BCCE

Cathrine Reck and James Parise*, Program Chairs*

SUNDAY AFTERNOON

136-DeBartolo Lecture Hall

Active Learning in Organic Chemistry: Approaches to Active Learning

Financially supported by Chemistry Collaborations, Workshops and Communities of Scholars (cCWCS)
A. Leontyev, C. Welder, *Organizers*
V. M. Maloney, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1. cCWCS inspired classroom change: "Clicking" toward success in small undergraduate Organic Chemistry courses. **R. DeCicco**

2:25 2. Making video keys for organic chemistry. **S. Zingales**

2:45 3. Active learning in organic chemistry with out loud problem solving. **P. Auburn**

3:05 4. Active learning in a medium-large class through simultaneous individual and collaborative discussion questions. **S.A. Hershberger**

3:25 Intermission.

3:40 5. Targeting nuanced understanding of challenging concepts. **S.A. Dandekar**

4:00 6. Flipped classroom approach to organic chemistry: Making room for biochemistry. **S.M. Kerwin**

4:20 7. Extraction on paper, an active learning technique to facilitate student understanding of liquid-liquid extraction. **K.J. McKnelly**, R.D. Link

4:40 8. Drawing and coloring pages and "how to find home" games for beginners in organic chemistry. **M.T. Saraswathiamma**

138-DeBartolo Lecture Hall

Big 10 Gen Chem Labs: Advances, Innovations, & Challenges

E. G. Malina, *Organizer, Presiding*
K. A. Moga, *Presiding*

2:00 Introductory Remarks.

2:05 9. Design of new general chemistry laboratory spaces at University of Wisconsin – Madison. **C. Wilkinson**

2:25 10. Lessons learned through large-scale renovations of chemistry teaching labs. **E. Crowe**

2:45 11. Did you break this Büchner funnel? Implementation of a shared glassware system in large general chemistry and organic chemistry laboratory courses. **J. Meyer**

3:05 12. Laboratory teaching assistant mentoring program. **B. Smith**, A. Jones, S.W. Sendler, S. Hauck

3:25 Intermission.

3:40 13. Promoting student preparation for lab using online prelab quizzes. **M. Miller**

4:00 14. Flexible, value-added approach to accommodating make-up labs. **J.W. Uebler**, T. Weaver, K. Fraley, K.A. Moga

4:20 15. Leveraging inclusion and self-efficacy through general chemistry lab. **S.N. Knezz**

4:40 16. Preparing students for general chemistry laboratory exercises. **S.B. Block**, L. Stoll, C. Wilkinson, R. Bain, L. Lamont, A. Tatarsky, S. Peters

214-DeBartolo Lecture Hall

Building an Identity as a Scientist from Orientation to Graduation

B. Blacklock, M. Nguyen, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 17. Building community for first-year chemistry students. **T.M. Neal Porter**, **M. Nguyen**

2:25 18. Scope of chemistry and biochemistry: A discipline-specific first-year seminar. **S. Brydges**

2:45 19. Fostering scientific community using an experiment-based first-year seminar course. **N.M. Karn**, **N.M. Santagata**

3:05 20. Science identity, self-efficacy, and science values changes in the first year of college and their relationship to an honors experience. **J. March**, D. Tucker

3:25 Intermission.

3:40 21. STEM Pathways Academy: A comprehensive program to build and encourage identity as a scientist. **K. Davis**, K.H. Short

4:00 22. Sophomore seminar for career preparedness. **C. Sheppard**, R.H. Singiser

4:20 23. Development of a course to introduce undergraduates to career options in chemistry & biochemistry. **D.M. Solano**, M. Shapiro

4:40 24. Expanding the community of scientists in sophomore and senior seminars. **B. Blacklock**, P. Basu, M. Nguyen

208-DeBartolo Lecture Hall

Chemistry Education Research: Graduate Student Research Symposium

J. Harshman, C. Hensen, *Organizers*
R. Harrison, D. Wren, *Presiding*

2:00 Introductory Remarks.

2:05 25. Facts versus fads: Understanding the historical development of chemistry education to inform reform. **T. Charles**

2:25 26. Building the conceptual profile of substance: Contributions from interactions in classrooms. **R. Orduna Picon**, H. Sevian, E. Fleury Mortimer, R. Reis Pereira

2:45 27. Caught in the act: Investigating the assessment design practices of high school chemistry teachers during professional development. **A.G. Schafer**, E.J. Yezierski

3:05 28. Toward chemical thinking: A formative assessment approach. **G. Banks**, H. Sevian, V. Talanquer

3:25 Intermission.

