

### **WP1: Modeling Instruction in High School Chemistry - 1**

Raymond Howanski, Laura E. Slocum (*1. Science Department, Heathwood Hall Episcopal School, Columbia, SC, United States. 2. Science Department, Ridley High School, Folsom, PA, United States.*)

Session: Preconference Workshop; July 16-27

Suggested Audience: High School

Workshop Cost: \$600

Maximum Participants: 15

Workshop Description: Modeling Instruction in High School Chemistry organizes the course around a small number of models, rather than a collection of topics. It provides an instructional framework that mimics how scientists “do science.” Students use experimental observations and evidence to construct and refine conceptual models of physical phenomena. Then they apply their models in different situations to answer questions or make predictions, and they probe the boundaries of their models to find out where they break down—where a better model is needed to explain what they observe. More information on Modeling Instruction is available at:

<http://modelinginstruction.org/> Participants will play two roles. First, they will perform the laboratory investigations and problem solving that their students are asked to do. Second, they will practice the techniques of managing student discourse in an inquiry-based classroom. Throughout the workshop, teachers are asked to reflect on their practice and how they might apply the techniques they have learned in the course to their own classes. As a follow-up to the workshop, each teacher will share for 5-10 minutes as part of the Modeling Symposium at the BCCE to help other high school teachers become familiar with what they have learned during this workshop. This workshop is being co-lead by Ray Howanski and Laura Slocum. They have conducted several summer workshops for teachers and have used modeling instruction in their classroom for years. If you have additional questions about this workshop, you can contact Ray at: [rhowanski@ridleysd.org](mailto:rhowanski@ridleysd.org) or Laura at: [lslocum@heathwood.org](mailto:lslocum@heathwood.org)

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### **WP2: Modeling Instruction in High School Chemistry - 2**

Larry Dukerich, Laura E. Slocum (*1. Science Department, Heathwood Hall Episcopal School, Columbia, SC, United States. 2. American Modeling Teachers Association, Phoenix, AZ, United States.*)

Session: Preconference Workshop; July 16-27

Suggested Audience: High School

Workshop Cost: \$600

Maximum Participants: 15

Workshop Description: Open to teachers who have completed a Chemistry 1 workshop, this workshop will focus on an evidence-based approach to the internal structure of the atom, periodicity and covalent bonding, intermolecular forces, equilibrium and acids and bases. Teachers will have the opportunity to refine their understanding of modeling pedagogy and strengthen their understanding of content in these areas. Participants will play two roles. First, they will perform the laboratory investigations and problem solving that their students are asked to do. Second, they will practice the techniques of managing student discourse in an inquiry-based classroom. Throughout the workshop, teachers are asked to reflect on their practice and how they might apply the techniques they have learned in the course to their own classes. More information on Modeling Instruction is available at: <http://modelinginstruction.org/> As a follow-up to the workshop, each teacher will share for 5-10 minutes as part of the Modeling Symposium at the BCCE to help other high school teachers become familiar with what they have learned during this workshop. This workshop is being co-lead by Larry Dukerich and Laura Slocum. Larry is one of the lead developers of Modeling Instruction in chemistry and has conducted numerous summer

workshops for teachers. Laura has used modeling instruction in her classroom for years and has led a summer workshop. If you have additional questions about this workshop, you can contact Larry at: [ldukerich@mac.com](mailto:ldukerich@mac.com) or Laura at: [lslocum@heathwood.org](mailto:lslocum@heathwood.org)

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**WSAP3: Enhancing chemistry formative assessment with classroom video analysis**

Scott F. Balicki, Hannah Sevian, Gregory Banks, Robert Huie, Raul Orduna Picon (*1. Science, Boston Latin School, Reading, MA, United States. 2. Chemistry Department, University of Massachusetts Boston, Boston, MA, United States. 3. Urban Science Academy, Boston, MA, United States. 4. Boston Latin Academy, Boston, MA, United States.*)

Session: Sunday, July 29, 9:00 am-noon and 2:00-5:00 pm

Suggested Audience: High School

Workshop Cost: \$40

Maximum Participants: 20

Workshop Description: Do you ever get to the end of a lesson and think that you could have done something better to improve your students' understanding of chemistry? Classroom video analysis gives us the benefit of hindsight and reflection to strengthen our teaching practices. In this workshop, you will learn how to analyze your own classroom instruction to recognize the ways your students think about chemistry, and to identify formative assessment strategies you can use to enhance the broad conceptions of chemistry framed by the NGSS. Formative assessment is a powerful approach for teachers to learn how their students use their knowledge to address questions that chemistry allows us to answer. It involves teaching practices that occur in cycles of eliciting, noticing, interpreting, and acting. This workshop builds on our article in *The Science Teacher* and professional development with Boston Public Schools, to guide chemistry teachers in examining their own formative assessment facilitation. Before the workshop, you will use your cellphone camera to video a formative assessment activity in one of your chemistry classes, to be uploaded via a secure FTP server, and collect students' written work. During the workshop, you will analyze your video and the student work to diversify your ability to further uncover the productive resources in your students' thinking and advance their understanding of chemistry based on those assets. High school teacher participants must sign up at least 8 weeks before the conference to allow time to capture classroom videos which will then be analyzed during the workshop.



**WSA4: Chemistry in Context**

Brad Fahmlan, John Kirk, Patrick L. Daubenmire (*1. Central Michigan University, Mount Pleasant, MI, United States. 2. Dept of Chemistry, Loyola University Chicago, Chicago, IL, United States. 3. Carthage College, Kenosha, WI, United States.*)

Session: Sunday, July 29, 9:00 am - noon

Suggested Audience: College, High School, General Audience

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: In this workshop, attendees will learn about the online features that complement the book, explore assessment strategies, and participate in a discussion about how to engage nonmajors in a science course.

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**WSA5: Learning to Learn Chemistry**

Daniel Apple (*1. Pacific Crest, Hampton, NH, United States.*)

Session: Sunday, July 29, 9:00 am - noon

Suggested Audience: High School, General Audience

Workshop Cost: \$10

Maximum Participants: 100

Workshop Description: This workshop will share the last 5 years of Learning to Learn Chemistry research and practices to advance the development of student learning processes and how to increase their success in STEM disciplines. Parallel research groups in mathematics and engineering are also advancing a set of practices in teaching Learning to Learn and self-growth. These research efforts include identifying critical risk factors that hinder student success, changes needed in the campus culture to support active learning and the growth of student learning skills, identifying the key characteristics that are the target of growth and development, and sharing of learning to learn activities that are used to develop these learning characteristics. The workshop consists of 4 activities: 1) Analyze the cultural shift needed for producing a learning to learn and growth culture; 2) Learn to identify key risk factors that prevent STEM students' collegiate success; 3) Learn to strengthen key learner characteristics that need additional development to mediate these risk factors; and 4) Sample Learning to Learn Activities that help to build these key learner characteristics. The overarching outcome of this workshop is for each educator to incorporate greater focus on the integration of the development of students' learning performances within the process of the students learning chemistry. Many practices will be explored in the areas of facilitation, assessment, mentoring, measurement and learning practices. Bring your computer to access the numerous online materials which will be used during the workshop.

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**WSP6: Active and Discovery Learning Using Open Spectrometry**Alex Scheeline, Alice Berkson (*SpectroClick, Champaign, IL*)

Session: Sunday, July 29, 2:00-3:30 pm

Suggested Audience: all levels Elem to College

Workshop Cost: \$25

Maximum Participants: 24

Workshop Description: Spectroscopy, the interaction of light with matter, is one of the principal ways to probe the physical world. A rudimentary spectrometer, used in an age-appropriate manner, can lead students to understand light fundamentally and semi-quantitatively. This workshop starts by showing how even the youngest students can see how white light is a composite of other colors and proceeds to demonstrate the use of colored solutions to illustrate light absorption. An additional activity, serial dilution, demonstrates how spectrometry can be used for quantitative analysis. For high school students, one adds quantitative description of diffraction grating function, allowing illustration of laboratory relevant trigonometry. Finally, by using uploaded jpg files with free software, advanced students can see how spectrometers quantify absorption, allowing them to discover the limitations of the rudimentary instrument. Professional spectrometers suffer the same problems as the rudimentary instrument, but in ways that are too subtle to easily demonstrate. By putting everything out in the open with our kit, discovery and innovation are inherent in instrument and lesson design. Analytes are specifically chosen for safety. The workshop describes alternatives to the vendor's products, suggesting how within the classroom, the instructor's emphasis and facilities can guide selection of the most appropriate active learning approach.

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**WMA17: Active Learning in Organic Chemistry: Backward Design**Cathy Welder, Justin Houseknecht (*1. Chemistry, Dartmouth College, Norwich, VT, United States. 2. Chemistry, Wittenberg University, Beavercreek, OH, United States.*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Active, student-centered pedagogies can dramatically improve student outcomes, but before implementing new teaching methods it is essential to clarify, both to yourself and to the students, what students should be learning. This workshop will apply principles of backward design from Wiggins and McTighe's book *Understanding by Design* (2006) to the undergraduate organic chemistry curriculum. Participants will develop course- and topic-level learning objectives as well as methods to assess student and course success. This clearer understanding of goals and assessment methods provides the foundation for instructional change. Results will be disseminated through the Organic Education Resources website at [OrganicERs.org](http://OrganicERs.org). While the backward design process aids in the development of any course, the workshop leaders will be focusing on the application of backward design to an organic chemistry course. High school teachers who wish to participate should be teachers of organic chemistry.

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**WSP7: An Active Approach to Learning Atomic Structure and Periodic Trends  
Hosted by Morton Publishing**

Kim Gunnerson, Colleen F. Craig (*1. Department of Chemistry, University of Washington, Seattle, WA, United States. 2. Department of Chemistry, University of Washington - Bothell, Bothell, WA, United States.*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 40

Workshop Description: Prior to the development of the periodic table, there were only catalogs of various physical and chemical properties for the known elements; the underlying patterns in these properties remained obscure. In the 1860s, Lothar Meyer and Dimitri Mendeleev both independently proposed a periodic system for the elements based on their macroscopic properties. It wasn't until the development of the quantum mechanical model of the atom in the 1920s that the origin of the periodic law was discovered. The electronic structure of the atom and periodic trends of elemental properties, however, are difficult to teach in a lab setting without being didactic. Some labs ask students to confirm the order of elements in a group, but this method does not teach critical thinking skills. We have developed a more active approach that puts students in Meyer and Mendeleev's shoes and tasks them with discovering the periodic law of the elements for themselves based on physical and chemical data about anonymous elements. The identities of the elements are not revealed until the students have developed their own periodic table. The students are then asked to justify the trends they observe using electronic structure arguments, allowing them to develop an awareness of the internal consistency provided by the quantum mechanical model of the atom. The activity we will present is one of 32 labs in Exploring General Chemistry in the Laboratory, a new full-color lab manual available from Morton Publishing.

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**WSP126: Creativity, Collaboration, and Customization: A Resources for  
Excellence Workshop**

Amy Jo Sanders (*1. Chemistry, Stark State College, North Canton, OH, United States*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 35

Workshop Description: Chemistry education varies widely and this is why the ACS Guidelines for Chemistry in Two-Year College Programs provides a comprehensive framework for your needs. Whether you want to get an undergraduate research program started, develop or assess a technical program, or create online chemistry courses, ACS can help you. Join us as we explore the free resources available to you on the ACS website, Chemical Education in Two-year Colleges. You will learn how to creatively apply ACS resources to make your goals a reality while collaborating with colleagues who have experience in your area of interest.

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**WMA89: Future faculty job application feedback workshop**

David Wren, Sonia M. Underwood (*1. Chemistry, Box 7486, Wake Forest University, Winston Salem, NC, United States. 2. Chemistry & Biochemistry, Florida International University, Miami, FL, United States.*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 12

Workshop Description: This Younger Chemistry Education Scholars (YCES)-sponsored workshop targets post-docs and soon-to-be graduating PhD students who are planning to apply for faculty positions. Registered participants who provide all application material by the July 9th will have their materials reviewed by faculty at institutions similar to which they are applying. Feedback of application material will include both strengths and areas to improve on each section of the application. Registered participants will be asked to provide an actual job ad to which they plan to apply by June 18th, which will be used to see how well application packets align to the posted position. This 3-hour workshop will have a 1-hour faculty feedback session, a 1-hour panel discussion, and time for general questions and discussion.

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**WSP10: Introduction to IONiC/VIPeR: Using and Sharing Inorganic Chemistry Education Resources**

Lori A. Watson, Hilary J. Eppley, Anne K. Bentley (*1. Chemistry, Earlham College, Richmond, IN, United States. 2. Depauw Univ, Greencastle, IN, United States. 3. Dept of Chem, Lewis Clark College, Portland, OR, United States.*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 16

Workshop Description: 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.ionicviper.org](http://www.ionicviper.org)) that provides a platform to share content and materials for teaching inorganic chemistry while building a community of inorganic faculty known as IONiC (Interactive Online Network of Inorganic Chemists). 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. Both experienced and new users of the site are welcome.

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**WSP11: Navigating the First Years as a Faculty Member: Professional Advice from Early Faculty**

Jordan Harshman, Ashley Donovan (*1. Chemistry and Biochemistry, Auburn University, Auburn, AL, United States. 2. American Chemical Society, Washington, DC, United States.*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College, General Audience

Workshop Cost: \$10

Maximum Participants: 40

Workshop Description: This workshop is jointly sponsored by the by Younger Chemistry Education Scholars (YCES) and the American Chemical Society (ACS). The purpose of this event is to provide graduate students, postdocs, and anyone interested in pursuing careers in chemistry education with advice and resources on applying for, obtaining, and navigating the first years as a teaching and/or research faculty in academia as well as early careers in other sectors. This professional development opportunity is part of a series of events sponsored by the YCES aimed at the professional preparedness of those in the chemistry education research field. This event will consist of a panel discussion with faculty and experts to provide career advice and answer questions from the participants, as well as a dedicated time for networking with light refreshments.

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**WSP12: Recent successes in large-scale chemistry curriculum reform and how to do it at YOUR own institution**

Douglas R. Mulford, Chris P. Schaller, Cindy D. Hauser, Joshua Kritzer (*1. Emory University, Atlanta, GA, United States. 2. Colg of St Benedict, Saint Joseph, MN, United States. 3. Dept of Chemistry, Davidson College, Davidson, NC, United States. 4. Chemistry, Tufts University, Medford, MA, United States.*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College, General Audience

Workshop Cost: \$10

Maximum Participants: 50

Workshop Description: Modern chemistry research and professional training standards are changing rapidly, but few institutions have updated traditional chemistry curricula to reflect these new expectations. In this workshop, educators from four very different types of institutions will discuss recent, large-scale reforms of their chemistry curricula. These examples will be described in detail, with a focus on each institution's process of curriculum redesign, implementation, and evaluation. Assessment techniques and strategies will also be discussed. Panel discussions will allow attendees to address their own concerns about curricular redesign and implementation at their own institutions. Finally, workshop leaders will work with attendees to explore how they might promote curricular change at their own institution. This will involve identifying goals for reform, strategies for implementation, and potential solutions for expected challenges and barriers. Attendees will leave the workshop with a plan of action for how to affect large-scale change at their own institution.

