry, while building the IONiC community. In this advanced workshop, participants will focus on (1) writing and uploading a learning object, (2) enhancing collaboration between instructors, and (3) fostering virtual interactions with students using technology. Participants will explore the VIPeR forums, where a global audience of inorganic chemists discuss burning issues in inorganic teaching and research.

Intended Audience: UG No fee; limit of 16 participants
Tuesday, August 5, 9:30 am-12:30 pm

W5: AP Chemistry Inquiry and Forensic Laboratory Manual

Jesse Bernstein, Miami Country Day School.

Jeffrey Bracken, Westerville North High School.

Paul Price, Trinity Valley School.

Here is an AP lab workshop that will satisfy virtually all of your desires; over forty-five inquiry and forensic based lab activities that parallel those now recommended (or required) by the College Board. The available manual contains detailed teacher notes, pictures of setups and sample data and calculations. All experiments have been correlated to a primary learning objective(s) and science practices as outlined in the College Board Curriculum Framework for AP Chemistry. An appendix now lists additional questions (with answers) teachers can ask students either during a pre-lab session or a post-lab analysis. Participants will have an opportunity to do several of the experiments contained within the lab manual.

Intended Audience: HS/UG No fee; limit of 24 participants
Monday, August 4, 9:30 AM - 11:00 AM
Monday, August 4, 2:00 PM - 5:00 PM

W6: AP Chemistry: Guided Inquiry Labs Using Probeware

Thomas Loschiavo, PASCO Scientific.

Use the POGIL approach to turn a traditional activity into a guided-inquiry laboratory experiment. With PASCO's SPARKvue® data acquisition and analysis software, you will explore guided-inquiry labs based on the new Framework for AP Chemistry. Discover firsthand how your students can meet AP lab requirements while gaining a deeper understanding of the required content. The workshop will run for approximately 90 minutes. Two subsequent 90 minute workshops will run in one three hour block.

Intended Audience: HS/UG No fee limit of 24 participants

Tuesday, August 5, 9:30 AM - 11:00 AM
Tuesday, August 5, 11:00 AM - 12:30 PM

W7: Atoms, Molecules and Ions, Oh My! Particulate Level Chemistry Inquiry Activities

Debbie Herrington, Grand Valley State University.

Ellen Yeziarski, Miami University.

This workshop will focus on strategies for incorporating inquiry instruction into your classes with a particular focus on particulate level models. Workshop participants will be introduced to some of the particulate level modeling activities that teachers who have completed the Target Inquiry (TI) program at Grand Valley State University have developed and tested with their students. Topics include physical and chemical change, equilibrium, and balancing equations. Workshop participants will have the opportunity to work through these activities, discuss important considerations for facilitating the activities, and learn strategies for incorporating more inquiry into their own classroom activities. Participants will receive a class set of materials to conduct the activities highlighted in the workshop and will be introduced the Target Inquiry web site where they can access student and teacher guides for over 40 TI teacher designed and tested inquiry-based chemistry activities.

Intended Audience: HS \$40 fee limit of 30 participants
Tuesday, August 5, 9:30 AM - 12:30 PM

W8: Automotive Energy Needs and Environmental Impacts

Craig Donahue, University of Michigan-Dearborn.

Codruta Savu, University of Michigan-Dearborn.

The presenters teach a two-semester General Chemistry course to undergraduate engineering majors using the theme of Chemistry and the Automobile. This workshop will explore automotive energy needs (morning) and environmental impacts (afternoon). Participant breakout groups will be asked to identify specific examples related to these themes and to suggest ways of integrating them into the chemistry curriculum. This cycle will be repeated three times in the morning and afternoon. The three morning cycles will focus on traditional fuels, alternative fuels (e.g. biofuels, hydrogen, and natural gas) and on the pros and cons associated with the use of three batteries – the lead storage battery, the nickel metal hydride battery, and the lithium ion battery. The three afternoon cycles will focus on air pollution, other environmental impacts, and possible case studies. The presenters will provide feedback on how these topics are integrated into their courses and a list of useful resources.

Intended Audience: UG No fee limit of 24 participants
Wednesday, August 6, 9:30 AM - 5:00 PM

W9: Before, During and After Class Learning Cycle Activities

John Gelder, Oklahoma State University.

Tom Greenbowe, Iowa State University.

Michael R. Abraham, University of Oklahoma.

This workshop introduces the instructional tactics and materials of a technology-based inquiry-oriented instructional project. Examples of instructional materials to be used "before", "during", and "after" class meetings will be explored. The Before Class Exploration (BCE) is a web-based exercise that students do before class. The BCE requires approximately 15 minutes to complete and upon submission, students receive a copy of their responses and an expert's response for comparison. The instructor can access all student BCE responses prior to lecture to gain a better picture of the student's pre-existing knowledge. The During Class Invention (DCI) is designed to be completed by small cooperative groups or instructor led discussion. Students can report their consensus response using "clickers". The After Class Application (ACA) is a web-based set of questions that allow students to apply their knowledge of the concept introduced by the BCE and 'invented' by the DCI. The Project website is <http://genchem1.chem.okstate.edu/BDA/Topics.php>.

Intended Audience: HS/UG
Sunday, August 3,

No fee
2:00 PM - 5:00 PM

limit of 24 participants

W10: BeSocratic: A Formative Assessment System Designed to Recognize and Respond to Free-Form Student Input

Sonia Underwood, Michigan State University.

Melanie Cooper, Michigan State University.

Sam Bryfczynski, Clemson University.

"BeSocratic is a flexible web-based system that gives instructors the ability to elicit, capture, and respond to students free form responses to a wide range of questions and scenarios such as student-generated graphs, simple diagrams and gestures. While instructional technology can be an important component of any course, the limitations of the interface often limit the types of questions and interactions that can be offered. However, there is emerging evidence that having students generate graphs and representations by hand is an important step in learning.

This workshop will focus on the use of BeSocratic where participants will have the opportunity to explore BeSocratic's unique features by creating activities using the system and designing specific feedback for the various types of questions. Participants will need to bring their laptop to use during this workshop and will be provided with access to program for personal use.

Intended Audience: HS/UG
Monday, August 4,

No fee
2:00 PM - 5:00 PM

limit of 20 participants

W11: Building a Lab Manual

Steven Brown, University of Arizona

The workshop is designed for anyone who wants to create their own lab manual for use in their own classes but is unsure of how to proceed. It will begin with a review of the decisions that need to be made regarding the structure and content of the manual and then proceed to the dynamics of manual construction and experiment writing. Participants are asked to bring along an existing experiment they would like to be in their manual. It is expected that each participant will leave with one, usable experiment; a good idea of how to construct more and the basic structure of their future lab manual.

Intended Audience: UG
Sunday, August 3,

No fee
2:00 PM - 5:00 PM

limit of 24 participants

W12: Card Games to Teach Ionic Compound Nomenclature

Janet Coonce, Tennessee Tech University
Twannelle Majors, Tennessee Tech University.

In this workshop, participants will play a multi-level card game designed to help introductory chemistry students learn how to read and write the names and formulas for common acids and ionic compounds. The instructional materials were developed by the workshop organizers for use in their high school and college introductory chemistry courses. After watching a short, 10-min video about the game, workshop participants will divide into groups of 3-4 to play the game. Participants will be asked to critique the card game for use in different educational settings. At the end of the workshop, each participant will receive a complimentary laminated game set. The game set includes the instructional video and the easily-modified document files for reprinting and classroom use.

Intended Audience: HS/2Y No fee limit of 30 participants
Monday, August 4, 2:00 PM - 5:00 PM

W13: Caveman Chemistry

Kevin Dunn, Hampden-Sydney College.

Non-science students often approach chemistry with reluctance and trepidation. This workshop will explore a strategy for engaging students through a series of 28 hands-on chemical projects. We begin in the Stone Age, making fire by friction, arrowheads, and honey wine. We make a ceramic crucible from clay, spin yarn from wool, and extract potash from wood ashes. We smelt bronze in our crucible and dye our yarn with indigo. In later projects we make paper from hay, soap from fat, mauve dye from aniline, and photographs from egg whites and salt. Along the way we learn a history of chemical technology from the Paleolithic campfire, to the crafts of antiquity, to the alchemy of the Middle Ages, to the chamber acid and soda factories of the Industrial Revolution, to the multi-national chemical giants of the twentieth century. The registration fee includes the book, Caveman Chemistry.

Intended Audience: HS/UG \$30 fee limit of 30 participants
Tuesday, August 5, 9:30 AM - 12:30 PM
Tuesday, August 5, 2:00 PM - 5:00 PM

W14: cCWCS Miniworkshop: Food Chemistry

Sunil Malapati, Clarke University.
Subha Ranjan Das, Canegie Mellon University.
Elizabeth Pollock,
Richard Stockton College of New Jersey.

Exploring Chemistry through Food makes science fun and approachable to a student while providing an endless array of everyday examples to teach chemical concepts to Chemistry majors and non-majors alike. This mini-workshop will provide the participants with hands-on activities, demonstrations, discovery-based lessons, and small experiments that will focus on chemical transformations using food. Basic chemical concepts such as pH, color, nature of heat & energy will be explored in addition to cutting-edge molecular gastronomy techniques that will excite faculty and students alike. Participants will take home materials they can plug into various courses and labs.

Intended Audience: HS/UG \$20 fee limit of 24 participants
Monday, August 4, 9:30 AM - 12:30 PM
Monday, August 4, 2:00 PM - 5:00 PM

W15: cCWCS Miniworkshop: Teaching Basic Chemistry Through Artists' Materials

Patricia Hill, Millersville University.

Michael Haaf, Ithaca College.

Jennifer Mihalick, University of Wisconsin Oshkosh.

This workshop will provide college and university faculty with hands on experience and resources that combine the chemistry of artists' materials with the teaching of basic general organic and analytical chemistry principles. The workshop is a small slice of the intensive 5 day cCWCS Chemistry Collaborations Workshops and Communities of Scholars Chemistry of Art Workshop funded through a grant from the National Science Foundation NSF TUES Type 3 Project 1022895. The half day workshop will consist of 4-5 laboratory activities facilitated by cCWCS workshop alumni and leaders who have used these lab activities in their teaching. Activities may include light and color XRF analysis of paint and metals, metal etching and coloring and synthesis and use of indigo dye.

Intended Audience: UG	\$10 fee	limit of 24 participants
Wednesday, August 6,	9:30 AM - 12:30 PM	
Wednesday, August 6,	2:00 PM - 5:00 PM	

W16: ChemEd Xchange: Be A Contributor

Jon Holmes, University of Wisconsin Madison

Deanna Cullen

The Chemical Education Xchange (ChemEd X, www.chemedx.org) welcomes contributions to its growing body of articles, activities, blogs, media, and picks on topics of interest to teachers and learners of the chemical sciences. Contributors create new content, comment on existing content, and share resources and ideas through social media. In this workshop, we will provide training for those who wish to share their unique perspective with the ChemEd X community. Although everyone interested in the chemical sciences is welcome to participate at ChemEd X, we are seeking to involve chemistry teachers in the Xchange of ideas that are unique to the pre-college and two-year college arenas. Many changes are being introduced to early science education such as AP Chemistry reform and the Next Generation Science Standards (NGSS) and ChemEd X seeks to help teachers navigate through this sea of change.

Intended Audience: HS/UG	No fee	limit of 24 participants
Thursday, August 7,	9:30 AM - 12:30 PM	

W17 W17:Chemistry, Life the Universe & Everything (CLUE)

Melanie Cooper, Michigan State University.

Sonia Underwood, Michigan State University.