3:40 29. A data-driven process for identifying the Anticipated Learning Outcomes (ALOs) of a biochemistry Course-based Undergraduate Research Experience (CURE). **S.M. Irby**, N.J. Pelaez, T.R. Anderson

4:00 30. Teaching Organic Chemistry in WORDS. **F. Shen**, R.E. Maleczka

4:20 31. From the minds of graduate students: An online upper-level undergraduate course on green chemistry and sustainability. **R.A. Haley**, **J. Ringo**, H. Hopgood, K.L. Denlinger, A. Das, D.C. Waddell

4:40 32. Development of student-centered teaching assistant training tools using authentic student interactions observed in the chemistry laboratory. **A. Hyett**, M.L. Miller

202-DeBartolo Lecture Hall

Communicating Chemistry Via Social Media

Financially supported by RSC Tertiary Education Group
G. Hurst, C. Sorensen-Unruh, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 33. Using infographics and images to communicate chemistry on social media. **A. Brunning**

2:25 34. Collation and curation of social media content: capturing the synergy of the crowd. **S. Lancaster**

2:45 35. Facebook and Linked-In as tools for personal branding and career advancement in the chemical sciences. **J.L. Maclachlan**

3:05 36. An integrated approach to the engagement of students in a science lecture/lab course via social media. **M.T. Gallardo-Williams**, B.H. Frohock

3:25 Intermission.

3:40 37. Give a scientific seminar using social media. **S. Page**

4:00 38. Podia as a social media tool for collaboration and communication in general organic chemistry classes. **S.T. Pillai**, A. Austin, I.R. Gould

4:20 39. Talking to students about careers in chemistry through social media. **C. Chemjobber**

4:40 Panel Discussion.

4:55 Concluding Remarks.

203-DeBartolo Lecture Hall

Developing & Supporting Chemistry Teachers

S. B. Boesdorfer, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 40. Who are our prospective chemistry teachers and what do they know about chemistry? An analysis of *Praxis® Chemistry Subject Assessment* examinees and performance. **L. Shah**, J. Hao, R. Fallin, K.J. Linenberger Cortes, H. Ray, G.T. Rushton

2:25 41. TA for credit: Pre-service teacher development in the chemistry lab. **J.F. Wiginton**

2:45 42. Combining pedagogical methods with hands-on chemistry demonstrations. **A. Miller**, **C. Callam**, K.E. Irving

3:05 43. At the intersection of "traditional" teacher preparation and a grant for recruiting and supporting STEM teachers for high needs schools. **S.D. Wiediger**, J.S. Krim, K. Barry, S.M. Locke, L. Cummings, T. Voepel

3:25 Intermission.

3:40 44. Mt. SAC STEM Teacher Preparation Program (STEM TP^2). **I.B. Nejad**

4:00 45. Baiting the hook for a future teaching force. **K. Weber Stickney**, K. Baker, D. Sachs

4:20 46. What undergraduate general chemistry instructors consider when creating multiple-choice exams. **J.B. Breakall**, R. Tasker

4:40 47. Supporting faculty in adopting active learning pedagogies. **I. Brown**, R.S. Cole, T.J. Wenzel

213-DeBartolo Lecture Hall

Engaging Students in Physical Chemistry

D. E. Gardner, J. Selco, *Organizers*
C. M. Teague, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 48. How do we know that? Using inquiry to teach physical chemistry. **J. Selco**

2:25 49. Considerations in the development of resources for flipped physical chemistry courses. **L.M. Goss**

2:45 50. Flipping the physical chemistry laboratory/lecture. **J.M. Serafin**

3:05 51. Comparing traditionally instructed physical chemistry and flipped classroom general chemistry student performance on elementary kinetics clicker questions. **G.I. Gellene**, J.T. Mason

3:25 Intermission.

3:40 52. Developing student understanding of thermodynamics and kinetics using a Writing-to-Learn assignment. **S.A. Finkenstaedt-Quinn**, A. Halim, A.C. Moon, A. Gere, G.V. Shultz

4:00 53. Integrating astrochemistry topics in undergraduate physical chemistry curriculum to encourage active learning. **W.K. Gichuhi**, D. Henson

4:20 54. Interpretation of the mass spectrum of bromomethane, CH_3Br. **I.H. Krouse**

4:40 55. Is there a place for negative Kelvin temperatures in the physical chemistry curriculum? **S. Cartier**

131-DeBartolo Lecture Hall

Enhancing Student Learning & Retention in Introductory "Gatekeeping" Chemistry Courses: Focusing on Developing Soft Skills & Mindset for Successful Learning

S. Kradtap Hartwell, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 56. Focusing on student retention through improved instructor behavior: Putting research into practice. **S. Kradtap Hartwell**

2:25 57. Response to perceived failure: An exploratory study in a postsecondary organic chemistry course. **C.J. Zumalt**, K.B. Fields, J.R. Raker

2:45 58. Using chemistry recitation class for something other than chemistry. **A.S. Soult**, T. Gastineau

3:05 59. What can I do to help you succeed? **B.D. Gute**

3:25 Intermission.