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**WSP13: Rethinking Common Practices in High School Chemistry Education**

Kaleb Underwood, Kim Duncan (1. *Duchesne Academy of the Sacred Heart, Houston, TX* 2. *American Chemical Society (AACT), Washington, DC*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience:

Workshop Cost: \$15

Maximum Participants: 48

Workshop Description: This workshop will explore several common practices in high school chemistry classrooms and provide alternatives for teachers seeking to build more robust student understanding of core ideas in chemistry. If you have ever wondered, “is there another way?” This workshop/symposium is for you. Join a group of educators dedicated to thinking differently about the way their courses are arranged and to share ideas. Topics addressed will include stoichiometry, reaction classification, physical/chemical changes, mathematics in chemistry, and in-class discussions.

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**WSP14: Teaching Effectively with 3D Visualization at the Molecular Level**

Jurgen Schnitker (*Wavefunction, Irvine, CA*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 32

Workshop Description: How can we best help students make the right connections between the macroscopic, symbolic, and molecular levels of chemistry? Attend this workshop and learn how to work with ODYSSEY Molecular Explorer and SPARTAN Student Edition—two highly interactive and scientifically sound programs for three-dimensional visualization and simulation. A number of examples from the standard General Chemistry and Organic Chemistry course sequence will be explored in hands-on activities (also applicable to High School Chemistry). Find out how abstract concepts can come to life and how students can develop an intuitive feel for the molecular world. Attendees are strongly encouraged to bring a laptop (Windows or Macintosh) and to come a few minutes early to install the programs. Some loaner laptops will be available for those who are unable to bring a computer.

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**WSP15: The POGIL Project Introduction to POGIL: The Fundamentals**

Martin D. Perry, Teresa J. Bixby (1. *Basic Sciences, St. Louis College of Pharmacy, St. Louis, MO, United States.* 2. *Chemistry, Lewis University, Romeoville, IL, United States.*)

Session: Sunday, July 29, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$25

Maximum Participants: 40

Workshop Description: 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.

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### **WSP126: WebMO Hands-On Workshop**

William F. Polik (WebMO LLC), (*1. Department of Chemistry, Hope College, Holland, MI*)

Session: Sunday, July 29, 2:00-4:00 pm

Suggested Audience: High School, College

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: WebMO is a web-based interface to modern computational chemistry programs (Games, Gaussian, Molpro, Mopac, NWChem, ORCA, 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
- \* Using WebMO on Apple and Android portable devices
- \* Installation and administration of a WebMO server

This is a hands-on workshop suitable for high-school and college faculty. Participants are encouraged to bring their own laptop (Windows, Mac, Linux) or portable device (Apple, Android). In addition to workshop activities, a WebMO developer will be available for questions and individual consultation.

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**WWA83: Active Learning in Organic Chemistry: Collaborative Learning and Classroom Assessment Techniques**

Alexey Leontyev, Justin Houseknecht (*1. Chemistry, Wittenberg University, Beaver Creek, OH, United States. 2. Campus Box 98, University of Northern Colorado, Alamosa, CO, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$30

Maximum Participants: 28

Workshop Description: Many faculty are excited about using more technology and the “flipped” classroom is making headlines, but these alone don’t improve student learning. This workshop will introduce proven active learning pedagogies, discuss why they are effective, and provide key characteristics of effective instruction that can use technology and work within the “flipped” paradigm. Participants will focus on developing activities and materials for a particular class session. The workshop facilitators will use examples from their experience teaching general and organic chemistry courses to classes ranging from 20-120 (?) students. Particular emphasis will be placed on effective in-class use of collaborative learning and assessment techniques such as classroom polling, minute paper, muddiest point, categorization grid, student-generated exam questions, and scratch-off quizzes.

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**WMA18: An Active Approach to Learning Atomic Structure and Periodic Trends Hosted by Morton Publishing**

Kim Gunnerson, Colleen F. Craig (*1. Department of Chemistry, University of Washington, Seattle, WA, United States. 2. Department of Chemistry, University of Washington - Bothell, Bothell, WA, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 40

Workshop Description: Prior to the development of the periodic table, there were only catalogs of various physical and chemical properties for the known elements; the underlying patterns in these properties remained obscure. In the 1860s, Lothar Meyer and Dimitri Mendeleev both independently proposed a periodic system for the elements based on their macroscopic properties. It wasn’t until the development of the quantum mechanical model of the atom in the 1920s that the origin of the periodic law was discovered. The electronic structure of the atom and periodic trends of elemental properties, however, are difficult to teach in a lab setting without being didactic. Some labs ask students to confirm the order of elements in a group, but this method does not teach critical thinking skills. We have developed a more active approach that puts students in Meyer and Mendeleev’s shoes and tasks them with discovering the periodic law of the elements for themselves based on physical and chemical data about anonymous elements. The identities of the elements are not revealed until the students have developed their own periodic table. The students are then asked to justify the trends they observe using electronic structure arguments, allowing them to develop an awareness of the internal consistency provided by the quantum mechanical model of the atom. The activity we will present is one of 32 labs in Exploring General Chemistry in the Laboratory, a new full-color lab manual available from Morton Publishing.

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**WMA19: Assessing Competency and Easing Grading Loads: Developing a Specifications Grading Scheme for Your Course**

Mary Beth Anzovino, Mai Yin Tsoi, Omar Villanueva, Cynthia M. Woodbridge (1. School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA, United States. 2. Georgia Gwinnett College, Lawrenceville, GA, United States. 3. School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA, United States.)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$35

Maximum Participants: 10

Workshop Description: Are you tired of being unsure whether your assessment and feedback efforts are really helping your students learn chemistry? In Specifications Grading, the grade earned in a course is a direct measure of student competency in the course's requisite knowledge and skills. This system involves a list of course objectives, each with a targeted assessment. Students have full control over the grades earned by demonstrating minimum competency of course objectives on a pass/fail basis. These assessments can be retaken (with stipulations) until mastery is demonstrated. By focusing students' attention on smaller, well-defined objectives, course expectations are clear and students can self-regulate what learning they must accomplish to reach the standard of minimum competency. Specifications Grading also communicates to all stakeholders which objectives are truly essential to passing the course and to be truly proficient in chemistry, since students who achieve higher grades can demonstrate that they have met the standards for minimum competency through this assessment methodology. In this workshop, participants will: -Learn about specifications grading and its implementation - Receive hands-on guidance in the development/revision of course learning objectives for their course(s) -Explore in a scaffolded way the development of effective assessment activities/questions that can accurately address various facets of each -objective -Discuss and decide on a blueprint for implementing specifications grading in their chosen course and educational level At the end of the workshop, participants will have a set of primary course objectives and a preliminary assessment plan that can be immediately implemented in their class.

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**WMA20: Atomsmith® Classroom Online: Interactive, Dynamic and Physically Accurate Models & Activities with Atoms and Molecules**

David Doherty (1. Bitwixt Software Systems LLC, Minnetonka, MN, United States.)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: You've heard the chatter. Now here is your opportunity to experience Atomsmith! Atomsmith Classroom Online is an HTML5 web application that runs in any browser. It provides a collection of 3D, interactive, physics-based models – based on models developed and used by scientists – that students use to see, interact with, and perform virtual experiments on atoms and molecules. As an educator, you know that if a picture is worth a thousand words, then a 3D, physics-based, interactive picture, that lets your students do REAL science, ups your game and saves a lot of teaching time. Bring your laptop and sign in to the Atomsmith Classroom Online

chemistry platform, and EXPLORE: • Historical atomic structure models that tell the story of the scientific method in action • The relationship between quantum numbers and the structure of the atom • The relationship between atomic structure and the periodic table/trends • How chemical reactions at the particulate level relate to stoichiometry, conservation laws and the movement of electrons • KMT and Gas Laws • How polarity determines solvation \* Properties of Acids and Bases • IMFs • Bonding (valence bond) orbitals • Chemical Equilibrium \* And MUCH MORE!

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### **WMA21: Beyond the Octet Rule: Developing an Explanatory Model of Bonding and Periodicity**

Brenda R. Royce (*1. Science, University High School, Fresno, CA, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 25

Workshop Description: Electron organization in the atom is central to understanding bonding and periodic trends in properties. Modeling Instruction offers a unique analogous model of electrons in the atom from an analysis of ionization energies that allows students to explain bonding and periodic behavior. This model is more robust than the usual energy level rings, yet is conceptually more concrete than a quantum orbital model. Participants are encouraged to bring a laptop with Excel (or other compatible program).

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### **WMA22: Demonstrations and Activities on a Dime for K-8 Chemistry and Physical Science**

Kimberly Duncan (*1. Education, American Chemical Society, Washington, DC, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: Middle School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Join a former chemistry and physical science teacher to learn about the many classroom resources available from the American Association of Chemistry Teachers (AACT). This workshop will feature several demonstrations and student activities using common household and inexpensive materials that you can use to teach the principles of physical science and chemistry to your K-8 student.

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**WMA23: Developing assessments that measure three-dimensional learning:****Part 1 – Core Ideas**

Sonia M. Underwood, Lynmarie A. Posey, Melanie Cooper, Deborah G. Herrington, Justin H. Carmel (1. *Chemistry and Biochemistry, Florida International University, Miami, FL, United States.* 2. *Michigan State University, East Lansing, MI, United States.* 3. *Department of Chemistry, Michigan State University, East Lansing, MI, United States.* 4. *Dept of Chem, Grand Valley State University, Allendale, MI, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: The 2012 National Research Council report, *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*, introduced the idea of three-dimensional learning as a guide to help students develop a robust understanding of science. Three-dimensional learning helps instructors to define what they want students to learn (core ideas), what they want students to do with their knowledge (scientific practices), and how students should connect their knowledge in one scientific discipline to another (crosscutting concepts). For this two-part workshop, participants will engage in groups to redesign and develop both open-ended and multiple-choice assessment items using the criteria we have developed as part of the Three-Dimensional Learning Assessment Protocol (3D-LAP). Within the first part of this workshop facilitators will assist participants by answering questions about the protocol and providing guidance for item development with respect to core ideas. Participants will leave with a copy of the 3D-LAP and a working knowledge of how to apply it to modify existing assessment items and build new ones. Participants are encouraged to attend both workshops, but it is not necessary to attend both if only one can be attended.

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**WMA24: Experiential Chemistry: A hands-on laboratory-based course for non-majors**

Marc L. Richard, Elizabeth Pollock (1. *Chemistry, Stockton University, Galloway, NJ, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$30

Maximum Participants: 24

Workshop Description: 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; 3-hour session.

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**WMA25: Forensic Chemistry using Vernier Sensors: Poisoned Wine and Mystery Powders**

Elaine Nam (*1. Vernier Software and Technology, Portland, OR, United States.*)

Session: Monday, July 30, 9:45-11:15 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Using Vernier sensors you will analyze crime scene evidence as part of an investigation. Sensors used in these activities will be the SpectroVis Spectrophotometer, Melt Station, pH Sensor, and Conductivity Probe. Participants will receive copies of each activity. Appropriate for high school and college.

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**WMA26: Vernier Instrumentation for the Undergraduate Laboratory**

Elaine Nam (*1. Vernier Software and Technology, Portland, OR, United States.*)

Session: Monday, July 30, 8:00-9:30 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: This hands-on workshop will provide training on Vernier instrumentation for general, organic, GOB, and biochemistry laboratory applications. Learn how to use the Polarimeter for studying optically active stereoisomers. Operate the Vernier Mini GC Plus, a gas chromatograph that uses room air as the carrier gas. Compare spectrometers for use in the visible and UV region including SpectroVis Plus along with fluorescence options using the Fluorescence/UV-VIS Spectrophotometer. Participants will receive sample experiments for each instrument. Appropriate for college.

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**WMA27: Interactive Experience with Microwave Technology in Teaching Laboratories**

Gabrielle Dusharm (*1. CEM Corporation, Charlotte, NC, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 25

Workshop Description: Microwave technology has become a common tool for chemical synthesis with many academic institutions 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 include 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 receive hands-on training to understand how microwave-assisted chemistry can fit into any teaching lab.

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### **WMA28: Introducing General/Organic/and Biochemistry Students to the Molecular World -- with Physical Models of Proteins and other Macromolecules.**

Tim Herman, Margaret Franzen (*1. Center for BioMolecular Modeling, MSOE, Wauwatosa, WI, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: The MSOE Center for BioMolecular Modeling (CBM) is an instructional materials design laboratory focused on the invisible molecular biosciences. The CBM uses 3D printing technology to create physical models of proteins and other molecular structures. In addition to 3D printed models, we have worked with educators over the past 15 years to create a wide range of student-centered manipulative teaching tools designed to engage students in thinking about this invisible molecular world. In this workshop, we will (i) introduce educators to a wide range of instructional materials that will make the molecular world real for your GOB students, and (ii) introduce educators to teaching with models as we tell two different molecular stories of current research. Instructional materials presented in this workshop will include: The Water Kit ... that models four basic principles of chemistry The Protein Folding Kit Narrated Jmol Explorations of Proteins Membrane Transport Kit The Dynamic DNA Discovery Kit Flow of Genetic Information Kit The two molecular stories that will be presenting in this workshop will focus on: A Universal Flu Vaccine .... directed against the hemagglutinin protein. The Beery Family Story .... in which whole genome sequencing was used to determine the molecular basis for a neurocognitive disorder related to neurotransmitter biosynthesis. All materials used in this workshop can be borrowed from the MSOE Model Lending Library (<http://cbm.msoe.edu/lendingLibrary/index.php>) ....at no charge other than the cost of return postage.

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### **WMA29: Mapping the Undergraduate Curriculum in Analytical Chemistry**

Shalini Srinivasan, Jessica J. Reed, Jaclyn M. Trate, Thomas C. Pentecost, Jeffrey R. Raker, Kristen L. Murphy (*1. Chemistry and Biochemistry, University of Wisconsin-Milwaukee, Milwaukee, WI, United States. 2. University of Wisconsin Milwaukee, Port Washington, WI, United States. 3. Chemistry Department, Grand Valley State University, Allendale, MI, United States. 4. Chemistry, University of South Florida, Tampa, FL, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: At ACS Exams, we have been working on constructing Anchoring Concept Content Maps (ACCM). These maps use a four-tiered structure and provide a content framework for the entire undergraduate chemistry curriculum. The first two tiers are broad and subdiscipline independent. The third and fourth tiers get progressively more detailed and are subdiscipline specific. We have published four ACCM (general, organic, physical and inorganic) only through the contributions from faculty and instructors through many focus groups and workshops. The maps for biochemistry and analytical chemistry are nearing completion. For this workshop, we are working on the final level three and four details for the content map in analytical chemistry. Reflecting on the feedback from the other subdiscipline maps often provides participants with a unique insight about the courses taught and how the concepts taught in these courses contribute to the overall undergraduate chemistry curriculum.