Michael Klymkowsky

"CLUE is a new NSF supported approach to general chemistry based on three learning progressions (structure, properties and energy). The curriculum was developed by answering five questions: 1. What do we want students to know? 2. In what order should they learn it? 3. What do students bring with them? 4. What materials are most appropriate for learning different concepts and skills? 5. How will we measure what students have learned?"

Participants in the workshop will answer these questions for their own institutional settings and their own students. In addition they will have the opportunity to work with the materials developed for the CLUE curriculum, including online beSocratic activities. Participants will also be provided with CLUE materials, including an electronic version of the text and student activities."

Intended Audience: UG	No fee	limit of 20 participants
Wednesday, August 6,	2:00 PM - 5:00 PM	

W18: ChemSource, the NGSS, and the Particle Nature of Matter

Mary Virginia Orna, College of New Rochelle.

Patricia Smith, Air Academy High School, CO (ret.).

In this workshop participants will identify, adapt, and develop classroom-ready templates and lesson plans allied with the NGSS (Next Generation Science Standards). They will select the basic material from the ChemSource module, Basic Chemical Reactions, and utilize the NGSS performance expectations for each grade level constructed by blending ideas from Science and Engineering Practices (Inquiry), Disciplinary Core Ideas, and Crosscutting Concepts. The templates will focus on the introduction of the particle nature of matter into middle school and secondary school chemistry instruction. The participants will learn the decision-making process for what they have to add or omit to existing activities to make them consistent with NGSS. In the process, participants will concentrate on answering three questions for their own grade level: (1) What should students know prior to instruction? (2) What characteristics must be common to learning activities? (3) How will I know if students have learned? And (4) How is this instruction alike and different from traditional instruction? The particle nature of matter and chemical reactions have been chosen for illustrative purposes because of their importance to chemistry education and emphasis in the NGSS which illustrates the development of a core concept or learning progression. Although the NGSS are utilized in this workshop, the process is useful for constructing any standards-based instructional materials. Participants will receive a packet of The New ChemSource material for use in the workshop and for future use. They will be able to exit the workshop with several viable lesson plans in their level of interest.

Intended Audience: HS/2Y

\$20 fee

limit of 30 participants

Wednesday, August 6,

2:00 PM - 5:00 PM

W19: ChemSource, the NGSS, and the Particle Nature of Matter

Mary Virginia Orna, College of New Rochelle.

Patricia Smith, Air Academy High School, CO (ret.).

In this workshop participants will identify, adapt, and develop classroom-ready templates and lesson plans allied with the NGSS (Next Generation Science Standards). They will select the basic material from the ChemSource module, Basic Chemical Reactions, and utilize the NGSS performance expectations for each grade level constructed by blending ideas from Science and Engineering Practices (Inquiry), Disciplinary Core Ideas, and Crosscutting Concepts. The templates will focus on the introduction of the particle nature of matter into middle school and secondary school chemistry instruction. The participants will learn the decision-making process for what they have to add or omit to existing activities to make them consistent with NGSS. In the process, participants will concentrate on answering three questions for their own grade level: (1) What should students know prior to instruction? (2) What characteristics must be common to learning activities? (3) How will I know if students have learned? And (4) How is this instruction alike and different from traditional instruction? The particle nature of matter and chemical reactions have been chosen for illustrative purposes because of their importance to chemistry education and emphasis in the NGSS which illustrates the development of a core concept or learning progression. Although the NGSS are utilized in this workshop, the process is useful for constructing any standards-based instructional materials. Participants will receive a packet of The New ChemSource material for use in the workshop and for future use. They will be able to exit the workshop with several viable lesson plans in their level of interest.

Intended Audience: HS/2Y

\$20 fee

limit of 30 participants

Wednesday, August 6,

9:30 AM - 12:30 PM

W20: Comparing Personally Written Test Items with ACS Exams Items

Tom Holme, ACS Exams Institute.

This workshop is designed to allow participants view the developing interface that will allow instructors to compare student performance on their own test items with national samples of student performances on ACS test items on the same topic. The comparison is based on the Anchoring Concepts Content Map (ACCM) for General Chemistry (JCE, 89, 721, 2012). 2000 test items from the past 20 years of general chemistry exams from ACS Exams have been aligned to the ACCM. The interface will help identify probably maps for an entered test item, allow the user to confirm a particular content area, and then provide comparison information about student performance. Feedback from participants will be used to provide features that will enhance the utility of this tool as it is developed. (Note this project is funded by the National Science Foundation.)

Intended Audience: UG No fee limit of 20 participants
Monday, August 4, 9:30 AM - 12:30 PM

W21: Constructing Stoichiometric Understanding Through LEGO®

Kenneth Hoffman, Rockyview Schools, Alberta, Canada.

Shirley Ng, Emery Collegiate Institute, Toronto, Canada.

"A 2012 survey of children's toy usage in the UK showed that 92% of 6 to 12 year old children play with LEGO® building blocks. Although LEGO® building blocks can be assembled in myriad structures there are a limited number of building rules that govern construction. Consequently, the use of LEGO® building blocks as a manipulative presents a powerful knowledge structure that can be readily applied to enhance student learning of stoichiometry.

This presentation will outline five hands-on activities that have been developed to leverage student fluency with LEGO® bricks to improve student learning of stoichiometry. The rationale for the use of LEGO® building blocks, the learning theory that underpins their utility and the precedence for them in chemical education will also be addressed."

Intended Audience: HS No fee limit of 30 participants
Tuesday, August 5, 9:30 AM - 12:30 PM

W22: Designing a Distance Learning Chemistry Lab Curriculum Using Carolina Investigations

Mark W. Meszaros, Carolina Biological Supply Company.

Help your online students learn the same critical science process skills as your classroom students. Carolina has transformed the hands-on labs you have used for years into distance learning labs that are reliable, safe, and affordable. Experience for yourself during this hands-on workshop how your students will easily learn the necessary lab skills and reinforce key concepts using Carolina Science Distance Learning kits. This workshop will last for one hour and fifteen minutes.

Intended Audience: HS No fee limit of 26 participants
Tuesday, August 5, 3:30 PM - 5:00 PM

W23: Designing Companion Computational Exercises to Enrich Traditional "Wet" Labs

Richard Lord, Grand Valley State University.

Mary Karpen, Grand Valley State University.

Christopher Lawrence, Grand Valley State University.

Have you ever wanted a computational module as part of one of your existing experimental labs? Students often have a disconnect between the macroscopic observations in the "wet" lab and what is happening at the microscopic, particulate level. We have found over the past 15 years that a student's experience in physical chemistry lab is significantly enriched by pairing related computational and experimental laboratories. In this workshop we will discuss strategies for designing such laboratories for not only physical, but also general, organic, inorganic, and biochemistry labs. We encourage participants to contact us ahead of time with specific experimental labs that could benefit from a computational component. During this workshop you will work with several computational chemistry experts to design your own computational lab.

Intended Audience: HS/UG

No fee

limit of 24 participants

Wednesday, August 6,

2:00 PM - 5:00 PM

W24: Developing a Thematic Approach to Teaching Organic Chemistry Courses

Paul Morgan, Butler University.

We all want our students to develop and use a broadly applicable base of organic chemistry knowledge, and we all know it's not easy to do. As an expert in organic chemistry your knowledge is broadly based and can be used reliably and flexibly to rationalize plausible answers to novel problems. How can we transfer these abilities to others? The group work in this workshop will be focused on helping you to explore your problem solving process and turn it into a process you can verbalize, teach to others and use to design effective assessment. My approach is to: 1) identify widely applicable concepts or themes within organic chemistry 2.) map them to content across the course(s) 3.) turn these concepts into recurrent themes within your course(s) 4.) hold students accountable to properly and flexibly apply these concepts on assessments

Intended Audience: UG

No fee

limit of 25 participants

Thursday, August 7,

9:30 AM - 12:30 PM

W25: Energy in Chemistry: From the Macroscopic to the Particulate Levels

Marta Gmurczyk, American Chemical Society.
Julie Andrew, University of Colorado,
Bonnie Bloom, Hilliard Davidson High School,
Shelley Belleau, Mapleton Expeditionary School of Art,
Chad Bridle, Grandville High School,
Alice Putti, Jenison High School,
Vicente A. Talanquer, University of Arizona,
Michael Tinneland, Science Consultant.

"Energy is a cross-cutting concept in all science disciplines and can be used as a framework in chemistry to help students understand the properties and behavior of substances at multiple levels. This is the first session of a two-part workshop designed to analyze, discuss, and reflect on diverse instructional strategies that actively engage students in thinking about energy issues in chemistry at the macroscopic, particulate, and atomic levels, using multiple representations. We will also illustrate how to diagnose and formatively assess student understanding. In this first session of the workshop participants will actively engage in design and modeling activities that can help students deepen their conceptual understanding about energy, heat, and temperature in macroscopic systems, and kinetic and potential energy of particles in models of matter developed to explain physical changes.

This workshop has been developed by the American Chemical Society (ACS) High School Chemistry Professional Development Leadership Group. "

Intended Audience: HS No fee limit of 50 participants
Monday, August 4, 9:30 AM - 5:00 PM

W26: Visualizing the Chemistry of Climate Change (www.vc3chem.com): A Hands-On Workshop Using Interactive, Electronic Learning Tools for Introductory University Chemistry

Lallie McKenzie, Chem 11 LLC.
Peter Mahaffy, Kings University College.
Marcy Towns, Purdue University.
Ashley Versprille, Purdue University,
Mary Kirchoff, American Chemical Society.
Brian Martin, Kings University College.

This workshop will explore new learning materials and pedagogical strategies to improve the link between core chemistry curricula and sustainability education, develop faculty expertise to place chemistry content in an interdisciplinary context, and use visualizations and case-based approaches to support an understanding of complex science. In 2014 the NSF-supported Visualizing the Chemistry of Climate Change (VC3Chem) project will release a set of free interactive learning tools to teach core chemistry concepts through the rich context of climate science. Participants in the workshop will investigate, test, and evaluate interactive web-based digital learning objects (DLOs) that connect climate literacy principles and core chemistry content. Specific topics include 1) isotopes and their relevance in determining historical temperature records, 2) IR absorption by greenhouse gases, 3) acid/base chemistry and impacts on changing ocean pH, and 4) thermochemistry and its role in combustion of fuels and the radiation balance of our planet.

Intended Audience: UG No fee limit of 24 participants
Tuesday, August 5, 2:00 PM - 5:00 PM

W27: Engineering-The Missing Piece of the Puzzle!

Greg Dodd, George Washington High School.

Join this “hands on” workshop and learn how to implement STEM instruction in the Chemistry classroom. Our present and future lives are dependent upon making America more competitive by training a STEM-educated work force. Presently, the STEM subjects are usually taught independently of each other. STEM Instruction must be cross-curricular and make use of 21st Century Skills and Technology. Most teachers have little difficulty integrating science, mathematics, and technology into their courses. The difficult piece of the puzzle is engineering. Many teachers misunderstand and fear engineering. This workshop focuses on Engineering Design-one of the NGSS Science and Engineering Practices. The goal of this workshop is to ease teachers’ concerns by their participation in a “hands on” STEM activity to understand how a colorimeter works and to design and use a simple colorimeter. Spectrophotometry is one of the areas now being emphasized in the AP Chemistry Curriculum. Handouts will be provided.

Intended Audience: HS No fee limit of 24 participants
Monday, August 4, 9:30 AM - 12:30 PM

W28: Experiential Chemistry: A Hands-On Laboratory-Based Course for Non-Majors

Marc Richard, Richard Stockton College of New Jersey
Elizabeth Pollock, Richard Stockton College of New Jersey.