3:40 60. Role of motivation, metacognition and mindsets in student performance and persistence in a large enrollment gateway general chemistry course. **U. Swamy**, T. Nicholas

4:00 61. Improving 3D visualization in organic and bio-organic chemistry. **S.A. Fleming**

4:20 62. Problem solving in chemistry (CHM 1008): A one-semester preparatory chemistry course using deliberate practice and metacognitive strategies to improve the student success in general chemistry. **B. Augustine**, H.B. Miller, T. Knippenberg

4:40 Discussion

4:55 Concluding Remarks

206-DeBartolo Lecture Hall

General Papers: Advances in Upper-Level Chemistry Courses

W. J. Donovan, *Organizer, Presiding*
K. S. Craig, A. Van Asselt, *Presiding*

2:00 Introductory Remarks

2:05 63. An integrated chemistry laboratory experience for upper division students. **K.S. Craig**

2:25 64. Lessons, observations, and adaptations of a longstanding undergraduate research program. **A. Van Asselt**

2:45 65. Analyzing exonuclease-induced hyperchromicity by UV spectroscopy: An undergraduate biochemistry laboratory experiment. **A. Chant**

3:05 66. Transitioning students from the classroom to the world; creating better prepared and more engaged scientists. **S.S. Rizk**

3:25 Intermission.

3:40 67. Modifying an advanced inorganic lab to give students a more realistic view of research. **M.C. Andrews**, A.F. Cozzolino

4:00 68. Increasing students' competency with NMR spectroscopy for careers in the chemical sciences: Educational applications of Thermo Fisher Scientific picoSpin instrumentation. **D. Frasco**

4:20 69. Implementing instrument building in instrumental analysis laboratory. **E. Mawk**

140-DeBartolo Lecture Hall

Innovative Ways to Lower Course Material Costs

M. A. Erdmann, J. A. Nikles, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 70. Reducing the cost of general chemistry instructional materials through an online laboratory notebook and homework system. **C.L. Aronson**, **E. Brown**

2:25 71. Saving students money without sacrificing quality. **E. Fahlgren**

2:45 72. Teaching introductory forensic chemistry using open educational resources. **B.E. Taylor**

3:05 73. Lowering the costs of general chemistry through the use of an Open Education Resource (OER) textbook, hand-written online homework assignments, and hand-written lab experiments. **A.J. Kabrhel**

3:25 Intermission.

3:40 74. Open-source college chemistry course materials with an adaptive courseware component for $50 per student. **J.F. Wiginton**

4:00 75. Innovative ways to affordable laboratory manuals and course texts. **J.P. Lanorio**, J.G. Lanorio

4:20 76. Direct billing and LMS integration of traditional textbooks. **J.E. Leibold**

4:40 77. Development of an online general chemistry course with open educational resources. **E. Ragan**

311-DeBartolo Lecture Hall

Interdisciplinary Collaboration in Chemistry Courses: Practices & Challenges

B. Widanski, *Organizer*
J. Thompson, *Presiding*

2:00 Introductory Remarks.

2:05 78. Interdisciplinary approach to developing research, communication, and information literacy skills in chemistry sophomore seminar. **G.B. Ray**, K. Jordan

2:25 79. Interdisciplinary approach to the chemistry curriculum: Infusing the liberal arts into majors-level courses. **D.A. Czegan**, D.M. Miller

2:45 80. Tracking information literacy in science students: Importance of early exposure in skills retention throughout the undergraduate curriculum. **M. Bruehl**, J.D. Knight, D. Pan, M.J. Resendiz

3:05 81. Chemistry, art, and information literacy. **D.G. Mitchell**, C. Wang, R. MacInnes, M. Kelly, A. Linshaw

3:25 Intermission.

3:40 82. Chemystery: A chemistry/english interdisciplinary course. **S.M. Strickland**, L. Brown

4:00 83. Collaborative integration of information literacy: A progress report from an introductory chemistry assignment. **J.R. Oh**

4:20 84. Teaching information literacy in an organic chemistry laboratory exercise using SciFinder. **E.D. Helms**, B. Swoger

4:40 85. Collaboration across the disciplines: Chemistry, library and English faculty working together with organic chemistry lab students. **B. Widanski**, J. Thompson

310-DeBartolo Lecture Hall

Issues in Teaching & Learning in a Biochemistry Course for Nonmajors

C. E. Brown, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 86. Systemic review of ketogenic diets and the evidence for mechanistic target of rapamycin inhibition. **J. Chavez**, C.E. Brown

2:45 87. More than muscles and chicken: Efforts to develop a deeper appreciation of proteins. **S.A. Mason**

3:05 88. Student engagement with case studies in a biochemistry course for non-chemistry majors. **C.E. Brown**, R.M. Hyslop

3:25 89. Flipping made easy for biochemistry. **M. Klemp**

3:45 Intermission.