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### **WMA30: Reformed Experimental Activities (REactivities): Rethinking How We Deliver an Organic Chemistry Lab**

Tina G. Goudreau Collison, Jason P. Anderson, Brian L. Edelbach (*1. Rochester Inst of Technology, Rochester, NY, United States. 2. Chemistry, Monroe Community College, Rochester, NY, United States. 3. Monroe Community College, Rochester, NY, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 16

Workshop Description: Reformed Experimental Activities (REactivities) are an innovative approach to the delivery of the traditional material in an undergraduate organic chemistry laboratory. In this workshop, you will have the opportunity to play the student for one REActivity in order to understand the novel delivery method. Through this experience you will become an insightful participant in a discussion around implementation, adoption barriers, and instructor training across four-year and two-year institutions. We will also present the current data collected using Reformed Teaching Observational Protocol (RTOP), and preliminary data using the Meaningful Learning in the Lab (MLLI) instrument as it relates to institutions who have adopted this regime. Future activities on this NSF-funded work and a unique opportunity for interested faculty will also be presented.

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### **WMA31: Shining the Light on what Matters**

Jennifer Schmeisser, Nadia Marano, Samantha Glazier (*1. Chemistry, St Lawrence University, Canton, NY, United States. 2. Chemistry, St. Lawrence University, Canton, NY, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$15

Maximum Participants: 40

Workshop Description: This workshop provides teachers of first year college chemistry and advanced high school chemistry with inquiry-based activities to set the stage for teaching the quantum model of the atom. At St. Lawrence, students perform these activities in a single general chemistry lab session. As our students would, the

participants will visit stations, make observations, and answer thought provoking questions. The overall goal is to understand how light, color, and matter are connected. The first activities develop understanding of the nature of waves, diffraction, and light. Students learn to distinguish continuous versus line spectra using familiar light sources (sunlight, LEDs, fluorescent and incandescent bulbs, lasers) and differentiate the terms: transmission, absorbance, reflection, and emission. Spectroscopic activities explore how light interacts with matter and introduces the concepts that electron energies are quantized, and the spacing of those levels is unique to each atom. This helps us to understand the structure of atoms and molecules. Once students see that both light and matter behave as particle-waves, we construct the quantum model of the atom.

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### **WMA32: Spectrometry and Colorimetry for AP and College Chemistry**

Tom Loschiavo (*1. PASCO scientific, Roseville, CA*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College / AP

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: How can light emissions tell you about atomic structure? How can the color of a solution tell you about molecular structure, concentration and reaction rates? In this hands-on workshop with the Wireless Spectrometer and New Wireless Colorimeter, you will incorporate spectrometry into your labs by performing experiments including light source emission studies and colored solutions analysis, Beer's Law, and kinetics.

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### **WMA33: Super Active Learning with Superstore Items**

Bernadette S. Harkness, Jonathan Gittens, Brian Aldrich (*1. Dept of Chemistry RM D165, Delta College, University Center, MI, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School, Middle School

Workshop Cost: \$10

Maximum Participants: 25

Workshop Description: This workshop will provide several tools and approaches that facilitate breakthrough learning of difficult concepts in Introductory and General Chemistry. Using low-cost items such as nuts, bolts, pasta, playdoh, plastic eggs and other items, participants will engage in activities that provide a tangible and tactile representation of the particulate nature of matter. Topics addressed include stoichiometry, limiting reactants, percent yield, empirical formulas, isotopes, dissociation, and atomic shape. Each participant will receive electronic lesson files to use in the classroom and a small sample of selected supplies. The workshop will use a modular/station layout allowing participants the flexibility to select their most relevant activities and spend adequate time at each station.

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**WMA34: Taking Action: Classroom Activities that Reinforce Key Chemistry Concepts**

Raymond B. Scott, Leanna C. Giancarlo (*1. Chemistry, Univ of Mary Washington, Fredericksbrg, VA, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$15

Maximum Participants: 24

Workshop Description: Six activities will be presented that have been used in a college level course designed for students who are under-prepared for General Chemistry. These activities would also be very appropriate for high school level courses targeting college bound students who are struggling with the abstract concepts found in chemistry. At the University of Mary Washington they are each run in a fifty minute period with students in teams of three. Each activity is designed to emphasize a particular foundational principle, giving students an opportunity to both enhance understanding and practice the skill being addressed, while building critical thinking and problem solving skills. The six activities address the Scientific Method: using a card game to practice designing and evaluating experiments, Significant Figures: using precise and imprecise measuring devices, Conversion Factors: building bridges using conversion factor cards, the Periodic Table: using information on fictitious elements to properly order them on a table, Pattern recognition and Problem Solving: demonstrating non-numerical reasoning, and Balancing Equations / Limiting Reagents: using small bricks to physically manipulate reaction components. Workshop attendees will be placed in teams of three and given the opportunity to work through each of the activities. Student and instructor feedback regarding learning gains from each activity will be discussed as well.

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**WMA35: Teaching Toxicology in Chemistry Courses: Resources and Techniques**

Amy S. Cannon, Pamela Spencer, Dalila G. Kovacs (*1. Beyond Benign, Wilmington, MA, United States. 2. The Dow Chemical Company, Midland, MI, United States. 3. Grand Valley State Univ, Allendale, MI, United States.*)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 50

Workshop Description: Toxicology concepts are being integrated into existing chemistry courses to reinforce chemistry concepts, while providing students with an understanding of how to design chemical products and processes with reduced human and environmental hazards. This workshop will feature new curriculum models and toxicology resources that can be implemented into introductory chemistry courses from general to organic chemistry and beyond. Hands-on tools will be introduced which allow chemists to predict toxicological endpoints based on structure. The workshop will be carried out by chemistry faculty and toxicology professionals. Participants will come away with case studies to implement within chemistry courses, new course models, and open-access toxicological tools to guide design strategies to reduce human and environmental hazards.

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**WMA36: Tech Talks: Creating an Interactive Classroom**

Tina Sabatello<sup>1, 2</sup> (1. Chemistry, Maine East High School, Park Ridge, IL, United States. 2. Google for Education Certified Trainer, Palatine, IL, United States.)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Learn to use free apps for immediate implementation that are compatible across all devices and to increase student engagement. Create interactive review lessons for students to evaluate their understanding and use the data to assess the progress of your students and address misconceptions. Some of the apps that will be presented include : Pear Deck, Quizlet Live, Quizizz & Google Forms..... BYOD for this hands-on session. There will be time to work with your favorite app from this session and receive assistance.

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**WMA37: The POGIL Project Introduction to POGIL: The Fundamentals**

Regina Frey, Jeffrey R. Pribyl (1. Chemistry, Washington University in St. Louis, St. Louis, MO, United States. 2. Dept Chem Geol, Minnesota State Univ - Mankato, Mankato, MN, United States.)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$25

Maximum Participants: 40

Workshop Description: 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.

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**WSP16: What Happens After a Test: General Chemistry Faculty Practices on Feedback and Encouraging Student Learning**

Cynthia Luxford, Jamie Schneider (1. Dept of Chemistry and Biochemistry, Texas State University, San Marcos, TX 2. Department of Chemistry and Biotechnology, University of Wisconsin-River Falls, River Falls, WI)

Session: Monday, July 30, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 15-20

Workshop Description: As general chemistry instructors, we often give summative assessments such as exams or tests. Generally, we give some feedback to students as indicator about their course performance and level of content knowledge acquired. For some faculty, this feedback might be a single score. Other faculty might hand back exams or use immediate feedback techniques. While studies are exploring students' perceptions and uses of test feedback, it is also important to identify common classroom practices as well as perceived limitations and barriers to testing feedback. As we work towards the development and implementation of a national survey, we are asking general chemistry faculty to help us identify what happens after a test in their classrooms in terms of both feedback and learning through focus group discussions as well as an activity designed to develop and modify national survey questions. Participants will also get an opportunity to see and discuss student data gathered through a series of classroom studies regarding the use of feedback between testing.





**WMP38: A Guide to Teaching and Learning of Scientific Writing, Peer Review, and Science Communication**

Rainer Glaser, Kaidi Yang, Joseph Schell (*1. Department of Chemistry, University of Missouri, Columbia, MO, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 40

Workshop Description: Participants in this workshop will learn about a student-centered, writing-intensive and scaffolded approach to integrate micro- and macroethical aspects of science into upper-division chemistry curricula. We describe a framework for an assignment-based curriculum to instruct students on best practices in writing a scientific paper, about the scientific publication process and peer review, and about professional issues. The rationale for the curriculum design is that students should not only understand scientific content and methods but they should also experience peer review as an integral and essential part of the process and microethical aspects of science. The curriculum *Scientific Writing in Chemistry* integrates content, context, collaboration and communication and addresses an essential need for science students across the globe and pedagogical aspects have been described (1). Each implementation employs a new curriculum, which is based on an overarching theme. The themes are selected to address timely science topics that are pertinent to macroethical discussions in society. All assignments are original with adapted online resources and rubrics for assessment. The assignments, associated data and sources, peer review devices including assessment rubrics, and samples of completed assignments are available online for nine implementations (2). Participants will actively engage in conversations about theme selection, begin collecting topic sources, practice scaffolding strategies for their theme, and practice the adaptation of assignments and rubrics. (1) Glaser, R. E. Design and Assessment of an Assignment-Based Curriculum to Teach Scientific Writing and Scientific Peer Review. *J. Learning Design* 2014, 7, 85-104. (2) SP18: [http://faculty.missouri.edu/~glaserr/RG\\_T\\_SP18.html](http://faculty.missouri.edu/~glaserr/RG_T_SP18.html).

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**WMP39: An Inquiry and Forensic Approach Towards Chemical Experimentation**

Jesse D. Bernstein, Jeffrey Bracken, Paul Price (*1. Science, Miami Country Day School, Aventura, FL, United States. 2. Science, Westerville North H.S., Westerville, OH, United States. 3. Science, Trinity Valley School, Ft. Worth, TX, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Here is an AP (or general college chemistry) lab workshop that will satisfy virtually all of your desires; over fifty inquiry and forensic based lab activities that parallel those now recommended (or required) by the College Board. The available for purchase 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. Approximately 12 experiments will be available to experience.

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**WSP8: Assessing Competency and Easing Grading Loads: Developing a Specifications Grading Scheme for Your Course**

Mary Beth Anzovino, Mai Yin Tsoi, Omar Villanueva, Cynthia M. Woodbridge (1. School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA, United States. 2. Georgia Gwinnett College, Lawrenceville, GA, United States. 3. School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA, United States.)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$35

Maximum Participants: 10

Workshop Description: Are you tired of being unsure whether your assessment and feedback efforts are really helping your students learn chemistry? In Specifications Grading, the grade earned in a course is a direct measure of student competency in the course's requisite knowledge and skills. This system involves a list of course objectives, each with a targeted assessment. Students have full control over the grades earned by demonstrating minimum competency of course objectives on a pass/fail basis. These assessments can be retaken (with stipulations) until mastery is demonstrated. By focusing students' attention on smaller, well-defined objectives, course expectations are clear and students can self-regulate what learning they must accomplish to reach the standard of minimum competency. Specifications Grading also communicates to all stakeholders which objectives are truly essential to passing the course and to be truly proficient in chemistry, since students who achieve higher grades can demonstrate that they have met the standards for minimum competency through this assessment methodology. In this workshop, participants will: -Learn about specifications grading and its implementation - Receive hands-on guidance in the development/revision of course learning objectives for their course(s) -Explore in a scaffolded way the development of effective assessment activities/questions that can accurately address various facets of each -objective -Discuss and decide on a blueprint for implementing specifications grading in their chosen course and educational level At the end of the workshop, participants will have a set of primary course objectives and a preliminary assessment plan that can be immediately implemented in their class.

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**WMP41: Developing assessments that measure three-dimensional learning: Part 2 – Scientific Practices**

Sonia M. Underwood, Lynmarie A. Posey, Melanie Cooper, Deborah G. Herrington, Justin H. Carmel (1. Department of Chemistry, Michigan State University, East Lansing, MI, United States. 2. Michigan State University, East Lansing, MI, United States. 3. Dept of Chem, Grand Valley State University, Allendale, MI, United States. 4. Chemistry and Biochemistry, Florida International University, Doral, FL, United States.)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: The 2012 National Research Council report, A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, introduced the idea of three-dimensional learning as a guide to

help students develop a robust understanding of science. Three-dimensional learning helps instructors to define what they want students to learn (core ideas), what they want students to do with their knowledge (scientific practices), and how students should connect their knowledge in one scientific discipline to another (crosscutting concepts). For this two-part workshop, participants will engage in groups to redesign and develop both open-ended and multiple-choice assessment items using the criteria we have developed as part of the Three-Dimensional Learning Assessment Protocol (3D-LAP). Within the second part of this workshop facilitators will assist participants by answering questions about the protocol and providing guidance for item development with respect to scientific practices. Participants will leave with a copy of the 3D-LAP and a working knowledge of how to apply it to modify existing assessment items and build new ones. Participants are encouraged to attend both workshops, but it is not necessary to attend both if only one can be attended.

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### **WMP42: Differentiate Your Course: Help students realize Chem Lab is their most important class**

Danielle Buckley, Katy Trionfi (*Macmillan Learning/Hayden-McNeil*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: Chemistry educators constantly strive to engage students and demonstrate ways in which science is relevant to their everyday lives but often face challenges along the way. Inquiry-based content and digital resources are some of the tools being used to inspire students and to illustrate the significance of chemistry. We will facilitate collaboration among laboratory educators and provide examples of novel approaches to increase student engagement and allow instructors more time for quality student interactions.

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### **WMP43: Engaging Students with Chemistry Games**

Edward Wang, Lindsay Plavchak (*1. PlayMada Games, New York, NY, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: High School, Middle School

Workshop Cost: \$10

Maximum Participants: 48

Workshop Description: Looking to increase student engagement in your classroom without sacrificing content? Unsure of how to integrate games into your lessons? Come explore Collisions™, a system of interconnected digital chemistry games designed specifically for the classroom, and experience gameplay that is both fun and exploratory for students. Strategies to use games to introduce, teach and review key chemistry concepts will be shared. Participants will also be provided with student materials designed to explicitly connect gameplay with content learning objectives. Bring a laptop/tablet or use one of our devices to participate in several classroom-ready game activities.

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**WMP44: Experiments with Vernier Wireless Sensors**

Melissa P. Hill (1. *Vernier Software and Technology, Beaverton, OR, United States.*)

Session: Monday, July 30, 2:00-3:30 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Are you new to probeware, plan to equip a new science laboratory, or need an affordable solution that includes free software? This workshop will show you the versatility of the Go Direct sensors using our free Graphical Analysis 4 and Spectral Analysis 4 app for computers, Chromebooks, and mobile devices. Connect the sensors wired via USB or wirelessly via Bluetooth. Come try a new Go Direct pH Sensor, Temperature Probe, Gas Pressure Sensor, and SpectroVis Plus Spectrophotometer. Download Vernier Graphical Analysis 4 and Spectral Analysis 4 and bring your device for this hands-on session. Appropriate for high school and college.

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**WMP45: Using Vernier Technology to Teach Chemical Kinetics**

Melissa P. Hill (1. *Vernier Software and Technology, Beaverton, OR, United States.*)

Session: Monday, July 30, 3:45-5:15 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Join us in this hands-on workshop to investigate chemical kinetics using two different reactions. We will examine the decomposition of hydrogen peroxide using a Gas Pressure Sensor and the reaction of crystal violet with sodium hydroxide with our SpectroVis Plus Spectrophotometer. Analysis will be done to determine the rate and order of each reaction. Lastly, we will derive a rate law for each reaction. Participants will receive copies of each activity. Appropriate for high school and college.