This workshop will be a hands-on introduction to Experiential Chemistry, a course designed specifically for non-science majors. The approach used in this course reverses the traditional pattern of science education where early mastery of factual material is required before the students are allowed to explore the interesting problems. Students are first presented with a series of exciting experiments and are allowed to experience the excitement of chemistry. Unlike other non-majors course, Experiential Chemistry is taught exclusively in the laboratory, with no lecture component. This workshop will give participants a chance to explore many of the experiences developed for the course and to discuss how the course is implemented. Copies of the course text will also be provided.

Intended Audience: UG \$50 fee limit of 24 participants
Tuesday, August 5, 9:30 AM - 12:30 PM

W29: Exploring Great Lakes Issues

Richard Rediske, Grand Valley State University.

Explore and learn about Great Lakes Issues on a 2.5 hr cruise onboard the research Vessel, W.G. Jackson. Workshop participants will learn about important environmental issues concerning, water quality, harmful algal blooms, invasive species, and pollution from industrial, urban, and agricultural sources. The program will emphasize the interrelationships between physical and natural sciences and how interdisciplinary approaches are necessary to solve complex environmental problems. During the cruise, participant will collect and analyze water and sediment samples from Muskegon Lake and Lake Michigan. The chemistry of water pollution explored in context with its interaction with biologic, geologic, and atmospheric systems. Participants will be provided with many examples can that utilized in the classroom setting to link chemistry education to environmental issues that to a sustainable earth. A tour of the Annis Water Resources Institute will follow the cruise. Transportation to the site is included in the fee.

Intended Audience: HS/UG \$40 fee limit of 30 participants
Wednesday, August 6, 2:00 PM - 5:00 PM

W30: Exploring Vernier Instrumentation in the Chemistry Laboratory

Melissa Hill, Vernier Software & Technology.

This workshop will highlight experiments for advanced high school, general, and organic chemistry courses. The workshop will feature our popular handheld data-collection solution, LabQuest 2. You will also be able to view and analyze data collected on LabQuest 2 using Graphical Analysis for iPad, or on any device with a supported browser using Vernier Data Share. Rotate through stations to explore instruments including our new Vernier UV-VIS Spectrophotometer, SpectroVis Plus VIS-NIR Spectrophotometer with fluorescence capabilities, Mini GC Plus Gas Chromatograph, Vernier Melt Station, and Chemical Polarimeter. Appropriate for college and high school chemistry. This workshop will run for approximately 90 minutes.

Intended Audience: HS/UG	No fee	limit of 24 participants
Tuesday, August 5,	11:00 AM - 12:30 PM	

W31: From Teaching Props to Learning Tools: Exploring the Polar Nature of Water and Its Impact on Protein Structure and Protein Folding

Margaret Franzen, Milwaukee School of Engineering.

Colleen Conway, Mount Mary University.

Kimberly Dirlam-Schatz, University of Wisconsin – Fox Valley.

Heather Mernitz, Alverno College.

Molecular concepts are challenging for many students, both because of the new vocabulary and the inability to interact with invisible entities. Accurate physical models allow students to experience these concepts. Participants will explore how water interacts with both polar and non-polar substances using magnetic water models. Next participants will discover how proteins fold in a watery environment, based on chemical properties of amino acids, using Mini-Toobers (foam-covered wires) and plastic sidechains. We will demonstrate 1) how the arrangement of amino acids in a protein influences the final three-dimensional protein structure, 2) how secondary structure stabilizes proteins, 3) how mutations can impact the protein shape and 4) what occurs at the molecular level when proteins denature. Additional models of proteins will be used to explore protein secondary structure, and Jmol tutorials that reinforce the concepts will be demonstrated. All materials are available online or through the MSOE Model Lending Library.

Intended Audience: HS/UG	No fee	limit of 50 participants
Tuesday, August 5,	9:30 AM - 12:30 PM	
Tuesday, August 5,	2:00 PM - 5:00 PM	

W32: Get Engaged: Developing and Assessing Effective Activities to Teach Challenging Concepts

Daniella Fisher, University of Cincinnati Blue Ash College.

Amy Gultice, University of Cincinnati Blue Ash College

Bradford Mallory, University of Cincinnati Blue Ash College

This participatory workshop is for educators who teach complex concepts that may be difficult to impart to students using standard lecture techniques. Explore demonstrations and engaging activities that get students out of their seats and thinking about complex concepts - such as factors that affect enzyme activity or how to determine molecular shape and polarity - while using fun props and aids. Participants will take part in an activity, discuss a Top 10 list of tips and strategies for developing effective activities, examine survey tools to assess the effectiveness of an activity, and explore potential pitfalls and strategies to avoid or overcome them. Participants will also share their experiences with in-class activities and collaborate on a new activity to enhance student learning of a challenging chemistry concept. Participants will leave with ready-to-use examples, plans for self-developed activities, and an assessment template for evaluating the effectiveness of their own activities.

Intended Audience: HS/UG

No fee

limit of 24 participants

Sunday, August 3,

2:00 PM - 5:00 PM

W33: Getting Students to make Evidence Based Claims: Development of Argument Driven Inquiry (ADI) and Science Writing Heuristic (SWH) Laboratory Materials

Dawn Del Carlo, University of Northern Iowa.

Joi Walker, Tallahassee Community College.

Elizabeth Pulliam, Tallahassee Community College.

Mary van Opstal, Loyola University of Chicago.

"Inquiry and argumentation are complementary goals that make laboratory experiences more scientifically authentic and educative for students (Berland & Reiser, 2009; Jimenez-Alexandre, 2008; Osborne, 2010; Walker & Sampson, 2013). This workshop focuses on preparing laboratory materials for two specific approaches to laboratory instruction: Argument Driven Inquiry (ADI) and the Science Writing Heuristic (SWH).

Participants are asked to bring an experiment that they want to adapt to ADI or SWH. Workshop leaders have extensive experience with each of the instructional models and will provide professional development on implementation of the two approaches, including investigation design, logistics of the lab report, and how to conduct argumentation sessions. Finally, participants will receive suggestions for convincing others to adopt one of these instructional models. While participation in the Principles of Running an ADI or SWH Laboratory workshop is not required, workshop leaders strongly recommend familiarity with at least one approach before registering for this workshop."

Intended Audience: HS/UG

No fee

limit of 25 participants

Monday, August 4,

9:30 AM - 12:30 PM

W 34: Getting Students to make Evidence Based Claims: Principles of Running an Argument Driven Inquiry (ADI) or a Science Writing Heuristic (SWH) Laboratory

Dawn Del Carlo, University of Northern Iowa.

Joi Walker, Tallahassee Community College.

Elizabeth Pulliam, Tallahassee Community College.

Mary van Opstal, Loyola University of Chicago.

Inquiry and argumentation are complementary goals that make laboratory experiences more scientifically authentic and educative for students (Berland & Reiser, 2009; Jimenez-Aleixandre, 2008; Osborne, 2010). Currently, there is an emphasis in laboratory instruction to move students toward making evidence based claims through instructional models that give a more central place to argumentation and its role in the social construction of scientific knowledge. This is not a simple adjustment for students or instructors given that challenges still exist even when implementing an inquiry-based laboratory. This workshop will focus on two specific approaches to laboratory instruction: Argument Driven Inquiry (ADI) (Walker & Sampson, 2013) and the Science Writing Heuristic (SWH) (Poock, et al., 2007). Participants will be introduced to each approach, engage in activities that compare the approaches and lead mock ADI and SWH discussion sessions to practice elements of these two instructional methods.

Intended Audience: HS/UG
Monday, August 4,

No fee
2:00 PM - 5:00 PM

limit of 25 participants

W35: Hands on Workshop on Proteopedia: A Powerful Tool for Biomolecular Communication and a 3D Web Encyclopedia of Biomolecules

Jaime Prilusky, Weizmann Institute of Science.

Joel L. Sussman, Weizmann Institute of Science.

"Proteopedia is an interactive resource that facilitates understanding the role of 3D protein structures have in their biological function <http://proteopedia.org>. Proteopedia is widely used in scientific research, in the preparation of papers for publication and teaching from secondary level to post-graduate.

The workshop is aimed at researchers, teachers and students, who will learn how to:

To browse the > 100,000 pages in Proteopedia, e.g.

http://proteopedia.org/w/HIV-1_protease

<http://proteopedia.org/w/Ribosome>

http://proteopedia.org/w/Group:SMART:A_Physical_Model_of_the_β2-Adrenergic_Receptor

To create your own pages in Proteopedia, including

Adding 3D interactive scenes via a user friendly GUI for Jmol

Adding text to Proteopedia pages, with hyperlinks to the interactive scenes.

This Proteopedia workshop smoothly blends with two other workshops offered in this same BBCE 2014: Jmol for Beginners and Ultimate Jmol,

Intended Audience: HS/UG
Wednesday, August 6,
Wednesday, August 6,

No fee
9:30 AM - 12:30 PM
2:00 PM - 5:00 PM

limit of 24 participants

W36: Hands-On Models for Solids

George Lisensky, Beloit College.

The spatial arrangement of atoms is central to the understanding of structure and properties. Hands-on manipulation of physical models is fundamental to understanding the three-dimensional atomic nature of materials, even with the availability of increasingly sophisticated computer displays. During the workshop we will make use of four different physical model kits based on hub and spoke (especially useful for covalent bonding), sphere packing (especially useful for ionic structures), polyhedral coordination (especially useful for oxides and environmental chemistry), and magnetic attraction (especially useful for showing the energetics of bond formation and addressing the common misconception among students that all bond formation requires energy.) Is a tetrahedron four spokes from a central atom, the space between four close-packed spheres, or a structural unit used to assemble larger structures? Multiple representations provide complementary views. We will also use some online models that allow switching between representations.

Intended Audience: UG
Monday, August 4,

\$15 fee
9:30 AM - 12:30 PM

limit of 32 participants

W37: Hands-On NMR Activities for Undergraduates

Marshall Werner, Lake Superior State University.
Charles Abrams, Truman College.

This workshop will provide you with both theoretical and applied approaches to teaching NMR principles at the undergraduate and two-year college levels. A brief introduction to several NMR topics will be followed by hands-on activities where workshop participants will run several NMR experiments and interpret results. The aim is to encourage novel use of NMR instruction for undergraduate classes as all levels. Topics will include investigating "alternative nuclei" other than ^1H and ^{13}C , and an introduction to heteronuclear 2-dimensional NMR; 3-hour session.

Intended Audience: UG
Sunday, August 3,

No fee
2:00 PM - 5:00 PM

limit of 24 participants

W38: Hey! You Can't teach It That Way! Overcoming Obstacles to Curricular Reform.

Brian Johnson, College of Saint Benedict/Saint John's University.
Edward McIntee, College of Saint Benedict/Saint John's University.
Kate Graham, College of Saint Benedict/Saint John's University.
T. Nicholas Jones, College of Saint Benedict/Saint John's University.
Richard Ice, College of Saint Benedict/Saint John's University.
Chris Schaller College of Saint Benedict/Saint John's University.
Henry Jakubowski, College of Saint Benedict/Saint John's University.

At CSB/SJU, we received NSF funding for "Connected Chemistry: An Inorganic, Organic and Biological Chemistry Approach" in which integrated foundation courses were developed. As we implemented cross-disciplinary courses, many shareholders were resistant to change. It was necessary to negotiate with faculty firmly embedded in their traditional disciplines as well as the biology department, education department, pre-health advisors, and the administration to ensure that our new courses fit the needs of various student groups. This workshop will cover aspects of the implementation of a new integrated curriculum, including faculty teaching cohorts, coordination of assessment plans, administrative collaborations, availability of resources and the use of differing pedagogical approaches. The CSB/SJU dean will help attendees brainstorm strategies for their home institutions. Workshop coordinators will use breakout sessions to catalyze discussion between people with similar curricular goals. Attendees will receive samples of activities from our courses and potential resources for supporting substantial curricular revision.