4:00 90. Design of virtual reality exercises for the study of metabolic pathways. C.E. Brown, R.M. Hyslop, **B. Whaley**, A. Sweitzer

4:20 Concluding Remarks.

201-DeBartolo Lecture Hall

Models & Modeling in Introductory Chemistry

L. E. Slocum, *Organizer, Presiding*
L. Dukerich, R. Howanski, *Presiding*

2:00 Introductory Remarks.

2:05 91. How Modeling Instruction helps teachers improve students' conceptual understanding of high school chemistry. R. Howanski, **L.E. Slocum**, L. Dukerich

2:45 92. Chemistry modeling workshop presentation. **Workshop Presenter 1**

2:55 93. Chemistry modeling workshop presentation 2. **Workshop Presenter 2**

3:05 94. Chemistry modeling workshop presentation 3. **Workshop Presenter 3**

3:15 95. Chemistry modeling workshop presentation 4. **Workshop Presenter 4**

3:25 Intermission.

3:40 96. Chemistry modeling workshop presentation 5. **Workshop Presenter 5**

3:50 97. Chemistry modeling workshop presentation 6. **Workshop Presenter 6**

4:00 98. Chemistry modeling workshop presentation 7. **Workshop Presenter 7**

4:10 99. Chemistry modeling workshop presentation 8. **Workshop Presenter 8**

4:20 Discussion.

215-DeBartolo Lecture Hall

More Bang for Your Buck: (More) Effective Active Learning Methods in General Chemistry

M. Blaser, *Organizer, Presiding*
D. Ramella, *Presiding*

2:00 Introductory Remarks.

2:05 100. Flipping the instructor: The evolution of a tried and true lecturer. **E.C. Wasinger**, R.A. Donatello

2:25 101. Combining pre-class preparation and meaningful, collaborative in-class activities to improve student engagement and success in General Chemistry. **M. Blaser**

2:45 102. Effectiveness of handout notes to group discussion in a General Chemistry course. **E.K. Mushibe**

3:05 103. Using clickers to boost performance in a Flipped Classroom through modified Peer Instruction and active learning strategies. **D.M. McGregor**, P. Mills, M.A. Deri

3:25 Intermission.

3:40 104. Flipping general chemistry: Students' perception and success. **K.M. Anderson**

4:00 105. Using flipped classroom settings to shift the focus of a general chemistry course from topic knowledge to learning and problem solving skills. A tale of students enjoying the class they were expecting to hate. **D. Ramella**, B.E. Brock

4:20 106. Modified flipped classroom teaching for science classes. **S. Sivalingam**, E. Gabbard

4:40 107. Curriculum transformation and student engagement in General Chemistry 103 and 104. **L. Lamont**, L. Stoll, E.L. Sibert, C.R. Landis

316-DeBartolo Lecture Hall

NSF Programs that Support Undergraduate Education

R. K. Boggess, *Organizer*
C. A. Burkhardt, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 108. National Science Foundation programs that support undergraduate chemistry education. **D. Rickey**, **T. Kim**

2:25 109. ARiEL: Augmented Reality in Educational Laboratories. **T. Holme**

2:45 110. Implementing active learning strategies in two-year Hispanic-serving institutions: Impacts on faculty change and student success in STEM courses. **D.R. Brown**, S. Brydges, S. Lo, M.E. Denton, M. Borrego

3:05 111. Instruction that blends qualitative with quantitive reasoning in chemical equilibrium and kinetics. **D. Yaron**, S. Raysor

3:25 Intermission.