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**WMP46: Fostering Connections between Macroscopic, Submicroscopic, and Representational Levels in the Lab: A Workshop to Experience and Understand the CORE learning cycle.**

Mitchell R. Bruce<sup>2, 1</sup>, Alice E. Bruce, Joseph Walter<sup>3, 1</sup> (1. *RiSE Center, University of Maine, Orono, ME, United States.* 2. *Chemistry Dept, University of Maine, Orono, ME, United States.* 3. *University of Maine, Milford, ME, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School

Workshop Cost: \$20

Maximum Participants: 20

Workshop Description: Scientists and science educators have emphasized the vital role that analogical reasoning (including modeling) plays in developing the skills necessary to connect macroscopic, submicroscopic and representational levels. The CORE learning cycle is a laboratory strategy designed to introduce explicit curricular scaffolding in support of development of analogical reasoning skills. The purpose of CORE (Chemical Observations, Representations, and Experimentation) is to empower students to understand how to think about the use and limitations of representations. CORE labs are phased to make chemical observations while considering some open-ended prompts (phase 1), use analogical reasoning to explore the macroscopic and submicroscopic connections (phase 2), and design and conduct experiments in response to a scientific question (phase 3). The workshop will employ a familiar lab activity to allow participants to experience the CORE strategy from a student's perspective as well as from the perspective of teachers at various levels (middle school, high school, and college). The workshop will also illustrate a method to assess student use of analogical reasoning to build scientific arguments in lab reports.

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### **WMP47: HARPOON project: Incorporating active research into the laboratory curriculum**

Jennifer D. Schuttlefield Christus, Michelle DeBoever, Zac A. Chambers (*1. Chemistry, University of Wisconsin-Oshkosh, Oshkosh, WI, United States. 2. Center for Chemical Innovation Solar Fuels, California Institute of Technology, Pasadena, CA, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School, General Audience

Workshop Cost: \$20

Maximum Participants: 30

Workshop Description: The HARPOON workshop is for educators looking to bring renewable energy concepts into their classroom. We have developed a laboratory experiment that utilizes real-time, inquiry-based research to discover catalysts for solar energy conversion. Instructors will experience the various steps of the lab, which includes creating unique combinations of mixed-metal oxide materials and analyzing the combinations utilizing a simple, inexpensive system that detects the amount of oxygen evolved during electrolysis. The HARPOON experiment is part of a larger outreach program called The Solar Army that was developed by the NSF-Funded Center for Chemical Innovation in Solar Fuels (CCI Solar). This experiment has the flexibility to be implemented at a variety of educational levels with the depth and breadth of the material covered accordingly and has resulted in the discovery of many new materials worth further investigating through student involvement. To date, we have recruited hundreds of students at the high school and undergraduate levels to join our "Solar Army" and search for the "holy-grail" catalyst.

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### **WMP48: Interactive Experience with Microwave Technology in Teaching Laboratories**

Gabrielle Dusharm (*1. CEM Corporation, Charlotte, NC, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 25

Workshop Description: Microwave technology has become a common tool for chemical synthesis with many academic institutions 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 include 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 receive hands-on training to understand how microwave-assisted chemistry can fit into any teaching lab.

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### **WMP49: Introducing General/Organic/and Biochemistry Students to the Molecular World -- with Physical Models of Proteins and other Macromolecules.**

Tim Herman, Margaret Franzen (*1. Center for BioMolecular Modeling, MSOE, Wauwatosa, WI, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: The MSOE Center for BioMolecular Modeling (CBM) is an instructional materials design laboratory focused on the invisible molecular biosciences. The CBM uses 3D printing technology to create physical models of proteins and other molecular structures. In addition to 3D printed models, we have worked with educators over the past 15 years to create a wide range of student-centered manipulative teaching tools designed to engage students in thinking about this invisible molecular world. In this workshop, we will (i) introduce educators to a wide range of instructional materials that will make the molecular world real for your GOB students, and (ii) introduce educators to teaching with models as we tell two different molecular stories of current research. Instructional materials presented in this workshop will include: The Water Kit ... that models four basic principles of chemistry The Protein Folding Kit Narrated Jmol Explorations of Proteins Membrane Transport Kit The Dynamic DNA Discovery Kit Flow of Genetic Information Kit The two molecular stories that will be presenting in this workshop will focus on: A Universal Flu Vaccine .... directed against the hemagglutinin protein. The Beery Family Story .... in which whole genome sequencing was used to determine the molecular basis for a neurocognitive disorder related to neurotransmitter biosynthesis. All materials used in this workshop can be borrowed from the MSOE Model Lending Library (<http://cbm.msoe.edu/lendingLibrary/index.php>) ....at no charge other than the cost of return postage.

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### **WMP52: Relative Strengths of Bases - Revisiting the B-L Model**

Larry Dukerich (*1. American Modeling Teachers Association, Phoenix, AZ, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: In the standard treatment of the Bronsted-Lowry model of acid-base behavior, acids are described as “proton donors” with an acid’s strength as a measure of its tendency to transfer protons to another species. However, it is counter-intuitive, at the particle level, to discuss the relative tendency of an acid to give up a proton, when, as students well know, energy is required to separate bound particles. In this workshop acid-base equilibria are viewed in terms of the competition between bases for the acidic proton. Participants will use conductivity data to determine the equilibrium position in a series of acid-base reactions and thus rank order the strengths of the bases involved.

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### **WMP53: Stoichiometry: Tools and Strategies to make it easier to teach**

Tom Loschiavo (*1. PASCO scientific, Roseville, CA*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: High School

Workshop Cost: 10

Maximum Participants: 24

Workshop Description: How can you tell when a reaction is complete? Why doesn’t more reactant always lead to more product? Help students engage and apply the concepts of mole ratios, stoichiometry and limiting reactants through this hands-on activity from Essential Chemistry using household chemicals and a Wireless Pressure Sensor. By incorporating molecular model kits and interactive simulations, your students understanding of difficult topics like reactions and stoichiometry will deepen as they make the connection between macroscopic observations and molecular phenomena. Attendees will have a chance to win a Wireless sensor at the end of the session!

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### **WMP55: Supporting molecular-level understanding under the NGSS**

Ryan Stowe, Melanie Cooper (*1. Chemistry, Michigan State University, East Lansing, Michigan, Macao.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: High School

Workshop Cost: \$10

Maximum Participants: 50

Workshop Description: Chemistry, under the Next Generation Science Standards (NGSS), should focus on helping students make sense of the world at a molecular level. This presents significant challenges as atoms and molecules are far removed from experience and behave in ways that cannot be intuited from macroscopic experience alone. In this workshop, we will consider how students should be supported in developing the resources necessary to predict, explain, and model phenomena at the molecular level. Four questions will guide our discussion: 1. What do we want students to know and be able to do as they progress through a course in chemistry? 2. How will we know students have developed a robust and useful understanding of chemistry? 3. How should concepts be scaffolded and interconnected to promote molecular-level understanding? 4. What role should curricular materials play in an NGSS-aligned chemistry course? Evidence from analysis of our NSF funded general chemistry curriculum “Chemistry, Life, the Universe, and Everything” (or CLUE) will be used to guide our discussion and CLUE will serve as a prototype of what an NGSS-aligned chemistry curriculum might look like. Workshop participants will focus on

answering our four focal questions for their own institutional settings. In addition, they will have the opportunity to work with the materials developed for the CLUE curriculum including formative and summative assessments. Participants will also be provided with CLUE materials, including an electronic version of the text, Powerpoint slides, and student activities.

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### **WMP56: Taking Action: Classroom Activities that Reinforce Key Chemistry Concepts**

Raymond B. Scott, Leanna C. Giancarlo (*1. Chemistry, Univ of Mary Washington, Fredericksbrg, VA, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$15

Maximum Participants: 24

Workshop Description: Six activities will be presented that have been used in a college level course designed for students who are under-prepared for General Chemistry. These activities would also be very appropriate for high school level courses targeting college bound students who are struggling with the abstract concepts found in chemistry. At the University of Mary Washington they are each run in a fifty minute period with students in teams of three. Each activity is designed to emphasize a particular foundational principle, giving students an opportunity to both enhance understanding and practice the skill being addressed, while building critical thinking and problem solving skills. The six activities address the Scientific Method: using a card game to practice designing and evaluating experiments, Significant Figures: using precise and imprecise measuring devices, Conversion Factors: building bridges using conversion factor cards, the Periodic Table: using information on fictitious elements to properly order them on a table, Pattern recognition and Problem Solving: demonstrating non-numerical reasoning, and Balancing Equations / Limiting Reagents: using small bricks to physically manipulate reaction components. Workshop attendees will be placed in teams of three and given the opportunity to work through each of the activities. Student and instructor feedback regarding learning gains from each activity will be discussed as well.

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### **WMP57: Teaching Effectively with 3D Visualization at the Molecular Level**

Jurgen Schnitker (*Wavefunction, Irvine, CA*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: 10

Maximum Participants: 32

Workshop Description: How can we best help students make the right connections between the macroscopic, symbolic, and molecular levels of chemistry? Attend this workshop and learn how to work with ODYSSEY Molecular Explorer and SPARTAN Student Edition—two highly interactive and scientifically sound programs for three-dimensional visualization and simulation. A number of examples from the standard General Chemistry and Organic Chemistry course sequence will be explored in hands-on activities (also applicable to High School Chemistry). Find out how abstract concepts can come to life and how students can develop an intuitive feel for the molecular



world. Attendees are strongly encouraged to bring a laptop (Windows or Macintosh) and to come a few minutes early to install the programs. Some loaner laptops will be available for those who are unable to bring a computer.

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### **WMP58: TechTools: Creating Interactive & Instructional Videos**

Tina Sabatello (*1. Chemistry, Maple East High School, Park Ridge, IL, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Learn to use EDpuzzle to create interactive videos with multiple choice or written response questions. View student responses, scores, time spent, add comments while grading their written work. You can use a video you find on the internet or create your own screencast with Screencastify .All the Apps are free !

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### **WMP59: The Investigation of the Unknown Chemical Spill**

Matthew J. Crawford (*1. Frostburg State University, Frostburg, MD, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: High School, Middle School, General Audience

Workshop Cost: \$20

Maximum Participants: 30

Workshop Description: Attendees will work through an inquiry based analysis of identifying an unknown chemical spill. The analysis is focused around common household products and understanding acid/base properties. Participants will be presented with the problem/scenario and will be provided with a brief background on acid/base properties both physical and chemical. The attendees will learn how to incorporate this background along with pH to help identify the spill. Once identified the participants will then work on a proposed plan for neutralizing the spill and cleaning it up. This workshop is flexible in terms of depth of the material and can be modified to meet the needs of the intended age group.

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### **WMP60: The Nitty-Gritty: Day-to-Day Tools for Active, Inquiry-Driven Classrooms**

Kevin Revell (*1. Department of Chemistry, Murray State University, Murray, KY*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 40

Workshop Description: For many students, chemistry can seem elusive and intimidating. Active-learning techniques can reduce this barrier by providing environments for students to practice key skills and concepts at a granular level, building a foundation for success in higher-level classes. This presentation will highlight several approaches – both pedagogical techniques and new digital tools – to help students engage with chemistry in active, inquiry-driven environments. Specifically we will examine ways in which a blend of in-class techniques, such as digital guided-inquiry activities, clickers, tablet-driven problem sessions, speed drills, and group problem-solving can to produce a flexible classroom experience to accommodate a variety of learning styles. While the workshop will feature tools from the new Revell Introductory Chemistry curriculum, many of the ideas and practices are also transferrable to general chemistry and higher-level courses.

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### **WMP61: The POGIL Project Climate Change Concepts in General Chemistry**

Daniel B. King, Gail H. Webster (*1. Drexel Univ, Philadelphia, PA, United States. 2. Guilford College, Greensboro, NC, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$25

Maximum Participants: 40

Workshop Description: 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.

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### **WMP62: The POGIL Project POGIL in High School Chemistry Courses**

Urik Halliday, Paula Butler (*1. Chemistry, Friedrich Von Steuben Metropolitan Science Center, Chicago, IL, United States. 2. Chemistry, Cincinnati Country Day School, Cincinnati, OH, United States.*)

Session: Monday, July 30, 2:00-5:00 pm

Suggested Audience: High School

Workshop Cost: \$25

Maximum Participants: 40

Workshop Description: 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.



**WTA63: An ACS Exams committee experience: Developing a test specification and writing and editing items**

Jeffrey R. Raker, Kristen L. Murphy, Shalini Srinivasan, Jessica J. Reed, Jaclyn Trate, Thomas C. Pentecost (1. Chem Dept, University of South Florida, Tampa, FL, United States. 2. Chemistry and Biochemistry, University of Wisconsin-Milwaukee, Milwaukee, WI, United States. 3. University of Wisconsin - Milwaukee, Milwaukee, WI, United States. 4. Chemistry Department, Grand Valley State University, Allendale, MI, United States.)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: Exam committees for ACS Exams follow a process for exam development that includes test specifications through item writing, editing and selection. This assessment workshop will be a “mini-exam development experience” where we will go through the process of developing an exam replicating a similar model to that which we use for ACS Exams. Included in this workshop will be: 1. How do determine a test specification: what will a test cover and to what depth 2. Different types of assessment items: how to select the best item type(s) and best array of item types to suit your needs 3. Writing and editing assessment items including writing incorrect responses and including visual-spatial or reference components 4. Assessing the assessment: basic statistics to examine how the test items performed

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**WTA64: An Alternative General Chemistry Curriculum - Chemistry, Life the Universe & Everything (CLUE)**

Alex T. Kararo, Sonia M. Underwood, Melanie Cooper (1. Chemistry, Florida International University, Miami, FL, United States. 2. Michigan State University, East Lansing, MI, United States.)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: CLUE is an NSF-funded approach to general chemistry based on four core ideas (Electrostatic and Bonding Interactions, Atomic/Molecular Structure and Properties, Energy – macroscopic, atomic/molecular, quantum – and Change and Stability in Chemical System). 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 students to determine how CLUE might work within their institution. In addition, they will have the opportunity to work with the materials developed for the CLUE curriculum, including online beSocratic activities. Participants will be provided with CLUE materials, including an electronic version of the text and student activities.

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**WSP9: Assessment of mechanism exam questions in the second-year organic chemistry course sequence**

Sarah Zingales<sup>1, 2</sup>, Jay W. Wackerly<sup>3</sup>, Michael T. Wentzel<sup>4</sup> (1. Department of Chemistry and Physics, Armstrong Atlantic State University, Savannah, GA, United States. 2. Chemistry & Biochemistry, Georgia Southern University, Savannah, GA, United States. 3. Department of Chemistry, Central College, Pella, IA, United States. 4. Augsburg College, Roseville, MN, United States.)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: This workshop will address the question of how to effectively write and assess organic chemistry mechanism questions. There are a wide variety of approaches and no standardized way to assign credit for incorrect/partially correct answers. Participants will score example questions and discuss why/how they assigned the grade. As a group, the participants will develop a rubric that can be applied to all mechanism questions. Participants will be asked to use this rubric in scoring questions in their courses and report back on its use.