Intended Audience: UG
Sunday, August 3,

No fee
2:00 PM - 5:00 PM

limit of 30 participants

W39: I Teach AP Chemistry-Are Inquiry Labs Necessary?

Greg Dodd, George Washington High School.

Research shows that students learn best through discovery. While cookbook labs are effective in verifying concepts, they are not as effective for student learning as Inquiry. The new AP Chemistry Curriculum mandates six Inquiry labs. The workshop goal is to provide participants with a "hands on" experience of moving from Cookbook thru Guided and, finally, towards Open Inquiry. Inquiry provides students the opportunity to develop their critical thinking skills to better prepare them for the challenges of the 21st Century. This goal can best be reached by realizing that this is a step-wise process that must be approached sequentially with adequate student preparation of laboratory and technology skills. The use of technology is another necessary piece of the puzzle since technology allows students to spend more time on actual Inquiry and less time with gathering, graphing, and analyzing collected data. The workshop will focus on two areas of Chemistry-spectrophotometry and Thermochemistry.

Intended Audience: HS
Sunday, August 3,

No fee
2:00 PM - 5:00 PM

limit of 26 participants

W40: Improving Labs with Formative Assessment

Melissa Hemling, Beaver Dam High School.

Student misconceptions dealing with the invisible particulate-level world of chemistry is well documented in research. Misconceptions in lab are inevitable since the observations students see in lab are caused by the invisible particulate-level of chemistry. This workshop will model techniques to help identify and address misconceptions during lab. Remediating during lab is crucial because it provides instructors additional tools to overcome misconceptions that a class discussion does not. Classroom research will be shared. Participants will perform an AP Chemistry inquiry-style lab using probe ware and engage in techniques to address misconceptions during lab.

Intended Audience: HS
Sunday, August 3,

No fee
2:00 PM - 3:30 PM

limit of 24 participants

W41: Infusing the Science of Learning into Your Chemistry Classroom: Cognitive Principles

Sam Pazicni, University of New Hampshire.

"Much research suggests that certain instructional strategies are particularly effective at promoting student learning and attitudes towards science. Yet, incorporating the latest evidence-based instructional practices into an existing lecture-focused classroom can be difficult.

In this workshop, participants will discuss several cognitive principles applicable to everyday use in chemistry courses. Topics such as testing effects, self-explanation, expertise reversal, distributed practice, and illusions of competence will be emphasized. Workshop participants will learn about these cognitive principles as well as the experimental evidence supporting these learning principles, and will be guided in the development of interventions and assessment protocols for several course-related learning issues.

We strongly encourage participants who are interested in how these learning principles apply to several specific instructional strategies to attend our subsequent "" Infusing the Science of Learning into Your Chemistry Classroom: Evidence-Based Instructional Strategies"" workshop."

Intended Audience: HS/UG
Wednesday, August 6,

No fee
9:30 AM - 12:30 PM

limit of 30 participants

W42: Infusing the Science of Learning into Your Chemistry Classroom: Evidence-Based Instructional Practices

Marilyne Stains, University of Nebraska-Lincoln.
Sam Pazicni, University of New Hampshire.
Travis Lund,

"Much research suggests that certain instructional strategies are particularly effective at promoting student learning and attitudes towards science. Yet, incorporating the latest evidence-based instructional practices into an existing lecture-focused classroom can be difficult.

In this workshop, participants will discuss several research-based, active-learning instructional strategies that can be easily added to any chemistry course. These strategies build directly on the cognitive principles presented in the associated morning workshop. The specific techniques of Peer Instruction, Predict-Observe-Explain (also known as interactive lecture demonstrations), and Jigsaw will be emphasized. Workshop participants will learn about the evidence supporting these strategies, will experience them from a student's perspective, and will be guided in the development of personalized materials ready for implementation in their own classrooms.

We strongly encourage participants not already familiar with cognitive principles such as testing effects, self-explanation, expertise reversal, distributed practice, and illusions of competence to attend our preceding "Cognitive Principles" workshop. "

Intended Audience: HS/UG No fee limit of 40 participants
Wednesday, August 6, 2:00 PM - 5:00 PM

W43: Inquiry Based AP Chemistry Experiments with Vernier

Jack Randall, Vernier Software & Technology

If you teach AP Chemistry, you won't want to miss this workshop. In this hands-on session, you will gain practice in conducting inquiry-based chemistry investigations using sensors and instruments with our LabQuest 2 - our popular stand-alone data-collection device. The workshop will feature experiments that correlate with the new lab guidelines for AP Chemistry, including Beer's Law, kinetics, and acid-base titrations. This workshop will fun for approximately 90 minutes.

Intended Audience: HS No fee limit of 24 participants
Tuesday, August 5, 3:30 PM - 5:00 PM

W44: Inquiry-Based Activities Exploring Light and Atomic Structure

Laura Eisen, George Washington University.
Samantha Glazier, St. Lawrence University.
Jennifer Schmeisser, St. Lawrence University.

The purpose of this workshop is to provide teachers of first year college chemistry and advanced high school chemistry with some inquiry-based activities designed to help students explore the nature of light, how light interacts with matter, and how this interaction helps us to understand the structure of atoms and molecules. We will begin with activities that explore the wave nature of light, providing evidence that light is a wave, that blue light has higher frequency than red light, and that the energy of light is proportional to frequency. We will then examine the particle nature of light. Finally, we extend the wave-particle duality of light to electrons, and consider how electron waves confined in atoms lead to quantization of electron energies, atomic orbitals and atomic spectra. The workshop will model inquiry-based learning by having participants complete the activities and then discuss them.

Intended Audience: HS/UG \$10 fee limit of 26 participants
Wednesday, August 6, 9:30 AM - 12:30 PM

W45: Integrating a Learning to Learn One-credit course with General Chemistry

John Goodwin, Coastal Carolina University.
Daniel Apple, Pacific Crest.

Pacific Crest has redesigned its intensive Learning to Learn Camp into a one-credit course that produces the same outcomes that the Learning to Learn Camp produces. This workshop will illustrate how by combining this one-credit course with a first term general chemistry course or with a Principles of Chemistry course, those students who consistently struggle with learning chemistry can improve the skills that excellent POGIL students exhibit: self-directed learning, critical thinking, generalization, problem solving, communication, writing to learn, teamwork, and self-assessment. The workshop will share a syllabus, stories, outcomes, and guidelines for structuring this integration.

Intended Audience: UG
Sunday, August 3,

No fee
2:00 PM - 5:00 PM

limit of 30 participants

W46: Interactive Experience with Microwave Technology in the Teaching Lab

Marsha Baar, Muhlenberg College.
Heather Baker, CEM Corporation.
Michael J. Karney, CEM Corporation.

"Microwave technology has become a common tool for chemical synthesis and many academic institutions are incorporating microwave-assisted experiments into their teaching and research labs. Early introduction to innovative instrumentation, such as microwave reactors, teaches students to embrace ideas on the cutting edge of chemistry, better preparing them for technologies they will encounter in their careers.

This workshop will begin with a review of microwave theory, provide a pedagogical comparison of both single and multi-mode technologies available for the teaching lab, and highlight several examples of experiments that have been adapted for microwave technology with an emphasis on green chemistry principles. Participants will then run a reaction in both microwave technologies to gain a hands-on understanding of how microwave-assisted chemistry can fit into any teaching lab. This workshop will be 90 minutes long."

Intended Audience: UG
Wednesday, August 6,
Wednesday, August 6,

No fee
9:30 AM - 11:00 AM
2:00 PM - 3:30 PM

limit of 24 participants

W47: FTIR Spectroscopy and Permanent Magnet NMR in the Undergraduate Curriculum

Bill Mohar, Thermo Fisher Scientific.

We present an overview of the importance of providing students hands-on experience with FTIR spectrometers as well as permanent magnet NMR and a hands-on workshop performing experiments with the instrumentation.

Intended Audience: HS/UG
Tuesday, August 5,

No fee
2:00 PM - 5:00 PM

limit of 24 participants

W 48: Interdisciplinary Chemistry: Tissue Engineering Scaffolds and Materials Science

Elaine Smith, Marion High School

In this hands-on workshop, participants will experience five guided inquiry activities related to ongoing research at Furman University that involves the development of ionomeric composites for nerve tissue engineering scaffolds. The activities include exploring alginate as a substitute for an extracellular matrix, producing a conductive polymer, measuring physical properties such as strength and viscoelasticity, and 3D printing. The discussion will include ways to foster a self-directed, research-oriented approach in students who lack experience with open inquiry. The activities incorporate the science practices from A Framework for K-12 Science Education.

Intended Audience: HS
Wednesday, August 6,No fee
2:00 PM - 5:00 PM

limit of 24 participants

W49: Introduction to IONiC/VIPeR: Using and Sharing Inorganic Chemistry Education Resources

Joanne Stewart, Hope College.

Lori Watson, Earlham College.

Chip Natara, Lafayette College.

Inorganic chemistry finds its way into the curriculum at a variety of levels from general chemistry to upper division undergraduate courses. VIPeR (the Virtual Inorganic Pedagogical Electronic Resource) is a website (www.ionicvipr.org) that provides a platform to share content and materials for teaching inorganic chemistry, while building a community of inorganic faculty known as IONiC. Workshop participants will be introduced to the IONiC community and will 1) learn how to find and adapt "learning objects" (in-class activity, literature discussion, laboratory, etc.) on VIPeR for teaching general chemistry and inorganic chemistry, 2) learn how to use the social networking features of VIPeR to give and receive support in teaching and research, and 3) learn how to design and upload a learning object to the site. Participants will be encouraged to bring a learning object and publish it on VIPeR by the end of the workshop.

Intended Audience: UG
Monday, August 4,\$10 fee
2:00 PM - 5:00 PM

limit of 24 participants

W50: Introduction to Vernier Technology for Chemistry

Elaine Nam, Vernier Software & Technology.

"If you're new to data collection with Vernier, or would like a basic refresher, this workshop is for you. Join us for hands-on practice using LabQuest 2— a popular stand-alone data-collection device. You will also be able to view and analyze data collected on LabQuest 2 using Graphical Analysis for iPad, or on any device with a supported browser using Vernier Data Share. Rotate through stations to conduct a selection of experiments from our three lab books, Chemistry with Vernier, Advanced Chemistry with Vernier, and Investigating Chemistry through Inquiry using the pH Sensor, our redesigned Drop Counter, Temperature Probe, Gas Pressure Sensor, Conductivity Probe, and Colorimeter. By the end of this workshop, you'll be a pro at data collection and analysis with Vernier. Appropriate for college and high school chemistry. This workshop will run for approximately 90 minutes."

Intended Audience: HS/UG
Tuesday August 5,No fee
9:30 AM – 11:00 AM

limit of 24 participants

W51: Jmol for Beginners

Robert Hanson, St. Olaf College.
Otis Rothenberger, Illinois State University.

This workshop will focus on the use of Jmol (<http://jmol.sourceforge.net>) for the inclusion of active content on web pages that illustrate molecular structure in a dynamic way. No previous experience with Jmol is required, but some experience with HTML and web page creation will be useful. Discussion will include web sites already available for class use that can be used as is or as starting points. Participants will learn how to implement Jmol on web sites both in Java and in pure HTML5 and how to use the Jmol application to set up views and animations. Participants should bring their own laptop computer, if possible. Presented by the principal developer of Jmol.