3:40 112. Collaboration, mentorship and sustainability through the NSF ATE program. **L. Cotner**

4:00 113. Exploring NSF S-STEM program student outcomes and benefits to departmental culture. **R.D. Walker**, **A.J. Bonham**, J. London

4:20 114. Improving STEM student success through the S-STEM program. **R.H. Jarman**, T. Carter, W.G. Roby, T. Schrader, B. Abromitis, S. Fenwick

4:40 115. Miami University Noyce program: Community-based and culturally responsive approach to STEM teacher preparation, induction, and retention. **E.J. Yezierski**, **T. Schwartz**, J. Blue, J. Wanko, N.U. Bautista

216-DeBartolo Lecture Hall

Promoting Argumentation in the Chemistry Laboratory

D. I. Del Carlo, J. P. Walker, *Organizers*
M. T. van Opstal, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 116. Experiences of implementing argument-driven inquiry into a general chemistry laboratory course. **B. Melroe Lehrman**

2:25 117. Argument Driven Inquiry: A chemistry laboratory implementation. **M. Lower**, J.P. Walker

2:45 118. Student challenges in scientific argumentation: The difficulty of changing claims and reasoning. **A.G. Van Duzor**, M. Lower, J.P. Walker

3:05 119. Scaffolding the Science Writing Heuristic in introductory general chemistry labs: An opportunity for a more focused data discussion in lab. **B.R. Flokstra**

3:25 Intermission.

3:40 120. Moving past the "right" answer: Promoting evidence-based claims in the general chemistry laboratory. **D.I. Del Carlo**

4:00 121. Using the Science Writing Heuristic (SWH) to promote argumentation in community college introductory chemistry. **M.T. van Opstal**

4:20 122. Encouraging students to argue more effectively in their writing in the introductory organic laboratory. **D.J. Slade**

4:40 123. Using the Science Writing Heuristic (SWH) as a strategy for analyzing the primary literature. **S.J. Gravelle**, J.K. Vohs

126-DeBartolo Lecture Hall

Research in Chemistry Education

T. J. Bussey, *Organizer*
R. Sansom, *Presiding*

2:00 Introductory Remarks.

2:05 124. Faculty members' choices in designing and implementing assessments: A qualitative investigation. **S. Srinivasan**, R. Gibbons, K.L. Murphy, J.R. Raker

2:25 125. Expert approach versus student approach, validating partial credit assignments. **J.L. Schneider**, J. Trate, C.J. Luxford, M.A. Teichert, T.S. Thomas, S. Srinivasan, K.L. Murphy

2:45 126. Breaking the language barrier: Equitable assessment in general chemistry. **E. Lee**, M. Orgill

3:05 127. Lexical analysis as a tool for formative assessment in organic chemistry. **A.J. Dood**, K.B. Fields, J.R. Raker

3:25 Intermission.

3:40 128. The impact of a group-testing protocol on women and first-generation students' test anxieties and test performance in general chemistry. **M. Mack**, C.F. Craig

4:00 129. Understanding student decision-making processes in the context of representational competence when solving assessment tasks. **J.M. Trate**, J.J. Reed, J.R. Raker, K.L. Murphy

4:20 130. Characterizing college science instruction: The three-dimensional learning observational protocol. **K. Bain**, R.L. Matz, C.L. Fata-Hartley, M.D. Caballero, D.G. Herrington, D. Ebert-May, E.M. Duffy, J.R. Stoltzfus, J.T. Laverty, J. Carmel, L. Bender, L.A. Posey, M. Urban-Lurain, R. Stowe, R.D. Sweeder, S.M. Underwood, S.H. Tessmer, M. Cooper

4:40 131. Factors that impact the difficulty of general chemistry exam items. T.C. Pentecost, J.R. Raker, **K.L. Murphy**

210-DeBartolo Lecture Hall

Spiral (Two-Cycle) Organic Chemistry

M. P. Garoutte, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 132. From Wittenberg to Millikin: More than two decades of two-cycle organic chemistry. **G.D. Bennett**

2:25 133. Fits and starts: Spiral organic chemistry through the decades. **M.P. Garoutte**

2:45 134. Ten years of teaching two-cycle organic chemistry. **F.M. Rossi**

3:05 135. A spiral organic chemistry sequence, 12 years after implementation. **D.M. Schirch**

3:25 Intermission.

3:40 136. Second semester organic chemistry options: Bioorganic chemistry and organic mechanism and synthesis. **J.M. Belitsky**, A.R. Matlin, D.P. Hua, L.M. Ryno, W.H. Parsons

4:00 137. Using a Two-Cycle, mechanistic approach in presenting year-long organic chemistry. **R.S. Majerle**

4:20 138. The Gutenberg Method as a course flipping technique in two-cycle organic chemistry. **D.J. Berger**

4:40 139. Developing a textbook organized by the foundation/depth principle. **B.T. Burlingham**

217-DeBartolo Lecture Hall

Student-Centered Inquiry Learning with an Emphasis on Process Skills in the Classroom & Laboratory

G. H. Webster, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 140. Process Oriented Guided Inquiry Learning (POGIL): A student-centered team-learning approach to chemistry instruction. **R.S. Moog**

2:25 141. Developing and collating POGIL activities in environmental chemistry. **C.L. Fish**, D.B. King, K. Aubrecht

2:45 142. Developing and implementing POGIL-ish activities in a large lecture setting: Providing opportunities for students to improve process skills and to revise mental models that enables the prediction and explanation of chemistry phenomena. **T.J. Greenbowe**, D.B. Exton, D.R. Sullivan

3:05 143. Assessment and feedback on process skills in large enrollment courses. **C.L. Stanford**, S.M. Ruder, R.S. Cole, J. Lantz, G.J. Reynders

3:25 Intermission.