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**WTA65: Atomsmith® Classroom Online: Interactive, Dynamic and Physically Accurate Models & Activities with Atoms and Molecules**

David Doherty (1. Bitwixt Software Systems LLC, Minnetonka, MN, United States.)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: You've heard the chatter. Now here is your opportunity to experience Atomsmith! Atomsmith Classroom Online is an HTML5 web application that runs in any browser. It provides a collection of 3D, interactive, physics-based models – based on models developed and used by scientists – that students use to see, interact with, and perform virtual experiments on atoms and molecules. As an educator, you know that if a picture is worth a thousand words, then a 3D, physics-based, interactive picture, that lets your students do REAL science, ups your game and saves a lot of teaching time. Bring your laptop and sign in to the Atomsmith Classroom Online chemistry platform, and EXPLORE: ● Historical atomic structure models that tell the story of the scientific method in action ● The relationship between quantum numbers and the structure of the atom ● The relationship between atomic structure and the periodic table/trends ● How chemical reactions at the particulate level relate to stoichiometry, conservation laws and the movement of electrons ● KMT and Gas Laws ● How polarity determines solvation \* Properties of Acids and Bases ● IMFs ● Bonding (valence bond) orbitals ● Chemical Equilibrium \* And MUCH MORE!

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**WTA66: beSocratic: an online system for the assessment of student constructed models, explanations and arguments**

Melanie Cooper (*1. Michigan State University, East Lansing, MI, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Learning environments where core ideas, and scientific practices such as constructing and using models, and developing arguments and explanations are emphasized are more likely to lead to the development of expertise, than those where assessments focus on fragments of knowledge and isolated skills. We have developed the beSocratic system to address the need for large-scale formative assessment of such activities. BeSocratic is a cross-platform, web-based formative tutorial and assessment system. It can recognize and respond contextually to student-generated graphs and simple diagrams and allows students to construct written explanations and arguments. It has recently been completely rebuilt and redesigned, and new modules will be added over the next year or two. This workshop will focus on the use of beSocratic, the development of new activities, and the analysis of student work. Participants should bring a laptop or tablet.

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**WTA67: Creating outreach shows that use demonstrations to teach concepts**

Holly W. Kerby<sup>1, 2</sup>, Brittlund DeKorver (*1. Fusion Science Theater, Madison, WI, United States. 2. Wisconsin Institute for Discovery, University of Wisconsin-Madison, Madison, WI, United States. 3. Chemistry, Grand Valley State University, Allendale, MI, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$15

Maximum Participants: 10

Workshop Description: A recent study indicates that chemical demonstration shows are a primary type of chemical education outreach and that a majority of presenters list increased understanding as a goal of their shows. Unfortunately, there is little evidence that these shows achieve this goal, and there is ample evidence that traditional demonstrations do not increase understanding even when employed in the classroom. However, there is a way to develop demonstration shows that do teach chemical concepts. Invented by Fusion Science Theater and funded by the National Science Foundation and the Henry and Camille Dreyfus Foundation Special Grant Program in the Chemical Sciences, these unique shows include embedded assessment, dramatization of concept models, and audience participation. This workshop will lead you through the process of creating a show that uses your own demonstrations to promote and assess conceptual learning. Come with ideas of a concept you would like to teach and demonstrations that illustrate that concept. Each registered participant will receive a How To Guide and Development Kit along with a sample script and video. Registered participants may bring colleagues from their institution.

**WTA68: Demonstrations and Activities on a Dime for K-12 Chemistry**

Bonnie Bloom, Sherri Rukes, Kimberly Duncan (*1. Hilliard Davidson High School, Hilliard, OH United States.; 2. Libertyville High School, Libertyville, IL, United States; 3. Education, American Chemical Society (AACT), Washington, DC, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Join two high school chemistry teachers to learn about the many classroom resources available from the American Association of Chemistry Teachers (AACT). This workshop will feature several demonstrations and student activities using common household and inexpensive materials that you can use to teach the principles of physical science and chemistry to high school students.

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**WTA70: Developing a Model of Equilibrium Processes**

Larry Dukerich (*1. American Modeling Teachers Association, Phoenix, AZ, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: High School

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: Stability and change is a cross-cutting concept common to all disciplines in science. In chemistry this concept is expressed in the equilibrium conditions for both physical and chemical changes. Yet students often have a poor understanding of equilibrium and how systems reach this condition. In this workshop a particle model of the equilibrium process is developed using a simple game that can be applied to various systems, making the equilibrium state, competing rates, and standard rate graphs more meaningful to students.

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**WTA71: ELIPSS Project Enhancing Learning by Assessing Professional Skills in Student Group Interactions and Written Work**

Courtney L. Stanford, Renee S. Cole (*1. Chemistry, Virginia Commonwealth University, Richmond, VA, United States. 2. Department of Chemistry, University of Iowa, Iowa City, IA, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$20

Maximum Participants: 40

Workshop Description: Students' professional skills (such as teamwork, communication, and critical thinking) can be enhanced when assessment and feedback on the development of these skills are provided. One way these skills are developed in active learning environments is through student-student interactions as they work collectively on



tasks. Monitoring these interactions provides feedback to the students on the quality of the observed skill and insights to the instructor on the overall effectiveness of the learning environment. These skills may also be developed and assessed in written assignments. Evaluating student written work allows an instructor to give feedback to individual students as well as reflect on the quality of the given assignments in eliciting evidence of professional skills. Intentional assessment of professional skills and subsequent feedback provides a means to explicitly incorporate these skills into regular classroom practice and better align the enacted curriculum with the intended learning outcomes. In this session, participants will:

- Identify professional skills within the context of student tasks
- Explore professional skills in group interactions and behaviors that provide evidence for them
- Explore professional skills and characteristics of student work that provide evidence for them
- Gain experience using rubrics to assess professional skills in student work and group interactions

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### **WTA72: Endless Possibilities: Collaborations with MSOE to Facilitate Student Learning with 3D Physical and Virtual Models**

Margaret A. Franzen, Tim Herman, Anne Alexander, Sunil Malapati, Anne-Marie L. Nickel, Cassidy R. Terrell (1. *Center for BioMolecular Modeling, Milwaukee School of Engineering, Milwaukee, WI, United States.* 2. *Physics and Chemistry, Milwaukee School of Engineering, Milwaukee, WI, United States.* 3. *Chemistry, Clarke University, Dubuque, IA, United States.* 4. *Center for Learning Innovation, University of Minnesota Rochester, Rochester, MN, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$35

Maximum Participants: 32

Workshop Description: The MSOE Center for BioMolecular Modeling (CBM) is an instructional materials development laboratory that collaborates with educators to develop engaging interactive classroom activities that illuminate challenging topics in the molecular biosciences. Participants will explore activities developed in conjunction with four undergraduate chemistry/biochemistry educators: \* Investigate in-class activities related to soluble and insoluble compounds interacting with water. The activities involve students constructing the interaction of components of the 3DMD's water kit and sodium chloride kit with newly developed models of sugars and fats. The incorporation of simulation activities and laboratory activities will also be included. \* Explore hydrogen bonding in macromolecules with a Jmol tutorial created with an easy-to-use template developed in the CBM. \* Interact with glucose molecules that can be manipulated into different anomers and used to construct complex carbohydrates, as well as models that illustrate the molecular basis of ABO blood groups, appropriate for genetics or biochemistry. \* Work with a series of active learning assessments, with corresponding learning objectives and physical models designed by a team of undergraduate students, that were developed to address the identified misconceptions of space, electronic interactions, and stereochemistry in enzyme-substrate interactions. Finally, we will discuss how table-top 3D printers were used to create many of these models; others can be borrowed from the MSOE Model Lending Library or the CBM. Participants will receive a water cup with magnets to represent hydrogen bonds.

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**WWP115: Implementing authentic student lab experiences in biochemistry labs and beyond.**

Paul Craig (*1. LaGrange College, LaGrange, Ga 2. Rochester Institute of Technology, Rochester, NY*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: Recently there has been a lot of interest in incorporating and expanding authentic learning in the classroom. The benefits of providing a hands-on research experiences to undergraduate students has long been known. According to a recent NAS convocation “[Many] factors constrain participation, particularly by members of groups historically underrepresented in STEM fields, many of whom could benefit considerably from being involve in research. BASIL (Biochemistry Authentic Scientific Inquiry Lab) is a model for a discovery based biochemistry lab course. This model along with the associated student and instructor modules was developed as a collaboration of multiple professors working across the country with support from an NSF IUSE grant. This approach takes advantage of the over 3700 unannotated structures in the Protein Data Bank. Using a combination of computational and traditional wet lab skills, students propose and test the likely function of their target protein of interest. One the major goals of the BASIL project is to learn more about how we can help students can learn to conduct authentic scientific inquiry and to assess the roles of faculty members and teaching assistants in this process. This presentation will explain the decisions and steps that has led LaGrange College from a traditional biochemistry lab that featured cookbook labs and predetermined answers to one that focuses on student discovery and highlights the scientific method. Currently the BASIL initiative is working to optimize the curriculum and support potential adopters during their transition. The BASIL project is supported by NSF IUSE 1503811 and 1709170.

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**WTA73: Implementing the Claim, Evidence, Reasoning (CER) Framework in the Chemistry Classroom**

Ben Meacham, Aimee Modic (*1. Prior Lake High School, Eden Prairie, MN, United States. 2. Katy High School, Katy, TX, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School, Middle School

Workshop Cost: \$10

Maximum Participants: 27

Workshop Description: As science teachers, we routinely ask our students to explain their understanding or make conclusions from the evidence they have gathered. However, we are consistently reminded that the majority of our students don't make the connections in their explanations or conclusions that we had hoped for. To support our students in gaining the skills necessary for writing better scientific explanations, conclusions, and engaging in argumentation, participants of this workshop will be actively learning about the Claim, Evidence, Reasoning framework. Workshop leaders will be sharing implementation strategies, experiences, applications, and ways to assess students of various grade levels and abilities. Participants can expect to perform an experiment from the perspective of a student, create their own scientific explanations, diagnose good from bad evidence/reasoning, engage in meaningful argumentation, gain insight to how actual students use the CER framework, and learn about

potential methods for grading scientific explanations. If you want to make a fundamental shift toward helping your students make the connections in their writing that you desire, then join us!

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### **WTA74: Interactive, 3D Microscopic Models of Particles, Atoms, Molecules, and Reactions to Aid Learning Chemistry Content in Middle and High School Science and Chemistry and Introductory College Chemistry Curriculum**

Angela Cannon (*1. VIVED, Coralville, IA, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School, Middle School

Workshop Cost: \$10

Maximum Participants: 45

Workshop Description: Gale Interactive Science (GIS) or Chemistry includes 14 multifunctional simulations developed by VIVED for use in early chemical education. The simulations target content throughout chemistry to bring to life atoms, molecules, and reactions for educators and learners. These simulations are presented through more than 100 sessions/activities for educators, students, and independent learners to actively engage microscopic level chemistry. These guided sessions begin with simplistic visualization and representation of particles, atoms, molecules, and reactions used to introduce students to the language of chemistry. The simulations can be used as resources to complement current science/chemistry curriculum and teaching format. Students can explore a concept independently before, during, or after it's discussed in the classroom. A relatively comprehensive understanding of the atomic and molecular scale visualizations and representations are included to prepare learners to excel in learning a variety of chemical concepts. A variety guided inquiry lessons plans are also provided to allow students to define terms that are previously defined for them. Various simulations can be used when discussing physical vs chemical change. The models show students what happens at the microscopic level. Students can investigate physical and chemical Law of Conservation of Mass and again directly associate microscopic and symbolic models to macroscopic observations. These simulations lead to the ability to teach students to read balanced chemical equations prior to learning how to balance a chemical equations. Simulations can be revisited for balancing, reaction type, gas properties, pH, molecular shape and polarity, intermolecular forces, and beyond.

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### **WTA75: Introduction to POGIL Labs: Strengthening Process, Inquiry, Reflection, and Application in the Laboratory**

Michael P. Garoutte, Craig M. Teague (*1. Chemical and Physical Sciences, Missouri Southern State University, Joplin, MO, United States. 2. Department of Chemistry, Cornell College, Mount Vernon, IA, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$25

Maximum Participants: 40

Workshop Description: This session will introduce the basic concepts and principles of the POGIL laboratory. Participants will experience a simulated POGIL laboratory experience and examine its components and structure. The criteria for a POGIL laboratory experiment will be introduced and applied to the written description of an experiment. After attending this session, participants will be able to: (1) articulate the components of a POGIL laboratory experiment and correlate them with the components of the Learning Cycle, (2) describe several differences between a POGIL laboratory experiment and a traditional laboratory experiment, and (3) determine the extent to which an experiment meets the POGIL laboratory criteria.

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### **WTA76: Juice from Juice: Bringing Solar Energy Research to the Classroom**

Michelle DeBoever, Jennifer D. Schuttlefield Christus (1. *Caltech, Pasadena, CA, United States.* 2. *Chemistry, University of Wisconsin-Oshkosh, Oshkosh, WI, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: High School, Middle School

Workshop Cost: \$10

Maximum Participants: 25

Workshop Description: The Juice from Juice workshop is for teachers wishing to address renewable energy concepts in their classroom using a hands on STEM activity to engage their students. This program was developed by researchers at the Center for Chemical Innovation in Solar Fuels (CCI Solar) who wanted to bring their research to the public. Currently CCI Solar successfully hosts workshops at Caltech and CSTA for local teachers to learn the activities and bring the lessons back to their classroom. We hope to expand the reach of this innovative program by hosting a workshop at the BCCE conference. We will teach teachers how to make dye sensitized solar cells using basic lab materials and blackberries. We will start with an overview presentation of the science behind the experiment, and then move on to a hands on activity where everyone can make their own DSSC. Every teacher will walk away with an NGSS aligned lesson plan for the activity.

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### **WTA77: Keep Calm and Chemistry On: Successful Lab Activities for the New Chemistry Teacher**

Jen Black, Felicia Cherry (*Carolina Biological Supply Company, Burlington NC*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: High School

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Looking for lab activities that work every time, not just periodically? Explore easy, engaging, and safe chemistry activities that will produce a reaction from your students. Whether you're new to chemistry or feeling out of your element, learn ways to create excitement with hands-on labs, digital content and demonstrations.

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**WTA78: Lab Assessment in the Age of the Internet**

Stephanie R. Dillon (*1. Chemistry and Biochemistry, Florida State University, Tallahassee, FL, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 48

Workshop Description: The tried and true method of lab assessment, the lab report, has become near to useless in this day and age due to the accessibility of past reports on the internet or through email from a friend. New and more technologically savvy methods for determining a student's preparation and understanding of lab concepts must be developed unless Instructors are willing to accept the majority of their students simply copying older reports. A new process by which student laboratory conceptual understanding is both assessed and student experiment preparation is more thoroughly required and developed is the focus of this workshop. Instructors that wish to explore the possibility of replacing a lab report/post lab exercise method of assessment with a more rigorous in-laboratory method that promotes student preparation and understanding of the lab concepts will be introduced. The workshop will give instructors hands-on lessons in how to implement the new process. They will be shown methods for question development and delivery using a University LMS as well as how to incorporate spreadsheets into the student's preparation for lab that will enhance student learning. While developed primarily for chemistry laboratories, the method presented will work for almost any STEM course. Workshop Outline: Introduction Lab Experiment Modification to Meet Time Constraints Development of "Thinking" Questions Using the LMS Spreadsheet Development Dealing with ADA Needs Wrap-Up The process being presented has been in use at Florida State University for two semesters (Summer 2017 and Fall 2017) and has demonstrated a 18% increase in student final exam grades thus far. As the process is innovative, it is being modified (tweaked) as needed semester to semester and it is expected to have an even greater positive impact on student learning and retention as the process is perfected. A great part of the workshop will be to give instructors insight on the potential problems that have been observed and to explain the needed solutions that have been developed.