Intended Audience: HS/UG	\$10 fee	limit of 24 participants
Monday, August 4,	9:30 AM - 12:30 PM	
Monday, August 4,	2:00 PM - 5:00 PM	

W52: Leapfrog learning - Diagnosing and surmounting obstacles to students' development of more sophisticated chemical thinking

Hannah Sevia, University of Massachusetts Boston.
Scott Balicki, Boston Public Schools.
Greg Banks, Boston Public Schools.
Michael Clinchot, Boston Public Schools.
Steven Cullipher, University of Massachusetts Boston.
Robert Huie, Boston Public Schools.
Jennifer Lambert, Boston Public Schools.
Rebecca Lewis, Boston Public Schools.
Courtney Ngai, University of Massachusetts Boston.
Gabriela Szeinberg, University of Massachusetts, Boston.
Vicente Talanquer, University of Arizona.
Melissa Weinrich, University of Arizona.

Do you struggle to understand what your students are thinking about chemistry? Come learn about a powerful formative assessment technique called 'cognitive interviewing' and practice using this technique to make sense of student thinking around foundational ideas in chemistry that students rely upon to determine how to identify matter and differentiate between kinds of matter. You will learn about the stepping stones that middle school, high school and college students traverse as they gain conceptual sophistication, and how you can move your students toward more expert understanding of chemical identity (the idea that every substance is unique). The workshop will utilize the 'GoKart Interview Protocol', a tool co-developed by a team of Boston middle and high school teachers, university faculty, and graduate students. Participants will leave with copies of the protocol and a learning progression map derived from our research study that characterizes productive stepping stones along the progression.

Intended Audience: HS/UG	\$25 fee	limit of 36 participants
Wednesday, August 6,	9:30 AM - 12:30 PM	

W53: Learning Chemistry at the Molecular Level with Advanced Visualization and Simulation Techniques (Part 1)

Jurgen Schnitker, Wavefunction Inc.

"The arguably biggest problem for student comprehension of chemistry is that molecular-level explanations depend on mental images rather than direct observation. In other words, teachers and students must resort to models in order to rationalize chemical phenomena. Unfortunately, the quality of models found in textbooks, animations, and online learning tools varies greatly. This workshop is about working with computer-based models that not only offer compelling three-dimensional visualization, but that are

- 1) fundamentally science-based (rather than ad hoc illustrations), and
- 2) explorable (rather than limited to singular messages).

From the viewpoint of students and teachers, the scientific basis for the models can be a complete black box—all that matters is that a lot of mathematics makes a model behave realistically. The fact that the models are explorable, however, is of direct interest as it allows for guided inquiry learning in a most natural way. The workshop attendees will address a few topics from the general chemistry curriculum with state-of-the-art software for molecular modeling. The potential pitfalls of using models in those areas of chemistry will also be discussed. Hands-on workshop—please bring your own laptop (Windows or Mac OS X) if you can."

Intended Audience: HS/UG
Monday, August 4,

No fee
9:30 AM - 12:30 PM

limit of 30 participants

W54: WebMO Hands-On Workshop

William Polik, Hope College.

"WebMO is a web-based interface to modern computational chemistry programs (Gamess, Gaussian, Molpro, Mopac, NWChem, PQS, PSI, Quantum Espresso, VASP, Q-Chem, Tinker). Using just a web-browser, users can draw 3-D structures, run calculations, and view results. WebMO is simple enough for novice users (reasonable defaults are provided, and result are presented graphically) but flexible enough for experts (full access to input and output files is provided, and job types can be customized).

Workshop topics will include:

- Overview of WebMO features and capabilities
- Drawing molecules using the WebMO Editor
- Running various job types
- Visualization of results using the WebMO Viewer
- Importing and exporting structures and jobs
- Customization WebMO job types
- Installation and administration of WebMO

This is a hands-on workshop, so participants are encouraged to bring their own Windows, Mac, or Linux laptop or Apple iPad. In addition to workshop activities, the WebMO developers will be available for questions and individual consultation."

Intended Audience: HS/UG
Monday, August 4,
Tuesday, August 5,

No fee
9:30 AM - 5:00 PM
9:30 AM - 5:00 PM

limit of 24 participants

W55: Learning Chemistry at the Molecular Level with Advanced Visualization and Simulation Techniques (Part 2)

Michelle Corrigan, Wavefunction Inc.

"(Part 2) The arguably biggest problem for student comprehension of chemistry is that molecular-level explanations depend on mental images rather than direct observation. In other words, teachers and students must resort to models in order to rationalize chemical phenomena. Unfortunately, the quality of models found in textbooks, animations, and online learning tools varies greatly. This workshop is about working with computer-based models that not only offer compelling three-dimensional visualization, but that are

- 1) fundamentally science-based (rather than ad hoc illustrations), and
- 2) explorable (rather than limited to singular messages).

From the viewpoint of students and teachers, the scientific basis for the models can be a complete black box—all that matters is that a lot of mathematics makes a model behave realistically. The fact that the models are explorable, however, is of direct interest as it allows for guided inquiry learning in a most natural way. Working with state-of-the-art software for molecular modeling, the attendees will address a few topics from the general chemistry curriculum (complementing the topics from the first workshop in the series). The workshop will conclude with a Top Ten list for using molecular models in the classroom. Hands-on workshop—please bring your own laptop (Windows or Mac OS X) if you can. "

Intended Audience: HS/UG
Tuesday, August 5,

No fee
9:30 AM - 12:30 PM

limit of 30 participants

W56: Learning to Learn Chemistry Camps

Daniel Apple, Pacific Crest.

Pacific Crest has facilitated over 70 Learning to Learn Camps for over the last 20 years. Recently we have contextualized these camps - Calculus Learning to Learn Camp (SUNY Buffalo State University), SMART GRID Learning to Learn Institute (Stony Brook University), POGIL STEM Up Learning to Learn Camp Integrating and Algebra Learning to Learn Camp (Hinds CC), and Scholar's Institutes for the Honors College and Academic Success Institutes for Freshmen Academy (Grand Valley State University). These camps are designed to help students become successful learners and faculty learn to facilitate POGIL activities more effectively. Participants will receive sample materials used to run a Chemistry Learning to Learn Camp, a sample agenda, access to a facilitator's manual, principles of why the camp works, sample outcomes and guidelines for implementing this camp. Our mission is to increase success of STEM students and advance use of Process Education and POGIL practices.

Intended Audience: UG
Tuesday, August 5,

No fee
2:00 PM - 5:00 PM

limit of 50 participants

W57: Microscale Chemistry from the United Kingdom

Bob Worley, CLEAPSS (UK)

"The session will show how qualitative and quantitative microscale techniques in practical chemistry, can tease out of the students a greater understanding of the particulate model of molecules and ions interacting with each other; how chemists interpret the visible with the invisible.

It will feature redox and precipitation reactions, volumetric and gravimetric analysis, electrolysis, a Hofmann voltameter, environmental, gas and organic chemistry.

Using equipment such as plastic folders, Petri dishes, crown bottle tops, plastic and Pasteur pipettes, syringes, very robust carbon electrodes and accurate microbalances, the participants will carry out most of the activities and asked to offer more possible applications of the techniques.

Positive comments point to the reduction of wasted lesson time allowing more discussion and questioning, better classroom control with less walking about, students able to work on their own, reducing working memory overload and improved safety. It also addresses green issues such as less waste."

Intended Audience: HS/2Y
Monday, August 4,

No fee
2:00 PM - 5:00 PM

limit of 20 participants

W58: Microwave Chemistry in Instructional Organic Laboratories

Shaun Murphree, Allegheny College.

Leah Eller, St. Mary's College of Maryland.

"Dedicated microwave reactors have become standard equipment in industrial labs, and microwave-assisted organic synthesis (MAOS) is increasingly well represented in the chemistry education literature. Thanks to the very short reaction times afforded by MAOS, organic lab curricula can be designed to incorporate inquiry-based approaches while still maintaining a broad synthetic repertoire.

In this workshop, participants will gain hands-on experience using dedicated microwave reactors to complete organic laboratory protocols, and can immediately determine the outcomes using a variety of analytical instruments (HPLC, FT-IR and/or NMR). The workshop will explore strategies for adapting conventional lab experiments to MAOS conditions. Curriculum design parameters and implementation factors will also be discussed."

Intended Audience: UG
Monday, August 4,

No fee
9:30 AM - 5:00 PM

limit of 24 participants

W59: Misconceptions in chemistry

Al Hazari, University of Tennessee.

Students develop their own understanding of how "nature really works." These pre-concepts are brought to school and teachers have to reflect and act on them for better instruction. In addition, there are "school-made misconceptions" which originate from inappropriate curriculum and instructional materials. This workshop is aimed to help teachers and professors diagnose and cure the pre-concepts. Participants will do several key hands-on activities that expose learner's misconceptions. This will be followed by discussion of ideas, criticizing prior knowledge and finally presenting the correct chemical concepts.

Intended Audience: HS/UG
Thursday, August 7,

\$30.00 fee
9:30 AM - 12:30 PM

limit of 24 participants

W60: Molecular Origami for Biochemistry: Accurate Paper Models of Proteins, Carbohydrates, Lipids, and DNA

Charles Abrams, Truman College.
Thomas Higgins, Harold Washington College.

Would your students enjoy building their own accurate models of proteins, carbohydrates, lipids, and DNA? Participants in this workshop will learn a method for modeling large biomolecules with paper. These models are affordable, easy to construct, and allow educational activities that are impossible with other kits. Inspired by Pauling's paper model of an alpha helix and Hanson's book "Molecular Origami", the models start with a molecular structure printed on standard weight paper, along with lines for cutting and folding. Pairs of numbers guide alignment of hydrogen bonds, which are secured with transparent tape. Participants will build several models from the following list: alpha helix, beta sheet, Rossmann fold, leucine zipper (pictured), collagen, cyclodextrin, amylose, amylopectin, cellulose, chitin, heparin, sphingomyelin, cardiolipin, glycolipids, and DNA.

Intended Audience: HS/UG \$20 fee limit of 30 participants
Wednesday, August 6, 2:00 PM - 5:00 PM

W61: New Bite-Sized Chemistry Teaching Resources that use Real 3D Crystal Structures

Susan Henderson, The Cambridge Crystallographic Data Centre.
Peter Hoare, Newcastle University.

"Fundamental chemistry concepts such as conformation, stereochemistry, chirality and the geometrical shapes of metal coordination spheres cannot be properly understood without knowledge of the three-dimensional nature of chemical compounds. Rather than using molecular modelling kits to aid student learning, with their limitations and misconceptions, how about using real crystal structures? The Cambridge Structural Database (CSD) stores the published results of small molecule organic and organometallic X-ray diffraction studies: real structures and not idealised models, thus an ideal resource for teaching chemistry.

This hands-on workshop will familiarise you with the free teaching subset of the CSD, the WebCSD online platform that accesses the subset and to new materials that introduce key chemistry concepts that frequently require visual aids to ensure full concept comprehension. Supervised by an academic with over 20 years teaching experience in UK high schools, these exercises have been written by students for students and have wide applicability."

Intended Audience: HS/2Y No fee limit of 24 participants
Wednesday, August 6, 9:30 AM - 12:30 PM

W62: Nitinol, the brainy wire

Al Hazari, University of Tennessee.

Come and learn about Nitinol, the interesting nickel-titanium alloy that's got memory, and about its several everyday life applications. Participants will do several hands-on activities that demonstrate the various properties of this alloy. A discussion of this and of other common alloys (samples will be shared) will be presented.

Intended Audience: HS/UG \$20.00 limit of 26 participants
Tuesday, August 5, 2:00 PM - 5:00 PM

W63: Non-Visual Methodologies for Teaching Multi-Sensory Chemistry Lab Activities

Cary Supalo, Independence Science.