3:40 144. How teaching science using project-based learning strategies affects the classroom learning environment and educational achievement. **M. Hugerat**, S. Hugerat, R.F. Abu-Much

4:00 145. Differentiating between a peer-led workshop (PLTL) and a TA-led recitation. **D.A. Turner**

4:20 146. Assessing the effectiveness of Google platform as part of the Problem-Based Learning (PBL) experience. **K.J. Martinez-Hernandez**

4:40 Panel Discussion.

207-DeBartolo Lecture Hall

Supporting the Growth & Impact of the Chemistry Education Research Community

P. L. Daubenmire, D. G. Herrington, R. D. Sweeder, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 147. Chemistry education research as a graduate discipline: What constitutes critical mass? **S. Bretz**

2:25 148. Undergraduate research in CER: Where is it now and where are we headed? **B.K. Dekorver**, **E.J. Yezierski**

2:45 149. I'm finally a doctor, what do I do now? The role of a post-doctoral experience in CER. **J.H. Carmel**, **M.N. Stains**

3:05 150. Building a web of opportunities: Networking in chemistry education research. **C.F. Bauer**, **S.C. Ryan**

3:25 Intermission.

3:40 151. Establishing effective collaborations in CER. **D.G. Herrington**, **R.M. Kelly**

4:00 152. Mentoring, the hallmark of CER: What is it and how can we practice it? **M.H. Towns**, **D.M. Bunce**

4:20 153. Contributing to the chemistry education research community across varying academic settings. **S.E. Lewis**, **R.S. Cole**

4:40 154. The intricacies of CER positions: Perspectives on what it takes to thrive doing CER in academia. **J.E. Lewis**, **M. Oliver-Hoyo**

129-DeBartolo Lecture Hall

Technology Integration in Chemistry Education & Research (TICER): Cheminformatics, Computational Chemistry, Medicinal Chemistry & the Use of Databases

T. Gupta, *Organizer*
R. Belford, *Presiding*

2:00 Introductory Remarks.

2:05 155. Development of a computationally-based medicinal chemistry course at a small, primarily undergraduate institution. **B. Hall**

2:25 156. Are you ready for big data chemistry? **S. Kim**, E. Bolton

2:45 157. Implementing a project-based medicinal chemistry course at Kentucky Wesleyan College. **K.D. Watson**

3:05 158. Reaxys Education. **N.D. Katz**, R.E. Belford, D.D. Ridley, E.C. Bucholtz, T. Géoui

3:25 Intermission.

3:40 159. Using free computer-aided drug design applications in an undergraduate medicinal chemistry course to investigate and apply foundational concepts. **T.M. Covey**

4:00 160. Chemistry learning exercises from the UK using web-based worldwide research databases. M. Conroy, **P. Hoare**

4:20 161. Design and integration of biochemistry computational and visualization labs into a new biochemistry lab course. **J. Stack**, L. Bolyard

4:40 162. Chemical accounting with an open-access life cycle assessment for student researchers. **J.R. Silverman**, C. Bode, B. Subramaniam

204-DeBartolo Lecture Hall

The Pros & Cons of Multi-week Research Projects in the General Chemistry Laboratory

G. R. Wyllie, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 163. How to make knives in college: Steel as a multi-week theme in the general chemistry lab. **M.E. Riehl**

2:25 164. Bioplastics: Combining seaweed and lobsters to create a new general chemistry research experience. **G.R. Wyllie**, A.M. Ward

2:45 Discussion.

205-DeBartolo Lecture Hall

Using Specifications Grading to Assess Learning Outcomes in Chemistry

H. J. Fletcher, *Organizer, Presiding*
E. Baldauff, *Presiding*

2:00 Introductory Remarks.

2:05 165. Standards Based Grading 2.0: A tool for assessing learning outcomes, increasing student success and developing mastery of course content. **S.A. Toledo**, T.D. Shepherd, J. Dubas

2:25 166. Assessing learning outcomes in general chemistry using specifications grading and setting students up for success in future chemistry courses. **E.A. Baldauff**, **H.J. Fletcher**

2:45 167. Early impressions and results of using specifications-based grading in a general chemistry course. **E.E. Wilson**

3:05 168. Bringing things into alignment: The processes used by ACS Exams to align exam items and how these can be used to align everything from learning objectives to courses within and between programs. **J.J. Reed**, J. Trate, S. Srinivasan, K.A. Marek, T.C. Pentecost, J.R. Raker, K.L. Murphy

3:25 Intermission.