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**WMP50: Mapping the Undergraduate Curriculum in Biochemistry**

Jessica J. Reed, Shalini Srinivasan, Jaclyn Trate, Thomas C. Pentecost, Jeffrey R. Raker, Kristen L. Murphy (*1. Chemistry Department, Grand Valley State University, Allendale, MI, United States. 2. Chemistry and Biochemistry, University of Wisconsin-Milwaukee, Milwaukee, WI, United States. 3. Chemistry and Biochemistry, University of Wisconsin - Milwaukee, Shorewood, WI, United States. 4. Chem Dept, University of South Florida, Tampa, FL, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: 10

Maximum Participants: 20

Workshop Description: At ACS Exams, we have been working on constructing Anchoring Concept Content Maps (ACCM). These maps provide a content framework for the entire undergraduate chemistry curriculum using a four-tiered structure. The first two tiers are broad and subdiscipline independent. The third and fourth tiers get progressively more detailed and are subdiscipline specific. We have published four ACCM (general, organic,

physical and inorganic) only through the contributions from faculty and instructors through many focus groups and workshops. The maps for biochemistry and analytical chemistry are nearing completion. For this workshop, we are working on the final level three and four details for the content map in biochemistry. Reflecting on the feedback from the other subdiscipline maps often provides participants with a unique insight about the courses taught and how the concepts taught in these courses contribute to the overall undergraduate chemistry curriculum.

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### **WMP51: OpenOChem Project – Creating interactive chemistry assessments and presentations accessible from most any LMS.**

Carl LeBlond, Jennifer L. Muzyka, Ehren C. Bucholtz (1. *Chemistry, Indiana University of Pennsylvania, Indiana, PA, United States.* 2. *Chemistry Dept, Centre College, Danville, KY, United States.* 3. *Basic Sciences, St. Louis College of Pharmacy, St. Louis, MO, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School, General Audience

Workshop Cost: \$15

Maximum Participants: 30

Workshop Description: OpenOChem is an assessment and presentation system that is accessible from most LMS's that support LTI 1.0. This workshop will introduce participants to using OpenOChem for creating interactive assessments (Quizzes) and presentations (SlideDecks). Participants will first learn to easily link their LMS including Moodle, Canvas, Sakai, or D2L to OpenOChem. Moodle accounts will be provided for those participants that do not have an LTI enabled LMS. A variety of question types specifically designed for organic chemistry (e.g. structural, electron pushing/curved arrow) using Chemdoodle Web Components as well as conventional question types (e.g. multichoice, T/F, short answer and calculated) will be examined. Participants will then organize these questions into Quizzes and SlideDecks and assign to their course. Finally the collaborative features of OpenOChem will be explored. Come learn about the OpenOChem project and experience the combined efforts of three chemistry educators. Don't forget to bring your laptop!

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### **WTA79: Tech Tools: Google Apps for the Chemistry Classroom**

Tina Sabatello<sup>1, 2</sup> (1. *Chemistry, Maine East High School, Park Ridge, IL, United States.* 2. *Google for Education Certified Trainer, Palatine, IL, United States.*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Learn to use free Google Apps such as Google Drawings and MolView for students and teachers create Particulate View drawings ; Google Sheets to teach students how to graph and analyze data; the pH App to calculate pH of acid-base mixtures as well as generate titration curves. Learn about free available online resources such as Wolfram Alpha's interactive calculators which allow students to check their work.

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**WTA80: What's in the water? Colorimetry and Conductivity of Solutions**

Tom Loschiavo (*1. PASCO scientific, Roseville, CA*)

Session: Tuesday, July 31, 8:00-11:00 am

Suggested Audience:

Workshop Cost: 10

Maximum Participants: 24

Workshop Description: Water is a precious resource. To protect our water, scientists try to identify the presence of pollutants, and, even more importantly, to measure their concentration. For students, how can we drive home the importance of measuring things in the water that they cannot see? Easy – model it with something that they can see! Sports drinks are a great way to introduce solutions and concentration. The color helps students visualize that a solute is present and conductivity measurements can quantify the amount of electrolytes. Molecular visualization tools are used to help students understand the process of dissolving. In this session, based on activities from Essential Chemistry, you will explore how the combination of data collection and molecular visualization tools can connect levels of representation and lead to meaningful student learning about water and solutions. Attendees will have a chance to win a Wireless sensor at the end of the session!

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**WTP81: 3D Printable Resources for Engaging Students in the Exploration of Instrument Design and Performance: Inexpensive and User-Friendly Instrument Kits for STEM Educators**

Lon A. Porter (*1. Wabash College, Crawfordsville, IN, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School

Workshop Cost: \$30

Maximum Participants: 15

Workshop Description: While much has been accomplished in developing low-cost instruments using children's building blocks and household items, greater access to 3D printing via community makerspaces and university fabrication centers allows educators to transcend the limitations of conventional tooling. The recent and accelerating advances in computer-aided design (CAD) and 3D printing methods provide access to innovative approaches in the development of new educational tools. While this evolving technology offers great potential, the barrier to entry is often intimidating for those unfamiliar with CAD software and fabrication equipment. This workshop will guide participants in the design of a colorimeter or fluorimeter instrument for lab use. Each participant will be provided with a 3D printed instrument kit to take home to use in their classrooms. Additionally, participants will receive a user-friendly set of computer-aided design (CAD) models and stereolithography (STL) files for the production of simple and inexpensive 3D printed analytical instruments. These designs allow educators to provide active learners with tools for constructing instruments in activities aimed at exploring the technology and fundamental principles related to quantitative analysis. These digital models are flexible in design, printed quickly, and each requires less than a dollar's worth of plastic filament. Once printed, the resulting instruments perform very well when compared to commercially available tools. No previous CAD, 3D printing, or electronics experience is required. This workshop welcomes both beginners and those with some experience.

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**WTP82: ACS Exams alignment processes and uses: How the item alignment process works at ACS Exams and how this can be used for other assessments**

Kristen L. Murphy, Jeffrey R. Raker, Shalini Srinivasan, Jessica J. Reed, Jaclyn Trate, Thomas C. Pentecost (*1. Chemistry and Biochemistry, University of Wisconsin-Milwaukee, Milwaukee, WI, United States. 2. Chem Dept, University of South Florida, Tampa, FL, United States. 3. Chemistry and Biochemistry, University of Wisconsin - Milwaukee, Shorewood, WI, United States. 4. Chemistry Department, Grand Valley State University, Allendale, MI, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: At ACS Exams, we have been evaluating the many test items developed for item characteristics including content, complexity, process type and image inclusion. The alignment process and how these are ultimately used to investigate performance and content coverage through a different lens have been used extensively at ACS Exams. This assessment workshop will take participants through the process of alignment and into evaluating how alignment information can be used. Included in this workshop will be: 1. Alignment parameters: what structures need to be considered and what information is sought 2. Alignment processes: how

will this be done and how will the results be vetted 3. Alignment information: how to synthesize the information from an alignment and how this can be used to develop new materials Also included in this workshop will be the use of an automated alignment tool developed by UMass in collaboration with ACS Exams.

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### **WTP84: Adopting and Adapting the LibreTexts for use in your Classroom**

Delmar Larsen, Robert E. Belford, Edward Bryant (*1. Department of Chemistry, University of California-Davis, Davis, CA.; 2. Department of Chemistry, University of Arkansas, Little Rock, AR.; 3. Department of Chemistry, Lansing Community College, Lansing, MI.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, General Audience

Workshop Cost: \$10

Maximum Participants: 50

Workshop Description: The LibreTexts (formerly ChemWiki) currently benefits over 60 million students per year and is the most visited chemistry website in the world. Central to its success is the construction and adoption of faculty specific and freely accessible course and instructor designed "LibreTexts" that substitute for costly conventional textbooks in post-secondary courses. These Libretexts are assembled on the central server (chem.libretexts.org) by incorporating content from an extensive network of existing chemistry and broader STEM materials. This workshop will serve as a collaborative hands-on development session to introduce faculty to the chemistry LibreTexts library with "hands-on" demonstrations of current capabilities including 3D visualization, online homework capabilities, student assessment, and numerical data analysis infrastructure. Workshop will be organized about constructing individualized LibreTexts, which will be facilitated by project development team members. Participants will also be guaranteed five hours of personalized support afterward to facilitate continued adaption and adoption of the LibreTexts into individual classrooms. You will need to bring your own computer device (laptop preferred) for this workshop.

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### **WTP85: Assessing assessments: Strategies for chemistry educators and chemistry education researchers to identify and evaluate instruments for classroom and research needs**

Regis Komperda, Thomas C. Pentecost, Jack Barbera (*1. Chemistry, Portland State University, Portland, OR, United States. 2. Chemistry Department, Grand Valley State University, Allendale, MI, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 25

Workshop Description: Effective assessment is the first step in understanding a range of variables that influence student learning such as interest, understanding, and types of teaching approaches. Selecting appropriate assessment tools is critically important to ensure that the intended variables of interest are being measured to an acceptable degree of precision. Chemistry educators and chemistry education researchers have many options

available when looking for appropriate instruments, they can 1) utilize a published instrument from the literature, 2) modify an existing instrument to better fit their requirements, or 3) create their own instrument. Regardless of the option chosen, attention should be paid to evidence for the quality of data obtained from the instrument. However, generating evidence for a new or modified instrument or evaluating the available evidence for a published instrument can be challenging. To aid participants in navigating this difficult, and often jargon-heavy, aspect of effective assessment, this workshop will use the Standards for Education and Psychological Testing as a basis for discussing the generation and interpretation of instrument quality evidence including aspects of validity and reliability. This workshop will focus primarily on assessment of existing instruments from the literature. Participants will spend the majority of the workshop time discussing and evaluating available evidence for instrument quality and identifying instruments to meet their own classroom and/or research assessment needs.

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### **WTP86: Building a Periodic Table Unit Plan Using American Association of Chemistry Teachers (AACT) Resources**

Kimberly Duncan (*1. Education, American Chemical Society, Washington, DC, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: High School

Workshop Cost: \$10

Maximum Participants: 40

Workshop Description: Building a new unit plan for chemistry can be a difficult undertaking and must include lectures, practice problems, classroom demonstrations, student activities, and chemical experiments. The classroom resources available on the American Association of Chemistry Teachers (AACT) website can help you find all the materials you need to create unit plans. Join two former high school chemistry teachers who are now part of the AACT staff as they show you how to put together a successful unit plan using the lessons, activities, labs, demonstrations, projects, videos, and animations that are available on the AACT website.

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### **WMP40: CV Speed Dating Workshop**

Jordan Harshman, Yujuan Liu (*1. Department of Chemistry, University of Wisconsin - Parkside, Kenosha, WI, United States. 2. Chemistry and Biochemistry, Auburn University, Auburn, AL, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: The Division of Chemical Education's Younger Chemistry Education Scholars (YCES) Committee is holding a professional development workshop as part of a series of workshops geared towards career preparation. The purpose of the workshop is to give graduate students and postdocs the opportunity to have their CVs evaluated by faculty who have either served on hiring committees in their departments or who have recently gone through the hiring process. The participants will meet different faculty for evaluations on their CV, conversations similar to a job interview, and suggestions for improvement. A brief panel discussion at the end of the session will be held to answer any remaining questions from participants. This workshop is an excellent

opportunity for participants to practice preparing a CV, discussing their experience and potential as part of their CV, and networking with professionals in the field. Faculty reviewers will be given CVs in advance of the conference so they can tailor their feedback to the participants.

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### **WTP87: Designing Safe and Fun Chemical Outreach Activities with a Harry Potter Potions Theme**

Jason D. Powell, Joshua Sanders (*1. School of Natural Sciences and Mathematics, Ferrum College, Ferrum, VA, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$30

Maximum Participants: 24

Workshop Description: In this 90-minute workshop, we will briefly describe our outreach activities that have utilized a Harry Potter Potions theme to excite children and introduce essential chemical and physical concepts in a dynamic yet safe atmosphere and then guide participants through the process of designing their own outreach activity for children. Participants will receive a copy of our outreach manual along with other useful tools for planning future events.

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### **WTP88: Endless Possibilities: Collaborations with MSOE to Facilitate Student Learning with 3D Physical and Virtual Models**

Margaret A. Franzen, Tim Herman, Anne Alexander, Sunil Malapati, Anne-Marie L. Nickel, Cassidy R. Terrell (*1. Center for BioMolecular Modeling, Milwaukee School of Engineering, Milwaukee, WI, United States. 2. Physics and Chemistry, Milwaukee School of Engineering, Milwaukee, WI, United States. 3. Chemistry, Clarke University, Dubuque, IA, United States. 4. Center for Learning Innovation, University of Minnesota Rochester, Rochester, MN, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$35

Maximum Participants: 32

Workshop Description: The MSOE Center for BioMolecular Modeling (CBM) is an instructional materials development laboratory that collaborates with educators to develop engaging interactive classroom activities that illuminate challenging topics in the molecular biosciences. Participants will explore activities developed in conjunction with four undergraduate chemistry/biochemistry educators: \* Investigate in-class activities related to soluble and insoluble compounds interacting with water. The activities involve students constructing the interaction of components of the 3DMD's water kit and sodium chloride kit with newly developed models of sugars and fats. The incorporation of simulation activities and laboratory activities will also be included. \* Explore hydrogen bonding in macromolecules with a Jmol tutorial created with an easy-to-use template developed in the CBM. \* Interact with glucose molecules that can be manipulated into different anomers and used to construct

complex carbohydrates, as well as models that illustrate the molecular basis of ABO blood groups, appropriate for genetics or biochemistry. \* Work with a series of active learning assessments, with corresponding learning objectives and physical models designed by a team of undergraduate students, that were developed to address the identified misconceptions of space, electronic interactions, and stereochemistry in enzyme-substrate interactions. Finally, we will discuss how table-top 3D printers were used to create many of these models; others can be borrowed from the MSOE Model Lending Library or the CBM. Participants will receive a water cup with magnets to represent hydrogen bonds.