This workshop will feature methodologies and techniques for teaching chemistry lab activities in a hands-on way without the use of vision. The activities are valuable to all learners, though they are designed for students with visual impairments. Multi-channel sensory feedback through tactile, olfactory, and hearing in addition to vision will be discussed and featured in the various activities as part of this workshop. Concerns related to laboratory safety regarding students with visual impairments and other disabilities will also be addressed. A combination of high tech and low tech solutions for science access for all learners will be featured. This workshop will demonstrate aspects of the Science Activities for the Visually Impaired (SAVI) curriculum published by the Laurence Hall of Science from the 1970s, and how these techniques are valuable in today's science curriculum. Further, commercially available technologies of audible and talking lab tools will also be presented.

Intended Audience: HS/UG	\$10 fee	limit of 26 participants
Monday, August 4,	9:30 AM - 11:30 AM	
Monday, August 4,	2:00 PM - 4:00 PM	

W64: Open-source teaching materials: Tailoring the text and other teaching materials to meet the needs of your classroom.

Kelly Neiles, St. Mary's College of Maryland.

Open source materials provide an instructor with the opportunity to have more control over the texts required for their course by allowing them to fit the textbook to their course rather than being forced to make the course fit the textbook. These materials also provide instructors with a method to lower the cost of textbooks for their students. This workshop will give participants the opportunity to learn more about what open source materials are all about. The first part of the workshop will be a discussion of open source materials including the following questions: What does open source mean exactly? What types of open source materials are available? How can we be confident in the quality of open source materials (are they peer reviewed)? How will students access these materials? In the second portion of the workshop, instructors will work to investigate and integrate open-source content into their curriculum.

Intended Audience: HS/UG	\$5 fee	limit of 24 participants
Wednesday, August 6,	9:30 AM - 12:30 PM	

W65: Permanent Magnet NMR in the Undergraduate Curriculum

Bill Mohar, Thermo Fisher Scientific.

We present an overview of the importance of providing students hands-on experience with NMR and a hands-on workshop performing experiments with the instrumentation.

Intended Audience: HS/UG	No fee	limit of 24 participants
Tuesday, August 5,	9:30 AM - 12:30 PM	

W66: PhET Interactive Simulations Supporting Materials: Develop Inquiry-Based Learning Activities

Julia Chamberlain, University of Colorado Boulder.

The PhET Interactive Simulations project (<http://phet.colorado.edu>) has developed over 30 chemistry simulations (sims), which support student learning through scientist-like exploration and experimentation. Sims make the invisible visible, incorporate multiple representations, and emphasize connections between real life phenomena and the underlying science. PhET sims are designed to be flexible tools, and can be used for classroom demonstrations, clicker questions, guided inquiry activities, laboratory exercises, and homework. In each context, the supporting materials (eg. an activity sheet) can target specific process and content learning goals using the sims. In this workshop, participants will use guidelines and existing activities to develop supporting materials and facilitation plans to couple with sims in their teaching. This workshop is appropriate for those new to PhET, as well as seasoned sim users looking to design and receive feedback on new supporting materials. This symposium is sponsored by the ACS CHED Committee on Computers in Chemical Education, <http://www.ccce.divched.org/>.

Intended Audience: HS/UG
Sunday, August 3,

No fee
2:00 PM - 5:00 PM

limit of 24 participants

W67: Preparing High-Quality Proposals for NSF Division of Undergraduate Education Programs

Dawn Rickey, National Science Foundation.

David Brown,.

Nicole Bennett,.

The National Science Foundation's Division of Undergraduate Education (NSF's DUE) promotes excellence in undergraduate science, technology, engineering, and mathematics (STEM) education for all students, and provides opportunities for faculty to obtain funding for projects that address current challenges and opportunities in undergraduate chemistry education. In this workshop, NSF DUE program officers will lead activities and discussions focused on important aspects of preparing high-quality proposals for projects designed to improve undergraduate chemistry education. The workshop will include an overview of DUE programs, as well as activities designed to assist participants in developing their skills for planning evidence-based and evidence-generating chemistry education projects; designing evaluation and dissemination plans; understanding the proposal review process; and considering the NSF/IES Common Guidelines for Education Research and Development.

Intended Audience: UG
Monday, August 4,

No fee
9:30 AM - 5:00 PM

limit of 45 participants

W 68: Promote Inquiry Using Chemistry Demonstrations from Flinn Scientific

David Jones, Flinn Scientific.

Looking for more ways to incorporate inquiry-based experiments into your chemistry classroom? Asking questions is the heart of inquiry, and there is no better way to get students asking questions than by presenting exciting, engaging demonstrations! Join us as we present classic demonstrations and describe a series of inquiry-based activities that were developed based on those demonstrations. We will model the inquiry process and share a strategy that allows you to easily develop safe and meaningful inquiry labs on a variety of topics. Handouts included for all attendees! This will be a 60-75 minute workshop.

Intended Audience: HS
Sunday, August 3,No fee
3:30 PM - 5:00 PM

limit of 75 participants

W69: PSI4 Education: Open Source Computational Chemistry

Tricia Shepherd, St. Edward's University.

Ashley Ringer McDonald, California Polytechnic State University.

Ryan Fortenberry, Georgia Southern University.

Mathew Kennedy, Georgia Institute of Technology.

PSI4 is an open-source suite of ab initio quantum chemistry programs ideal for both research and education. Pairing PSI4 with the WebMO graphical user interface, students can easily build molecules and set up computations to explore various chemical concepts such as polarity, molecular orbitals, and spectroscopy. In this workshop, we will present a variety of lab activities for beginner, intermediate, and advanced chemistry students using the PSI4/WebMO interface. Participants will not only receive hands-on experience using PSI4 and WebMO, but will also have time to develop their own lab activity in the presence of expert PSI4 software developers available for consultation. Each participant will receive a flash drive containing a lab manual with all activities presented at the workshop, the PSI4 software, and detailed information for setting up and using PSI4 and WebMO in a context similar to their home institution.

Intended Audience: UG
Tuesday, August 5,
Tuesday, August 5,\$10 fee
9:30 AM - 12:30 PM
2:00 PM - 5:00 PM

limit of 24 participants

W70: Putting the Green in the Next Generation Science Standards

Dalila Kovacs, Grand Valley State University.

Kate Anderson,

Kathe Blue Hetter,

Erika Fatura,

Thomas Pentecost, Grand Valley State University.

Jennifer Sherburn,

Sarah Williams,

Ryan Schoenborn,

Amy Cannon,

Join us for an interactive hands-on workshop on how to incorporate and align green and sustainable chemistry with the new generation science standards in your daily teaching. Learn from a team of high school teachers involved in 'Putting the Green in the Next Generation Science Standards" a project organized by the Michigan Green Chemistry Clearinghouse, GVSU Chemistry Department, and the Regional Math and Science Center, and by Beyond Benign, an organization known world-wide for its vision to revolutionize the way chemistry is taught and learned. Be prepared to walk away with useful tools and resources to bring back to your classrooms and laboratories.

Intended Audience: HS

No fee

limit of 20 participants

Thursday, August 7,

9:30 AM - 12:30 PM

W71: Research Experiences for Teachers: Models that Work (Panel Discussion)

Elaine Smith, Marion High School

Research experiences for teachers vary widely, from short-term, highly defined summer research projects to complete graduate programs. What are the goals and expected outcomes of such experiences? Our panelists will present a variety of models and discuss the impact of teachers' research experiences on (1) teachers' growth as science practitioners, (2) the formation of collaborative partnerships, and (3) their students' scientific reasoning. Finally, we will discuss the potential for broadening teachers' access to research opportunities, along with corresponding practical concerns such as teacher compensation, K-12 curriculum flexibility, and variance in teachers' interests and experience levels.

Intended Audience: HS/UG

No fee

limit of 24 participants

Wednesday, August 6,

9:30 AM - 12:30 PM

W72: Resources for Excellence: Using ACS Resources to Enhance Effectiveness at your Institution

Candice McCloskey, Georgia Perimeter College

Two-year college participants work in groups to identify challenges at their institutions, and learn about and use ACS resources specifically for two-year colleges to solve them. Bring your business cards!

Intended Audience: 2Y

No fee

limit of 45 participants

Tuesday, August 5, 2:00 PM - 5:00 PM

W73: Scientific Soapmaking

Kevin Dunn, Hampden-Sydney College.

In the past 20 years a cottage industry has grown around the production of soap on a relatively small scale. Only a minimal physical plant is needed to produce custom-formulated soaps on a scale from 10-100 lbs per batch. This cottage industry is made up primarily of women producing soap and selling it at craft fairs, boutiques, on the internet, and to hotels desiring private-label soap. The science of soapmaking touches on many chemical topics, including stoichiometry, equilibrium, and the properties of acids, bases, alcohols, esters, and oils. This workshop would be appropriate for high school and college faculty desiring to teach a course for students interested in handcrafted soap as a business or hobby. It would also be appropriate for faculty wanting to include a soapmaking module as part of another course. Workshop fee includes a copy of the book, Scientific Soapmaking.

Intended Audience: HS/UG	\$30.00 fee	limit of 26 participants
Wednesday, August 6,	9:30 AM - 12:30 PM	
Wednesday, August 6,	2:00 PM - 5:00 PM	

W74: Share Your Teaching Resource Online: Join the Open Access Community!

Patricia Kreke, Mount St. Mary's University.

Stephanie Brouet

Do you have a teaching resource that you want to share online? Join the iCollaborative community! Bring your teaching resource (class activity, lab, quiz, video lesson or just an idea) to this session for feedback from peers and iCollaborative representatives then receive help submitting your resources for publication on the iCollaborative site. This workshop will have four parts: brief introduction to iCollaborative; review of the iCollaborative's resources and peer feedback tools; peer-mentoring session for potential submissions; and overview of the submission process. The AAMC-sponsored Pre-health Collection within MedEdPortal's iCollaborative (www.mededportal.org/icollaborative/pre-health) includes teaching resources geared for undergraduate courses populated by pre-health students. . The collection provides a searchable online repository of recommended instructional resources that target pre-health competencies like those on the revised MCAT exam. Many of the open access resources feature real-world contexts and active learning. Join the iCollaborative community of dedicated teachers/professionals and help shape this initiative!

Intended Audience: UG	No fee	limit of 24 participants
Monday, August 4,	9:30 AM - 12:30 PM	

W75: Spectroscopy for your Computer and Tablet

Thomas Loschiavo, PASCO Scientific.

New from PASCO, a wireless spectrometer and fluorometer that allows you to easily connect to a computer or a tablet. The PASCO Spectrometer was designed for educational use and built around the new PASCO App: Spectroscopy software. Use the PASCO spectrometer and software to intuitively perform spectroscopy experiments including light source emission studies, determination of the concentration of unknown solutions using Beer's law, and rates of reactions. The workshop will run for approximately 90 minutes.

Intended Audience: HS/UG	No fee	limit of 24 participants
Wednesday, August 6,	9:30 AM - 11:00 AM	

W76: Student Directed Chemistry with Vernier

Jack Randall, Vernier Software & Technology

"Do you need to add inquiry labs to your chemistry course? Vernier has done the work for you with our lab book, Investigating Chemistry through Inquiry. In this hands-on workshop, you will learn how to conduct a chemistry inquiry investigation using sensors with our LabQuest 2. You will also be able to view and analyze data collected on LabQuest 2 using Graphical Analysis for iPad, or on any device with a supported browser using Vernier Data Share. Appropriate for college and high school chemistry. This workshop will run for approximately 90 minutes."