3:40 169. Applying specifications grading to the general chemistry laboratory. **E.A. Baldauff**

4:00 170. Student perseverance and performance in survey, general, and organic chemistry courses using specifications grading: A mixed methods study. **M. Anzovino**, M. Tsoi, M.S. Morton, O. Villanueva, C.M. Woodbridge, M. Maxwell, M. Yaceczko

4:20 171. Using specifications grading to create self-regulated learners. **W. Hollinsed**

4:40 Discussion.

MONDAY MORNING

204-DeBartolo Lecture Hall

Accelerated Chemistry: Teaching One Course at a Time

B. Lybbert, K. Mahoney, *Organizers*
S. Swallen, *Presiding*

8:00 Introductory Remarks.

8:05 172. Organization of the University of Wisconsin Colleges' "bootcamp" style organic chemistry lab course. **K. Mahoney**

8:25 173. Using post-laboratory worksheets to speed grading of scientific notebooks in an accelerated "boot camp" organic chemistry laboratory course. **A.J. Kabrhel**, **J.E. Kabrhel**

8:45 174. Switching from semesters to blocks: Yes, students can learn organic chemistry (lecture) in 18 days. **J.A. Shanata**

9:05 175. Organic Laboratory as its own course: It's about time! **C.A. Liberko**

9:25 Intermission.

9:40 176. Two semesters of organic chemistry labs in one week. **S.T. Pillai**, A. Austin, M. Tejeda, P. Trakanrungroj, I.R. Gould

10:00 177. Knowing what students know: Using reading quizzes to tailor an accelerated general chemistry class. **L. Demoranville**

10:20 178. General chemistry II in 3 weeks: Observations and lessons learned. **C.A. Ashe**

10:40 179. Reflections on 47 years of accelerated teaching. **S.A. Meyer**, A. Dounay

136-DeBartolo Lecture Hall

Active Learning in Organic Chemistry: Active Learning in a Flipped Classroom

Financially supported by Chemistry Collaborations, Workshops and Communities of Scholars (cCWCS)
A. Leontyev, V. M. Maloney, *Organizers*
C. Welder, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 180. Active learning in organic chemistry: an all in approach to flipping the classroom. **C. Welder**

8:25 181. Partially flipping large organic chemistry lectures - group workdays. **A. Steelman**

8:45 182. Flipping organic chemistry 1: First try. **S. Gupta**

9:05 183. Flipping the classroom using Lightboard technology: The active learning story. **A.M. Azman**

9:25 Intermission.

9:40 184. Student perspectives on a flipped OB course at course completion and 2-3 years later. **D.M. Schirch**

10:00 185. Still not perfect: Ongoing challenges in a flipped organic classroom. **L.J. Martin**

10:20 186. Ceding control and adjusting on the fly: Experiences implementing an active-learning organic chemistry course during the summer session for the first time. **E. Victor**, K. Hess

10:40 187. Flipping OChem without losing the details: Producing detailed instruction videos for organic chemistry with an iPad and a simple screen capture device. **A.C. Royer**

202-DeBartolo Lecture Hall

CERtainly You Can Do Inquiry in Chemistry

A. Modic, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 188. Strong vs. weak arguments: Setting the expectation for good justifications. **A. Modic**

8:25 189. Using discrepant events and CER to avoid formation of misconceptions within inquiry experiences. **M. Ogden**

8:45 190. WISE science: How writing inquiry stories to explore science supports students' claims, evidence, and reasoning. **S.A. Hershberger**

9:05 191. Enhancing your stoichiometry unit with a unique investigation. **B. Meacham**

9:25 Intermission.

9:40 192. Condiment challenge: An authentic inquiry experiment. **A. Modic**

10:00 193. Redesigning the first two years of the undergraduate laboratory curriculum: The Claim, Evidence, Reasoning (CER) framework as a unifying theme. N.L. Powell, **B. Harmon**

208-DeBartolo Lecture Hall

Chemistry Education Research: Graduate Student Research Symposium

J. Harshman, *Organizer*
C. Hensen, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 194. Supporting general chemistry students' understanding of the nature and purpose of mathematical models in chemistry contexts. **K.J. Lazenby**

8:25 195. Use of pychophysiological techniques to determine cognitive load of modeling activities in general chemistry. **J. Calvert**, K.J. Linenberger Cortes, X. Prat-Resina, A. Randolph, C.R. Terrell

8:45 196. Productive Features of Problem-Solving in Chemical Kinetics. **J.G. Rodriguez**, K. Bain, M.H. Towns

9:05 197. Polar or nonpolar: Student decision-making when offered sequential or simultaneous exemplars with and without electrostatic potential maps. **C.L. Lavoie**, C.F. Bauer

9:25 Intermission.