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### **WTP90: Interactive, 3D Microscopic Models of Particles, Atoms, Molecules, and Reactions to Aid Learning Chemistry Content in Middle and High School Science and Chemistry and Introductory College Chemistry Curriculum**

Angela Cannon (*1. VIVED, Coralville, IA, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School

Workshop Cost: \$10

Maximum Participants: 45

Workshop Description: Gale Interactive Science (GIS) or Chemistry includes 14 multifunctional simulations developed by VIVED for use in early chemical education. The simulations target content throughout chemistry to bring to life atoms, molecules, and reactions for educators and learners. These simulations are presented through more than 100 sessions/activities for educators, students, and independent learners to actively engage microscopic level chemistry. These guided sessions begin with simplistic visualization and representation of particles, atoms, molecules, and reactions used to introduce students to the language of chemistry. The simulations can be used as resources to complement current science/chemistry curriculum and teaching format. Students can explore a concept independently before, during, or after it's discussed in the classroom. A relatively comprehensive understanding of the atomic and molecular scale visualizations and representations are included to prepare learners to excel in learning a variety of chemical concepts. A variety guided inquiry lessons plans are also provided to allow students to define terms that are previously defined for them. Various simulations can be used when discussing physical vs chemical change. The models show students what happens at the microscopic level. Students can investigate physical and chemical Law of Conservation of Mass and again directly associate microscopic and symbolic models to macroscopic observations. These simulations lead to the ability to teach students to read balanced chemical equations prior to learning how to balance a chemical equations. Simulations can be revisited for balancing, reaction type, gas properties, pH, molecular shape and polarity, intermolecular forces, and beyond.

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### **WTP91: The Nitty-Gritty: Day-to-Day Tools for Active, Inquiry-Driven Classrooms**

Kevin Revell (*1. Department of Chemistry, Murray State University, Murray, KY*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 40

Workshop Description: For many students, chemistry can seem elusive and intimidating. Active-learning techniques can reduce this barrier by providing environments for students to practice key skills and concepts at a granular level, building a foundation for success in higher-level classes. This presentation will highlight several approaches – both pedagogical techniques and new digital tools – to help students engage with chemistry in active, inquiry-driven environments. Specifically we will examine ways in which a blend of in-class techniques, such as digital guided-inquiry activities, clickers, tablet-driven problem sessions, speed drills, and group problem-solving can to produce a flexible classroom experience to accommodate a variety of learning styles. While the workshop will feature tools from the new Revell Introductory Chemistry curriculum, many of the ideas and practices are also transferrable to general chemistry and higher-level courses.

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### **WTP92: The POGIL Project Development and Implementation of Guided Inquiry Experiments for Physical Chemistry**

Robert M. Whitnell, Marc N. Muniz (1. Guilford Coll, Greensboro, NC, United States. 2. Chemistry, Western Washington University, Bellingham, WA, United States.)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$25

Maximum Participants: 24

Workshop Description: 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.

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### **WTP93: The POGIL Project Student-Centered Learning in the Laboratory: The Science Writing Heuristic Approach**

Steven J. Gravelle, Brandon M. Fetterly (1. Saint Vincent Coll, Latrobe, PA, United States. 2. Chemistry, University of Wisconsin Richland, Richland Center, WI, United States.)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$25

Maximum Participants: 40

Workshop Description: In this session, participants will explore an active learning strategy known as the Science Writing Heuristic. Features of SWH including beginning questions, procedures and results, and claims and evidence will be demonstrated through a lab simulation experience. After attending this session, participants will be able to: (1) articulate the components of an SWH laboratory experiment, (2) describe methods for soliciting and facilitating the generation of beginning questions, (3) show students how to derive evidence-based claims that are drawn from the actual data collected in lab, (4) articulate the structure of the SWH laboratory experience and contrast it with the laboratory report format.

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### **WTP94: Un-badge- lievable!: Incorporating Outcomes-Based Digital Badges in the Chemistry Curriculum**

Marcy H. Towns, Sarah Hensiek, Cynthia Harwood (*1. Purdue University, West Lafayette, IN, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School, General Audience

Workshop Cost: \$10

Maximum Participants: 40

Workshop Description: Digital badges are emerging in the field of education as a way for students to demonstrate knowledge tied to specific criteria and learning objectives. The badge format allows instructors to draw evidence-based conclusions about student knowledge using authentic assessment practices. While digital badges can be a useful tool for any course, they have successfully been implemented in the general chemistry laboratory as an authentic assessment of students' hands-on laboratory skills. Student videos submitted as part of the badge provide a way for instructors to give individual feedback on hands-on lab skills, while alleviating time and resource constraints that typically impede this type of assessment especially in large-scale courses. This workshop will introduce participants to the world of digital badging. Participants will see examples of badges in the laboratory and explore the possibilities for digital badging throughout the chemistry curriculum. Finally, they will begin building a badge for their own course.

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### **WTP95: What Causes My Bathtub's Ring?**

Greg Dodd (*1. Science, George Washington High School, Pennsboro, WV, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Results for Question #6 from the 2017 AP Chemistry Exam (1.11/4) indicate that students have misconceptions related to solubility product constants (Big Idea 6). Sixty-eight percent of the students received a "1" or less on this question. Misconceptions include: failed attempts to recall an algorithm, taking a square root instead of a cube root, forgetting to double the hydroxide ion concentration, and mistaking  $K_{sp}$  for molar solubility. In this "hands-on" session, participants will explore an inquiry lab "What Causes My Bathtub's Ring?", an activity designed to help overcome student misconceptions about  $K_{sp}$  while supporting Learning

Objectives 6.1, 6.2, 6.6, 6.7, 6.21, 6.22, 6.23, and 6.24; and Science Practices 1-7. A discussion of best practices for implementing this inquiry-based activity follows the exploration.

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### **WTP96: What Is Found at the End of the Rainbow?**

Greg Dodd (*1. Science, George Washington High School, Pennsboro, WV, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: The 2017 AP Chem Exam Question 4 (score 1.78/4) suggests a misunderstanding of Chromatography, Molecular Interactions, and Molecular Polarity (Big Ideas 1 & 2). Forty-five percent of students scored a “1” or less. Recent AP questions test understanding of: molecular interactions and polarity, chromatography, and spectroscopy. This “hands-on” inquiry, “What Is Found at the End of the Rainbow?” explores the relationship between a chromatogram and a spectrogram. This activity supports Learning Objectives 1.16, 2.3, 2.7, 2.8, 2.10, 2.13, 2.15, and 2.18; and Science Practices 1-7. There will be time for questions and handouts provided.

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### **WTP97: Writing A Competitive Research Proposal**

Nancy J. Jensen (*1. ORG, American Chemical Society, Washington, DC, United States.*)

Session: Tuesday, July 31, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 50

Workshop Description: The workshop will cover general basic guidelines for writing a proposal and identify common pitfalls in proposal writing. While the focus will be on writing research proposals much of the information will be applicable to proposal writing in general. The workshop will include two interactive exercises.

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**WWA99: A “Hands On” Workshop Using At Home Labs for Distance Learning Chemistry Courses**

Kathy E. Carrigan (*1. Chemistry, Portland Community College, Vancouver, WA, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School, General Audience

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: This workshop will give you a chance to do (parts of) up to 6 different labs offered for students who take our Allied Health Chemistry courses as a completely distance learning option. This will give you the chance to determine if this is a plausible option for your classes if you are considering doing a distance learning chemistry course. We will have labs set up for you to try, as well as provide a short presentation of the best practices for labs for DL courses, and we will be willing to collaborate with you as you begin this process.

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**WWA100: Academic Recovery Course for Students Who Have Failed**

Daniel Apple (*1. Pacific Crest, Hampton, NH, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 100

Workshop Description: This workshop will share the last 8 years of experiences in implementing academic recovery courses. These recovery courses continue to produce increasingly stronger transformations of students' learning performance. The first recovery course was Hinds Community College's Nursing and Allied Health, where two-thirds of these failed students became practicing nurses for the last 8 years. Grand Valley State University, after 4 years of Learning to Learn Camps and with 100 experienced faculty and staff, have held 3 annual May recovery courses for students being academically dismissed. Over ninety percent of these students passed the course with an "A" or "B". Over the last year, 6 online recovery courses were held at Western Governors University where successful completion was required before a student could reenroll. This workshop will help participants understand how they can transform risk factors into success factors with improved facilitation and mentoring. The workshop will have the faculty in teams explore 1) Resulting transformations by analyzing students' self-growth papers; 2) Learning experiences used in the course; 3) Students' required reflective practices and self-assessment; 4) The impact writing a life vision has on the student; 5) The role critical thinking and elevating critical thinking has on improving learning performance; and 6) The role that methodologies play in learner development. Participants will have access to the curriculum and actual student work (who have given permission for its use).

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**WWA101: AcademiNext: Training the next Generation of Academics**

Rebecca Broyer, Jessica A. Parr (*1. Chemistry, University of Southern California, Los Angeles, CA, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, General Audience

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: Graduate students focus the majority of their time honing their research skills and knowledge in a very narrow area of expertise. They are sent off to post-doctoral positions where they continue to grow as scholars and scientific investigators. In most graduate programs, there is very little opportunity to train graduate students to become lecture instructors, the majority of Teaching Assistant assignments are in undergraduate instructional labs. The Chemistry Department at the University of Southern California has developed a fellowship program with the goal of providing an internship like experience to more thoroughly complete the training of future faculty in chemistry. Graduate students learn how to prepare lectures, exams, deal with challenge students, and overall classroom management. In this workshop we describe a training program to give graduate students experience teaching in large enrollment classrooms. The workshop activities will focus on how to design and implement training programs for graduate students of chemistry to gain valuable teaching experience. We will discuss assigning an appropriate faculty mentor who is involved and can provide feedback throughout the semester. Workshop participants will be asked to reflect on their own experiences as graduate students and new faculty to determine what is important to include in a fellowship program, and how they could implement a similar program at their own institution.

**WWA102: Adapting Authentic Research Protocols to the Undergraduate Teaching Lab**

Benjamin J. McFarland (*1. Seattle Pacific Univ, Seattle, WA, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 8

Workshop Description: In this workshop, all participants will discuss the details of how we have brought authentic research experiences into undergraduate teaching labs in the form of course-based undergraduate research experiences (CUREs). Research experiences are immensely valuable, but transitioning the research from the graduate or post-doctoral chemistry or biochemistry laboratory into the undergraduate teaching laboratory poses specific challenges in terms of time, money, and student expertise. My own experiences come from how I have adapted three different multi-week projects from my post-doctoral research into undergraduate laboratory courses: a bioinformatics project to Biochemistry I, a protein production project to Biochemistry II, and a protein-protein interaction kinetics project to Survey of Physical Chemistry. For five years, I have used the GENI website ([geni-science.org](http://geni-science.org)) to help organize the flow of information in large and small classes. GENI gives protocols to students and collects data from students, facilitating authentic research and publishable results. In this workshop, we can discuss the details of our experiences with CUREs, what has and has not worked in adapting research protocols to the undergraduate laboratory, and make plans for future protocol adaptations. Topics for discussion include: 1.) Scheduling research activities within limited, weekly lab periods; 2.) Verifying student-collected data;

3.) Evaluating and grading results (and reassuring students); and 4.) Responding to unexpected lab results. If you have a research project that you have adapted and/or that you plan to adapt, please bring the protocols and some data. Participants should bring laptops if possible.

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### **WWA103: Designing experiments with MicroLAB instruments and software to meet course outcomes**

Shayna Burchett, Jack Lee Hayes (*1. State Fair Community College, Sedalia, MO*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Labs bring chemical phenomena to life. Instrumentation translates qualitative results into quantitative results available for data analysis. This workshop will offer the opportunity for participants to experience and design instrument-driven lab activities to meet their course outcomes. Instrumentation, common reagents, and potential lab activities will be provided for each group. Participants are encouraged to bring a list of their desired course outcomes, problem labs, and ideas to share. Participation in this workshop is free but space is limited.

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### **WTA69: Designing Safe and Fun Chemical Outreach Activities with a Harry Potter Potions Theme**

Jason D. Powell, Joshua Sanders (*1. School of Natural Sciences and Mathematics, Ferrum College, Ferrum, VA, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$30

Maximum Participants: 24

Workshop Description: In this 90-minute workshop, we will briefly describe our outreach activities that have utilized a Harry Potter Potions theme to excite children and introduce essential chemical and physical concepts in a dynamic yet safe atmosphere and then guide participants through the process of designing their own outreach activity for children. Participants will receive a copy of our outreach manual along with other useful tools for planning future events.

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**WWA104: Digital formative assessment tools**

Ashleigh L. Thomas (*1. Chemistry & Physics, Lincoln Memorial University, Maynardville, TN, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Formative assessment allows students an opportunity to learn in a low-stakes environment prior to attempting summative assessments. Assessing a student's progress at regular intervals, while providing feedback, has been shown to increase the achievement level and motivation of the student. With the use of technology in the classroom increasing every year, countless formative assessment tools are now available at your fingertips. Digital assessment tools are routinely used to administer quizzes, both in and out of the classroom, enhance collaboration, and enrich slide shows and videos. Some examples include Plickers, Kahoot, Quizizz, Piazza, Edpuzzle, and many, many more. This workshop will demonstrate several of these digital tools for using formative assessment in the college classroom, with a focus on tools that are low-cost and available across multiple platforms. Attendees will experience the assessment tools from both an instructor and student perspective, discuss how they would use the tools for the specific chemistry courses they teach, and share their personal experiences with other attendees.

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**WWA105: Hydrogen-powered Soda Bottle Rockets**

Steve G. Sogo (*1. Science, Laguna Beach High School, Laguna Hills, CA, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Participants will engage in a rich learning activity to load and launch a rocket built from a 2-liter soda bottle. The rocket is fueled with a stoichiometric ratio of hydrogen and oxygen. Oxygen gas is generated from the catalyzed decomposition of hydrogen peroxide. Hydrogen gas is generated from the reaction of calcium with water. The rocket is launched electronically using a home-made igniter made from aluminum foil. In addition to stoichiometry, this lab project includes thermochemistry, gas laws, catalysis, and activation energies. At Laguna Beach High School, this activity is run as a 1-week project.

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**WWA106: Organic Chemistry Reactions Couple 3D Animations to 2D Schemes**

Angela Cannon (*1. VIVED, Coralville, IA, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Traditionally, organic students primarily study organic reactions with 2D schemes. Student outcomes can improve when they use 3D model kits to build organic molecules. Students are now able to simultaneously view 2D schemes and animated 3D molecules of 48 unique organic reactions through Gale Interactive Chemistry, a new interactive educational platform developed by VIVED. These reactions are annotated by Ph.D. organic chemists that step the learner through changes to the molecules as the reaction proceeds. Students no longer have to rely on their own understanding to know the 3D molecules and changes are accurate. These reactions can be viewed, stopped, and reviewed all at each student's own pace of investigation. Gale Interactive Chemistry explores all classes of hydrocarbons and each functional group with multiple reactions. Organic Chemistry students can be assigned these reactions as a study resource before, during, or after discussing the reaction in the classroom. This workshop will explore the features of this organic chemistry reactions simulation. Work with faculty to align it to their Organic Chemistry textbook. Explore questions to ask that accompany each reaction. Look at a variety of other Chemistry sims that may prepare Organic students to further understand organic chemistry: atomic orbitals, VSPER Theory, molecular polarity, bonding etc.

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### **WWA107: Scale-themed instructional materials for lecture and laboratory**

Jaclyn M. Trate, Victoria Fisher, Peter Geissinger, Anja Blecking, Kristen L. Murphy (*1. Chemistry and Biochemistry, University of Wisconsin-Milwaukee, Milwaukee, WI, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School, Middle School

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: According the AAAS and the NRC, an important component of a student's science literacy is scale and concepts relating to scale. Scale, or the skills related to understanding quantity within chemistry concepts, has long been an area of interest within our research. However, our focus is not just on developing scale themed interventions to aid in teaching general chemistry students these important skills, but rather students across all scientific disciplines. We have created an extensive suite of scale-themed instructional materials that can easily be incorporated into any general chemistry course, and easily adapted to fit other science disciplines. At this workshop, we will introduce and describe the activities and instructional materials that we have incorporated into our curriculum, and provide selected resources for educators who wish to incorporate our activities into their own courses. Limited travel support is available and interested participants seeking funds should contact the workshop organizer directly.