Intended Audience: HS/UG
Tuesday, August 5,

No fee
2:00 PM - 3:30 PM

limit of 24 participants

W77: Successful Inquiry Labs for AP Chemistry

Carolina Teaching Partner

Bring inquiry to your classroom with new Carolina chemistry activities and see your classroom come alive. Carolina's new labs help students develop essential chemistry practices, understand Big Idea chemistry concepts, and learn chemistry through inquiry per the new AP Chemistry curriculum. Experience 3 different activities in this hands-on workshop. Handouts/free giveaways. This workshop will last for approximately one hour and 15 minutes.

Intended Audience: HS
Tuesday, August 5,

No fee
2:00 PM - 3:30 PM

limit of 40 participants

W78: Teaching and Learning Inquiry in Chemistry Using Bonding

Alisa Grimes, University of Colorado.

Angela Cannava, University of Colorado in Boulder,

Heather Waldron, Englewood High School.

Sara Severance, University of Colorado Boulder.

This workshop is designed to help participants develop an understanding of scientific inquiry in the high school chemistry classroom. Participants experience the structures that support the implementation of inquiry-based lessons in their chemistry classrooms by engaging in a lesson on chemical bonding. The inquiry strategies that will be illustrated in this workshop include aspects of the scientific process such as making simple observations, developing models, data collection, making evidence-based claims, and refining models and defending claims in a classroom discussion. The workshop will include opportunity to discuss common concerns about the implementation of inquiry in high school chemistry classrooms and strategies for overcoming common barriers.

Intended Audience: HS/2Y
Tuesday, August 5,
Tuesday, August 5,

No fee
9:30 AM - 12:30 PM
2:00 PM - 5:00 PM

limit of 26 participants

W79: The Automobile and the Periodic Table

Craig Donahue, University of Michigan-Dearborn
Codruta Savu, University of Michigan-Dearborn.

The presenters teach a two-semester General Chemistry course to undergraduate engineering majors using the overarching theme of Chemistry and the Automobile. This workshop will explore automotive materials (morning) and automotive-related compounds (afternoon). Participant breakout groups will be asked to identify specific examples related to these themes and to suggest ways of integrating them into the chemistry curriculum. This cycle will be repeated three times in the morning and afternoon. The three morning cycles will focus on defining broad categories of automotive materials, the issue of lightweighting the automobile and possible case studies. The three afternoon cycles will focus on redox reactions that can be connected to the automobile and ways to categorize these reactions into manageable subsets, automotive-related metal compounds, and automotive-related nonmetal compounds. The presenters will provide feedback on how these topics are integrated into their courses and a list of useful resources.

Intended Audience: UG
Tuesday, August 5,

No fee
9:30 AM - 5:00 PM

limit of 24 participants

W80: The Fabulous World of Beaded Molecules: Constructing Arbitrary Fullerenes with Beads

Bih-Yaw Jin, National Taiwan University.

"Constructing a three-dimensional physical model for a complicated molecule is important for students to visualize the spatial arrangement of different parts in that molecule. We developed systematic strategy for making cage-like fullerene without any hole based on the spiral code of the corresponding fullerene and other exotic graphitic structures using the technique of mathematical beading.

In this workshop, we will give the participants hands-on experience on how to make beaded models for several important fullerenes such as C₆₀ or C₇₀ and give the correct interpretation based on the valence sphere model developed by Prof. Henry Bent. In the first project, we will make beaded model for the hypothetical molecule C₂₀, which consists of twelve pentagons. Participants will learn the basic techniques of weaving for other fullerene compounds in about half hour. With this experience, we will move on to the next structure C₆₀ or C₇₀ in the next project."

Intended Audience: HS/UG
Monday, August 4,

No fee
2:00 PM - 5:00 PM

limit of 30 participants

W81: Workshop Using the ChemConnections Workbook

Sharon Anthony, Northland College.
Heather Mernitz, Alverno College.
Kevin Braun, Beloit College.

How does a nuclear reactor work? How is nylon formed? What is in my blood? This session will introduce activities from the new ChemConnections Activity Workbook that includes 59 classroom tested activities written in the context of societal and environmental issues. Derived from the ChemConnections modules, the collection of individual activities and laboratories allow real-world problems to be integrated into a broad range of teaching environments including lectures, recitations, and workshop based courses. Designed with attention to pedagogy and student learning styles, these activities introduce real-world applications utilizing a variety of methods including data analysis, laboratory, guided inquiry, and discovery. Ultimately these activities assist students in not only learning general chemistry, but also in understanding how chemistry relates to modern issues such as acid rain, nuclear energy, nutrition, and technology.

Intended Audience: HS/UG
Monday, August 4,
Monday, August 4,

No fee
9:30 AM - 12:30 PM
2:00 PM - 5:00 PM

limit of 30 participants

W82: The Future of the General, Organic, Biochemistry Course Sequence: An Ideas Lab Workshop for Responding to Upcoming MCAT Changes

Jeffrey R. Raker, University of South Florida.
LaKeisha McClary, George Washington University.

Recently, the American Medical Association proposed changes to the Medical College Admissions Test (MCAT) based on recommendations from the Howard Hughes Medical Institute and its own survey research in an effort to revise the MCAT to best assess the knowledge and skills necessary for success in medical school. Pertinent to chemical educators, these recommendations deemphasize a portion of the curricula of the traditional full-year general chemistry and full-year organic chemistry courses, adding more emphasis on biomolecules and biochemistry. The chemical education community has begun to discuss the changes via the July 2013 issue of the Journal of Chemical Education. However, the discussion in response to these changes is far from finished. The purpose of this workshop will be: (1) to discuss the changes to the MCAT that impact chemistry instruction, and (2) to generate ideas of how chemistry instructors and departments can best prepare premedical students.

Intended Audience: UG
Tuesday, August 5, No fee limit of 30 participants
2:00 PM - 5:00 PM

W83: The POGIL Project Workshop: Classroom Facilitation

Tricia Shepherd, St. Edward's University.
Michael Bruno,

There is no single way to implement POGIL -- each time there are unique characteristics that can influence how particular goals are achieved. Facilitating a POGIL classroom effectively involves more than student groups and collaborative activities; it requires careful planning and effective classroom management through reflective facilitation techniques. This workshop is designed to provide participants with an introduction to facilitating POGIL activities. Through this experience, participants will reflect on how facilitation can enhance or interfere with student learning, as well as how facilitation strategies can be critical in the development of student process skills. After attending this session, participants will be able to: (1) name different components of classroom facilitation, (2) explain how the actions of the instructor can promote or inhibit development of student process skills, and (3) propose facilitation strategies for classroom use.

Intended Audience: HS/UG \$25 fee limit of 36 participants
Wednesday, August 6, 9:30 AM - 12:30 PM

W84: The POGIL Project Workshop: Climate Change Concepts in General Chemistry

Daniel King, Drexel University.
Gail Webster, Guilford College.

Process Oriented Guided Inquiry Learning (POGIL) activities have been used in a large number of general and introductory chemistry courses. While the activities themselves are designed to engage students in the learning process, sometimes the activity content does not engage the students. We have written a set of classroom POGIL activities that use climate change concepts to teach fundamental chemistry content. Another unique aspect of these activities is the incorporation of socioscientific models and questions, which are designed to encourage data-driven discussions of non-scientific content. Participants in this workshop will have the opportunity to work through a sample activity. Time will be spent highlighting the range of chemistry content covered in this set of activities and discussing how these activities might be incorporated into a general chemistry curriculum.

Intended Audience: HS/UG \$25 fee limit of 36 participants
Tuesday, August 5, 9:30 AM - 12:30 PM

W85: The POGIL Project Workshop: Development and Implementation of Guided Inquiry Experiments for Physical Chemistry

Rob Whitnell, Guilford College.
Maria Pacheco,

The NSF-funded POGIL-PCL project implements the principles of Process Oriented Guided Inquiry Learning (POGIL) in order to improve student learning in the physical chemistry laboratory (PCL) course. Tested POGIL principles are being used to develop inquiry-based physical chemistry experiments that emphasize macroscopic and molecular models of chemical phenomena. The goal of the POGIL-PCL project is to make available a wide range of physical chemistry experiments with training materials and practitioner support so that instructors may assess their needs and resources and choose from a variety of turn-key experiments that best enhance their students' learning. This workshop will introduce the structure of a POGIL physical chemistry experiment through a classroom-tested, hands-on example, providing participants with both the POGIL-PCL experience from the student perspective and an illustration of what makes an effective guided inquiry experiment. Workshop participants will have the opportunity to discuss how to use the POGIL-PCL principles to write new experiments, how to convert existing physical chemistry experiments, and how to participate further in the POGIL-PCL project.

Intended Audience: UG
Tuesday, August 5,

\$25 fee
2:00 PM - 5:00 PM

limit of 12 participants

W86: The POGIL Project Workshop: Facilitating Upper Level POGIL Courses in Analytical Chemistry

Juliette Lantz, Drew University.
Caryl Fish,

Implementing POGIL in an upper level course such as analytical chemistry presents some unique challenges that differ from implementing POGIL in general and organic chemistry sequences. The goals of this workshop are to introduce faculty to the collection of POGIL materials available to teach analytical chemistry principles, as well as the facilitation and assessment strategies that are useful for a successful implementation of these materials. This workshop will a) introduce users who are already familiar with POGIL to newly developed classroom materials for analytical chemistry, b) help instructors develop implementation strategies that lead to effective use of these materials in an upper-level classroom and c) discuss assessment strategies an instructor could use to gauge the success of POGIL materials in upper-level courses. Interactive sessions where participants will work through selected POGIL analytical chemistry classroom materials and begin to develop a syllabus will be included.

Intended Audience: UG
Tuesday, August 5,

\$25 fee
2:00 PM - 5:00 PM

limit of 36 participants

W87: The POGIL Project Workshop: Introduction to POGIL

Gina Frey, Washington University in St. Louis.
Brandon Fetterly,

This session is designed for those with limited or no previous exposure to POGIL. Participants will have the opportunity to engage in POGIL activities, observe facilitation strategies firsthand, learn about POGIL classroom implementation, and discuss common barriers to implementation. After attending this session, participants will be able to: (1) name essential elements of POGIL pedagogy and philosophy, (2) list student learning outcomes supported in a POGIL classroom, and (3) create plans to begin implementation of POGIL in their own classrooms.

Intended Audience: HS/UG
Sunday, August 3,

\$25 fee
2:00 PM - 5:00 PM

limit of 36 participants

W88: The POGIL Project Workshop: Introduction to POGIL

Marty Perry, Ouachita Baptist University.
Amy Hanson, Denver Public Schools.

This session is designed for those with limited or no previous exposure to POGIL. Participants will have the opportunity to engage in POGIL activities, observe facilitation strategies firsthand, learn about POGIL classroom implementation, and discuss common barriers to implementation. After attending this session, participants will be able to: (1) name essential elements of POGIL pedagogy and philosophy, (2) list student learning outcomes supported in a POGIL classroom, and (3) create plans to begin implementation of POGIL in their own classrooms.

Intended Audience: HS/UG \$25 fee limit of 36 participants
Monday, August 4, 9:30 AM - 12:30 PM

W89: The POGIL Project Workshop: Introduction to POGIL in GOB/Allied Health or Prep Chem

Ashley Mahoney, Bethel University.
Michael Garoutte,

Process Oriented Guided Inquiry Learning (POGIL) is a student-centered, team-based learning approach based on constructivism and the learning cycle. Teams of 3 or 4 build their understanding while working through content-based material and developing targeted process skills, such as teamwork, critical thinking, management, and problem solving. This workshop will provide an introduction to the principles and practice of POGIL , utilizing published activities for a GOB or prep-chem course as examples. Participants will experience a model POGIL classroom, analyze the structure of an activity, and discuss implementation strategies for beginning students. Attendance at this workshop will provide appropriate background for those interested in attending other POGIL Project workshop sessions.

Intended Audience: UG \$25 fee limit of 36 participants
Tuesday, August 5, 9:30 AM - 12:30 PM

W90: The POGIL Project Workshop: POGIL in High School Chemistry Courses

Amanda Zullo, Saranac Lake High School.
Mahesh Alur,

This session is designed for high school teachers with limited or no previous exposure to POGIL. With a focus on high school classrooms, participants will have the opportunity to engage in POGIL activities, observe facilitation strategies firsthand, learn about POGIL classroom implementation, and discuss common barriers to implementation. After attending this session, participants will be able to: (1) name essential elements of POGIL pedagogy and philosophy, (2) list student learning outcomes supported in a POGIL classroom, and (3) create plans to begin implementation of POGIL in their own classrooms.

Intended Audience: HS \$25 fee limit of 36 participants
Monday, August 4, 2:00 PM - 5:00 PM

W91: The POGIL Project Workshop: Student-Centered Learning in the Laboratory: The POGIL and the Science Writing Heuristic Approaches

Tom Greenbowe, Iowa State University.
Steve Gravelle,

POGIL (Process-Oriented Guided Inquiry Learning) and SWH (Science Writing Heuristic) are two complementary approaches to laboratory work that follow a three-stage learning cycle and involve active learning and guided inquiry. In response to a question posed by the instructor (POGIL) or questions developed by the students (SWH), students work in teams to gather data from experiments run under a variety of conditions. They examine the pooled data from which they construct theories and make claims that can be backed up by the experimental results. Group discussions, reflective writing, and in some cases additional experiments are used to further develop the concepts. Participants in this workshop will examine model experiments, work with student-generated data in a simulated laboratory setting, and convert existing and currently used lab activities to POGIL or SWH experiments. Workshop participants should bring copies of two of their lab activities for conversion to POGIL or SWH experiments.

Intended Audience: HS/UG \$25 fee limit of 36 participants
Wednesday, August 6, 9:30 AM - 12:30 PM

W92: The POGIL Project Workshop: Writing POGIL Activities - Advanced

Laura Trout, Lancaster Country Day School.
Colleen Conway, Mount Mary University.
Kimberly Dirlam-Schatz, University of Wisconsin – Fox Valley.
Heather Mernitz, Alverno College.

In this session participants will review the learning cycle, the qualities of good learning objectives, and the characteristics of a robust model. Ample time will be given to begin writing an activity, including a structured brainstorming session for participants to share ideas for activities. After attending this session, participants will be able to: (1) write a set of content and process learning objectives for a POGIL activity, (2) develop a robust model for a POGIL activity, (3) categorize questions in a POGIL activity according to the learning cycle, and (4) use the author scaffold to outline a POGIL activity they would like to write.

Intended Audience: HS/UG \$25 fee limit of 36 participants
Wednesday, August 6, 2:00 PM - 5:00 PM

W93: The POGIL Project Workshop: Writing POGIL Activities - An Introduction

Amy Hanson, Denver Public Schools.
Laura Trout, Lancaster Country Day School.

This session is an introduction to the essential characteristics and structure of high-quality POGIL activities. Participants will also examine the value of developing content and process objectives for POGIL activities, and create a draft or outline of an activity based on these learning objectives. After attending this session, participants will be able to: (1) identify the basic components of a POGIL activity, such as a model and critical thinking questions, (2) classify questions in an activity according to the following types: directed, convergent, or divergent, (3) classify questions in a learning cycle activity according to the following types: exploration, concept invention/term introduction, or application, (4) use both the Learning Cycle and question types to critically analyze activity structure and guide construction of quality POGIL activities, and (5) write, or begin to write, a POGIL activity focused on specific learning objectives.

Intended Audience: HS/UG \$25 fee limit of 36 participants
Wednesday, August 6, 9:30 AM - 12:30 PM

W94: Transferability Among Postsecondary Institutions: Past, Present, and Future

Kishore Bagga, Drexel University College of Medicine.
Joan Sabourin, American Chemical Society.

"An interactive workshop will be held on student transfer and its related aspects. Through breakout and group discussions, participants will address challenges and concerns, as well as models that have been successfully used by institutions to aid student transfer. The workshop is designed for faculty and administrators of two- and four- year colleges.

The workshop will identify opportunities within ACS to raise awareness of student transfer among postsecondary academic institutions. The following questions will be discussed:

- What challenges do students and institutions face with regard to student transfer?
- What resources currently exist, both inside and outside of ACS, to facilitate student transfer?
- What models for successful student transfer currently exist?
- What unique role, if any, can/should ACS play in disseminating resources for successful student transfer?

Participants can expect to share their ideas, learn about effective practices at other institutions, and inform current ACS discussions with regard to facilitating student transfer."

Intended Audience: UG Monday, August 4,	No fee 2:00 PM - 5:00 PM	limit of 60 participants
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W95 Ultimate Jmol

Robert Hanson, St. Olaf College.
Dean Johnston, Otterbein University.

In this workshop for experienced users of Jmol, we will focus on more advanced aspects of Jmol and JavaScript scripting, including what's new for Jmol 14.0, the issue of Java vs. HTML5, and cross-browser compatibility. Participants should bring examples of pages using Jmol or at least be prepared to go behind the scenes with ones provided in order to work on some of the more challenging aspects of using Jmol on the web. The JSmol framework will be described fully. Participants will learn how to coordinate Jmol with other apps, including JSpecView (NMR, IR, UV/Vis, Raman, MS) and JSME (2D drawing). Presented by the principal developer of Jmol.

Intended Audience: HS/UG Sunday, August 3	\$10 fee 2:00 PM - 5:00 PM	limit of 12 participants
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W96: Using design-based activities to uncover students' understanding of chemistry at different educational levels

Hannah Sevian, University of Massachusetts Boston.
Cott Balicki, Boston Public Schools.
Greg Banks, Boston Public Schools.
Michael Clinchot, Boston Public Schools.
Steven Cullipher, University of Massachusetts Boston.
Robert Huie, Boston Public Schools.
Jennifer Lambertz, Boston Public Schools.
Rebecca Lewis, Boston Public Schools.
Courtney Ngai, University of Massachusetts Boston.
Gabriela Szeinberg, University of Massachusetts, Boston.
Vicente Talanquer, University of Arizona.
Melissa Weinrich, University of Arizona.

Students often have difficulty applying classroom skills to a real life context. A method to address this issue is to engage students in design-based problems in which they must apply the core practices of chemistry -- synthesis, analysis, and transformation of matter. Using design-based problems in the classroom can enable instructors to identify how students are thinking about a chemical problem in order to better move them forward in their learning. In this workshop, participants will engage in a design-based lab experience to create and optimize an explosion in a Pringles can and reflect on student understandings that can be revealed through questioning during the laboratory activity. Participants will also learn how to improve their methods of asking questions to elucidate students' underlying assumptions about chemical entities and processes. Finally, participants will have the opportunity to modify currently used lab activities to include a design component.

Intended Audience: HS/UG	\$25 fee	limit of 24 participants
Wednesday, August 6,	2:00 PM - 5:00 PM	

W97: Using Doceri to Teach Wirelessly, Annotate on the Projector, and Record Screencasts

Andrew J. Grall, University of Arizona.

"Teaching traditionally, particularly in large classes, limits an instructor's access to students throughout the classroom. An iPad app called Doceri allows an instructor to move freely around the room during a class - while still controlling a computer, highlighting important concepts, drawing or annotating on the projector - and even recording screencasts of the lecture. Participants in this workshop will practice using the Doceri app in many of its capabilities for classroom management and student engagement.

Participants are strongly encouraged to bring their own iPads with them to the workshop. The workshop will run twice (ninety minutes each) in one three hour block."

Intended Audience: HS/UG	No fee	limit of 25 participants
Wednesday, August 6,	9:30 AM - 11:00 AM	
Wednesday, August 6,	11:00 AM - 12:30 PM	

W98: Using Learning Catalytics to Facilitate Peer Instruction in a Flipped Classroom

Matthew Stoltzfus, The Ohio State University.

Brian Lukoff,

"Learning Catalytics is a ""bring your own device"" student engagement, assessment, and classroom intelligence system allowing instructors to assess students in real time, using open-ended tasks to probe student understanding. Instructors can engage students by creating open-ended questions that ask for numerical, algebraic, textual, or graphical responses - or just plain multiple choice.

Participants of this workshop will first experience Learning Catalytics from the student perspective, as the facilitators will demo the various question types. They will then be given time to create their own questions in the Learning Catalytics platform. Finally, participants will deliver the questions they wrote to the rest of the group allowing them to become familiar with the question delivery and data analytics. The goal of the workshop is to provide the necessary background and best practices for participants to use Learning Catalytics in their chemistry classroom.

Participants will need to have a laptop for this workshop."

Intended Audience: HS/UG
Tuesday, August 5,

No fee
9:30 AM - 12:30 PM

limit of 26 participants

W99: Using Threshold Concepts to Improve Student Learning in Undergraduate Biochemistry

Jennifer Loertscher, Seattle University.

Vicki Minderhout, Seattle University.

Threshold concepts are concepts that when mastered, represent a transformed understanding of a discipline, without which the learner cannot progress. They are therefore essential for learning. By focusing on threshold concepts, instructors can maximize the impact of instruction. During this workshop, participants will be introduced to what is known about threshold concepts in biochemistry and how these concepts relate to prerequisite coursework. Workshop participants will contribute to a community-based effort to create instructional and assessment tools to support undergraduate students in gaining a deeper understanding of selected biochemical threshold concepts. Participation in this process will provide faculty the resources and skills needed to begin to change their instruction to better address learning of these vital concepts. Those who teach undergraduate biochemistry as well as those who teach prerequisite courses for biochemistry (general chemistry, organic chemistry, general biology) are encouraged to attend the workshop.

Intended Audience: UG
Monday, August 4,

\$5 fee
9:30 AM - 12:30 PM

limit of 40 participants

W100: Utilizing Individualized and Active Learning to Demonstrate Student Gains

Terry Haugen, Pearson Education.

"This workshop will facilitate a collaborative development of strategies for integrating adaptive and active learning techniques in chemistry courses. Workshop participants will work together to discuss, present and analyze various techniques and tools that increase student preparation, student self-awareness, and student engagement including Learning Catalytics, an advanced, cloud-based learning analytics and assessment system developed by Eric Mazur, Brian Lukoff, and Gary King of Harvard University. Research shows that instant feedback and peer-to-peer engagement lead to improved student comprehension and this workshop will explore the most effective ways to determine which concepts require further exploration and how to group students accordingly for additional discussion and problem solving"

Intended Audience: UG
Tuesday, August 5,
Tuesday, August 5,

No fee
9:30 AM - 12:30 PM
2:00 PM - 5:00 PM

limit of 24 participants

W101: Beyond the Homework: Authoring Interactive Tutorials In the WebAssign System

Steven Matchett, Grand Valley State University.

Jason Justice, WebAssign.

On-line homework has become a familiar feature of most introductory college courses. Now they do the homework, but are they doing the assigned reading? Imagine a world where the students were assigned an interactive reading that you created. With students reading and answering questions prior to coming to class, you start the lecture on firm ground or can even flip part of the class. What does this cost the student? If you are already using WebAssign, the answer is nothing. This workshop will show how the WebAssign homework system can be used to write interactive tutorials. Topics will include formatting to give a professional look, inclusion of figures, videos, randomization and more. Examples will be drawn from a privately authored general chemistry textbook written entirely in WebAssign, but the applications go well beyond chemistry. The workshop is most beneficial to those with some experience writing questions in WebAssign. Time will be provided to work on a project of your design.

Intended Audience: HS/UG
Sunday, August 3,

No fee
2:00 PM - 5:00 PM

limit of 24 participants