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### **WWA108: Take Home Labs**

Amiee Modic, Kimberly Duncan (*1. Katy High School, Katy, TX, United States.; 2. Education, American Chemical Society (AACT), Washington, DC, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: It seems that the scope and size of our curriculum in chemistry is continuously expanding, but the time we are given to teach the material does not expand; rather, I would argue that the time we're allotted to teach has actually decreased because of an increasing load of non-instructional intrusions into our time. So the problem I had was: "How do I get my students doing more labs when I have less time available for teaching?" My solution: implement Take Home labs as a part of my curriculum.

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### **WWA109: Teaching Chemistry with Food**

Sunil Malapati, Elizabeth Pollock (1. *Chemistry, Clarke University, Dubuque, IA, United States.* 2. *Chemistry, Stockton College, Stockton, NJ, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Exploring Chemistry through Food makes science fun and approachable to a student while providing an endless array of everyday examples to teach chemical concepts. 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, gas laws, reaction rates, 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 classroom and laboratory activities that have been tested and can be plugged into their chemistry courses.

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### **WWA98: Tech Tools for Assessment & Giving Feedback**

Tina Sabatello<sup>1, 2</sup> (1. *Chemistry, Maine East High School, Park Ridge, IL, United States.* 2. *Google for Education Certified Trainer, Palatine, IL, United States.*)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 30

Workshop Description: Cut your grading time in half and grade more consistently with free Google apps such as Google Forms & Flubaroo. In this hands-on session, learn about tips, tricks and tools you can use quickly to provide comments on student work. (for example : Kaizena, .... Google Keep)

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**WWA110: The POGIL Project Classroom Facilitation**

Kristin N. Plessel, Santiago A. Toledo (1. UW-Rock County, Janesville, WI, United States. 2. Chemistry, St. Edward's University, Austin, TX, United States.)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$25

Maximum Participants: 40

Workshop Description: 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.

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**WWA111: Visualizing matter: Subscripts, Coefficients and Molecular models**

Tom Loschiavo (1. PASCO scientific, Roseville, CA)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: High School

Workshop Cost: 10

Maximum Participants: 24

Workshop Description: Can your students tell the difference between coefficients and subscripts? Do they know when they need more of an atom in a compound, or more of the compound itself? How are molecular properties related to phenomena that they can observe and measure? Help your students by using the Molecular Model Kit and Essential Chemistry Equation Builder to make molecules and model chemical reactions! Then, use models and the Wireless Temperature to make the important connections between bonding, shape and evaporative cooling. Attendees will have a chance to win a Wireless sensor at the end of the session!

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**WWA125: Workshop on Proteopedia**

Joel Sussman, Jaime Prilusky 1. Weizmann Institute of Science, Rehovot, Israel. 2. Weizmann Institute of Science, Rehovot, Israel.)

Session: Wednesday, August 1, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 50



Workshop Description: 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.

- o [http://proteopedia.org/w/HIV-1\\_protease](http://proteopedia.org/w/HIV-1_protease)

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

- o [http://proteopedia.org/w/Group:SMART:A\\_Physical\\_Model\\_of\\_the\\_β2-Adrenergic\\_Receptor](http://proteopedia.org/w/Group:SMART:A_Physical_Model_of_the_β2-Adrenergic_Receptor)

- To create your own pages in Proteopedia, including

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

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



## **WWP112: Adapting Authentic Research Protocols to the Undergraduate Teaching Lab**

Benjamin J. McFarland (*1. Seattle Pacific Univ, Seattle, WA, United States.*)

Session: Wednesday, August 1, 2:00-5:00 pm

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 8

Workshop Description: In this workshop, all participants will discuss the details of how we have brought authentic research experiences into undergraduate teaching labs in the form of course-based undergraduate research experiences (CUREs). Research experiences are immensely valuable, but transitioning the research from the graduate or post-doctoral chemistry or biochemistry laboratory into the undergraduate teaching laboratory poses specific challenges in terms of time, money, and student expertise. My own experiences come from how I have adapted three different multi-week projects from my post-doctoral research into undergraduate laboratory courses: a bioinformatics project to Biochemistry I, a protein production project to Biochemistry II, and a protein-protein interaction kinetics project to Survey of Physical Chemistry. For five years, I have used the GENI website ([geni-science.org](http://geni-science.org)) to help organize the flow of information in large and small classes. GENI gives protocols to students and collects data from students, facilitating authentic research and publishable results. In this workshop, we can discuss the details of our experiences with CUREs, what has and has not worked in adapting research protocols to the undergraduate laboratory, and make plans for future protocol adaptations. Topics for discussion include: 1.) Scheduling research activities within limited, weekly lab periods; 2.) Verifying student-collected data; 3.) Evaluating and grading results (and reassuring students); and 4.) Responding to unexpected lab results. If you have a research project that you have adapted and/or that you plan to adapt, please bring the protocols and some data. Participants should bring laptops if possible.

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## **WWP113: BIG K, Small k, and Buffers: Merging Equilibrium with Limiting Reactant**

Paul Price, Kimberly Duncan (*1. Trinity Valley School, Fort Worth, TX, United States.; 2. Education, American Chemical Society, Washington, DC, United States.*)

Session: Wednesday, August 1, 2:00-5:00 pm

Suggested Audience: High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: As we plan our curriculum to get our students ready for the AP exam, buffers are always a topic that make students (and teachers) cringe. It is in many ways the “capstone” of equilibrium, yet having students develop a strong conceptual understanding (which makes quantitative problem solving that much easier) is always difficult. Join us as we examine demos, sample labs, and pedagogical techniques as we delve into this important topic before the 2017 exam. In addition, we will examine how the similar ideas could be used to attack problems such as 2016 #6, which gave students fits.

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### **WWP114: Engaging Students with Chemistry Games**

Edward Wang, Lindsay Plavchak (*1. PlayMada Games, New York, NY, United States.*)

Session: Wednesday, August 1, 2:00-5:00 pm

Suggested Audience: High School, Middle School

Workshop Cost: \$10

Maximum Participants: 48

Workshop Description: Looking to increase student engagement in your classroom without sacrificing content? Unsure of how to integrate games into your lessons? Come explore Collisions™, a system of interconnected digital chemistry games designed specifically for the classroom, and experience gameplay that is both fun and exploratory for students. Strategies to use games to introduce, teach and review key chemistry concepts will be shared. Participants will also be provided with student materials designed to explicitly connect gameplay with content learning objectives. Bring a laptop/tablet or use one of our devices to participate in several classroom-ready game activities.

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### **WWP116: Scale interventions: Their adaptation into a class and measuring their effect**

Victoria Fisher, Jaclyn M. Trate, Peter Geissinger, Anja Blecking, Kristen L. Murphy (*1. University of Wisconsin-Milwaukee, Milwaukee, WI, United States.*)

Session: Wednesday, August 1, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School

Workshop Cost: \$10

Maximum Participants: 20

Workshop Description: According to the AAAS and the NRC, an important component of a student's science literacy is scale and concepts relating to scale. Scale, or the skills related to understanding quantity within chemistry concepts, has long been an area of interest within this work, however, we have recently begun to expand this research into other science disciplines. Through the use of well-developed assessments and research methods in general chemistry, the extension of this work into an introductory Anatomy & Physiology course has not only reinforced the importance understanding scale has in understanding science, but has also demonstrated the profound deficiency in scale skills that exists in introductory college science students. This workshop will focus on confronting the challenges that arise when assessments and instruction developed in one discipline are applied in a new setting and how materials of this type can be used by faculty to research their students. Additionally, selected resources will be supplied to educators who wish to incorporate any of the described measures into their own courses. Limited travel support is available and interested participants seeking funds should contact the workshop organizer directly.

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### **WWP117: Teaching Chemistry with Food**

Sunil Malapati, Elizabeth Pollock (*1. Chemistry, Clarke University, Dubuque, IA, United States. 2. Chemistry, Stockton College, Stockton, NJ, United States.*)

Session: Wednesday, August 1, 2:00-5:00 pm  
Suggested Audience: College, High School  
Workshop Cost: \$10  
Maximum Participants: 24

Workshop Description: Exploring Chemistry through Food makes science fun and approachable to a student while providing an endless array of everyday examples to teach chemical concepts. 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, gas laws, reaction rates, 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 classroom and laboratory activities that have been tested and can be plugged into their chemistry courses.

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### **WWP118: Teaching Cultural Issues in Organic Chemistry Labs**

Ginevra Clark (*Department of Chemistry, University of Illinois-Chicago, Chicago, IL*)

Session: Wednesday, August 1, 2:00-5:00 pm  
Suggested Audience: College, High School, Middle School, General Audience  
Workshop Cost: 10  
Maximum Participants: 30

Workshop Description: As part of our ongoing work to develop labs that relate chemistry to healthcare, we have developed a framework to teach social justice concepts and applied the framework to two labs. This workshop will prepare participants to: (1) Understand our framework and how it was developed. (2) Train teaching assistants and others in implementing the framework. (3) Apply the framework to two specific labs appropriate for GOB or Organic Chemistry course. (4) Implement appropriate laboratory procedures for two labs, which includes detailed TA notes. (5) Share ideas with others on how to use the framework in their own lab development. The “TLC lab” uses thin layer chromatography (TLC) to evaluate fetal lung development, a critical test in treatment to prevent neonatal respiratory distress (NRDS). This lab teaches concepts of chemical separation and detection, which are prevalent in any lab environment. It also explores how NRDS is diagnosed and treated in different healthcare environments. NRDS is the leading cause of death for pre-term infants. The “Carbohydrates Lab” uses chemical and enzymatic means to explore carbohydrate chemistry, which is foundational in understanding nutrition and metabolism. Students develop a test for sucrose intolerance, which impacts approximately 10% of the Inuit population. Students further explore cultural and social issues as they relate to science by considering issues of food sovereignty and the impact of dietary restrictions on cultural practices in relevant pre-lab, during-lab, and post-lab activities.

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### **WWP119: The POGIL Project Writing POGIL Activities - An Introduction**

Joyce B. Easter, Andrea E. Martin (*1. Chemistry, Virginia Wesleyan University, Virginia Beach, VA, United States. 2. Widener University, Avondale, PA, United States.*)

Session: Wednesday, August 1, 2:00-5:00 pm  
Suggested Audience: College, High School, Middle School, General Audience  
Workshop Cost: \$25

Maximum Participants: 40

Workshop Description: 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.

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### **WWP120: Writing A Competitive Research Proposal**

Nancy J. Jensen (*1. ORG, American Chemical Society, Washington, DC, United States.*)

Session: Wednesday, August 1, 2:00-5:00 pm

Suggested Audience: College, High School, Middle School, General Audience

Workshop Cost: \$10

Maximum Participants: 50

Workshop Description: The workshop will cover general basic guidelines for writing a proposal and identify common pitfalls in proposal writing. While the focus will be on writing research proposals much of the information will be applicable to proposal writing in general. The workshop will include two interactive exercises.

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**WRA121: Developing Instructional Safety Programs in Undergraduate Chemistry Programs**

David C. Finster (*1. Chemistry Department, Wittenberg University, Springfield, OH, United States.*)

Session: Thursday, August 2, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$10

Maximum Participants: 25

Workshop Description: The 2016 ACS Committee on Professional Training Guidelines for Undergraduate Chemistry Programs states that safety instruction should appear in all laboratory courses and research projects in the undergraduate chemistry curriculum. Further, the ACS Committee on Chemical Safety has recently published a set of guidelines that describe the learning outcomes of good safety instruction for undergraduate students. This workshop will explore 1) the desirable context of undergraduate safety instruction, 2) methods and resources for program implementation, and 3) various rationales to convince faculty to develop good safety instruction. Thus, participants will consider what to teach, how to teach it, and why to teach it. The goal is not to create a “one size fits all” instructional program, but to develop institution- and department-based programs from the array of options. Since the development of good safety programs is often evolutionary in nature, long-term goals will be considered with the creation of phasing in programs over time.

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**WRA122: Test Writing**

Stephanie A. Myers (*1. Dept of Chemistry Physics, Augusta University, Augusta, GA, United States.*)

Session: Thursday, August 2, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 24

Workshop Description: Writing a good test can be difficult. This interactive workshop will look at factors to consider when writing a test including: testing philosophies, uses of tests, learning levels, question styles, types of tests, evaluation of tests, practicalities and helping students study.

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**WRA123: Engaging Organic Chemistry Students in an Active Learning Process That Promotes Development of Critical Thinking Skills and the Ability to Apply Essential Concepts**

Barbara van Kuiken (*1. Southern Virginia University/ Mariner Media, Buena Vista, VA, United States*)

Session: Thursday, August 2, 8:00-11:00 am

Suggested Audience: College

Workshop Cost: \$25

Maximum Participants: 50



Workshop Description: A major goal when educating organic chemistry students is to help those students gain a knowledge base of fundamental concepts and build the analysis skills and logic needed to apply those concepts. However, it is well known that many organic chemistry students try to memorize a limited set of reactions and facts just long enough to spit them back on a test paper. Others work enough problems to be able to solve a limited number of reactions by rote. Many students do not develop the ability to logically think through a problem. They do not really understand organic chemistry. They are also generally unable to apply organic chemistry outside the course. The facts memorized by each type of student are of little long-term value. In this workshop, you will gain hands-on experience using an innovative and objectively assessed method for improving student engagement and true learning. These teaching techniques help organic chemistry students deeply understand essential concepts and build analysis skills. By learning and using these techniques, your students will be better able to work important reactions, retain information in long term memory, seamlessly correlate concepts, and apply information and analysis skills to newly encountered situations. In addition, your students will become much more proficient at understanding complex ideas, engaging as life-long learners, interpreting new discoveries, tackling new questions in research, and applying organic chemistry to other disciplines.

Participants will receive a sample workbook that illustrates this teaching method.

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### **WRA124: Workshop on Proteopedia**

Joel Sussman, Jaime Prilusky 1. *Weizmann Institute of Science, Rehovot, Israel.* 2. *Weizmann Institute of Science, Rehovot, Israel.*)

Session: Thursday, August 2, 8:00-11:00 am

Suggested Audience: College, High School

Workshop Cost: \$10

Maximum Participants: 50

Workshop Description: 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.
  - o [http://proteopedia.org/w/HIV-1\\_protease](http://proteopedia.org/w/HIV-1_protease)
  - o <http://proteopedia.org/w/Ribosome>
  - o [http://proteopedia.org/w/Group:SMART:A\\_Physical\\_Model\\_of\\_the\\_β2-Adrenergic\\_Receptor](http://proteopedia.org/w/Group:SMART:A_Physical_Model_of_the_β2-Adrenergic_Receptor)
  
- To create your own pages in Proteopedia, including
  - o Adding 3D interactive scenes via a user friendly GUI for Jmol
  - o Adding text to Proteopedia pages, with hyperlinks to the interactive scenes.