9:40 198. Connecting students' understanding of London dispersion forces to phase changes. **K. Noyes**, M. Cooper

10:00 199. Visualizing students' linking of chemistry concepts via an open-ended assessment. **A. Gilewski**, L. Ye

10:20 200. Analyzing the retention of knowledge among second semester general chemistry students. **J. Kingsepp**, S.E. Lewis

10:40 201. Improving assessment practices in general chemistry: The development and use of a multiple-choice item writing flaws evaluation instrument. **J.B. Breakall**, R. Tasker, C. Randles

311-DeBartolo Lecture Hall

Collaborative & Cooperative Learning

L. A. Morsch, *Organizer*
J. Chamberlain, B. McCollum, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 202. Open ended team-based induction task to support the development of project skills. **D.P. Williams**

8:25 203. PROJECT PONDER - Integrating different clicker-based methodology into problem-based learning sessions. **R.J. Pearson**

8:45 204. Emphasizing biochemistry concepts using medical-based case studies in a large collaborative reception. **C.T. Cox**

9:05 205. Metacognition in chemical thinking. **J. Tashiro**, J.R. Pollard

9:25 Intermission.

9:40 206. Resistance is futile: Oncoming OER revolution and how the Libretexts (née ChemWiki) can help you navigate it. **D.S. Larsen**

10:00 207. Student metaphors of online collaborative learning from INCLD: International Network for Chemistry Language Development. **L.A. Morsch**, B. McCollum, M.T. Wentzel

10:20 208. Success in collaborative learning. C. Pinder, M. Macias, E. Campbell, S. Falcione, K. Davis, **J. Chamberlain**, L.A. Morsch, B. McCollum

10:40 Panel Discussion.

138-DeBartolo Lecture Hall

Current Research on the Undergraduate Chemistry Laboratory

N. L. Burrows, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 209. Flipping the general chemistry laboratory lecture: Increasing student engagement by enhancing self-directed learning. **R.M. Theisen**, J.A. Halfen

8:25 210. Flipped classroom in organic chemistry laboratory. **Y. Liu**, X. Wang

8:45 211. Student use of a science writing heuristic style pre-lab. **N. Bonde**, D.I. Del Carlo

9:05 212. Impacting scientific practice through instruction on the nature of science. **G. Kerstiens**, A.M. Baranger, M.C. Douskey, M. Robak, L.B. Armstrong

9:25 Intermission.

9:40 213. Students' difficulty in performing laboratory skills and techniques. **L.K. Kendhammer**, N.J. Pienta

10:00 214. What motivates students to learn hands-on lab skills?: Looking deeper into digital badges. **S. Hensiek**, T. McCord, C. Harwood, M.H. Towns

10:20 215. Assessing laboratory competencies using peer review and digital badges. **M. Seery**

10:40 216. Development and analysis of scientific practices assessment tasks for the chemistry laboratory. **N.S. Stephenson**, J.H. Carmel, E.M. Duffy, D.G. Herrington, M. Cooper

203-DeBartolo Lecture Hall

Developing & Supporting Chemistry Teachers

S. B. Boesdorfer, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 217. A longitudinal study exploring the development of teacher leadership traits and teacher self-efficacy among new chemistry and physics teachers. **M.L. Head**, S. Ake, J. Long, A. Edwards, G.T. Rushton, B.A. Criswell

8:25 218. Summer workshop for high school teachers to utilize MOOCs in their classroom. **K.R. Woodrum**, A.S. Soult

8:45 219. Safety in the chemistry lab: A CEU module for in-service chemistry teachers. **J.F. Wiginton**

9:05 220. Online chemistry teacher development: Assessing the impact of an online program on chemistry teachers' development. **S.B. Boesdorfer**, D. Frederking

9:25 Intermission.

9:40 221. Changing classroom practices through micro-credentialing - Creating meaningful modeling lessons for high-school chemistry classrooms. **A. Blecking**

10:00 222. Chemistry Interactive Demonstrations and Educational Resources (CIDER): A comprehensive instructional activity website. **D.R. Sullivan**

10:20 223. A flipped approach model to a dual-credit general chemistry course. **K. Arnold**, **D. Snaddon**, K. Smola

10:40 224. Connecting research to the classroom: Perspectives from a novice teacher and a veteran teacher. **M.L. Cole**, C. Fish, H. Fish

310-DeBartolo Lecture Hall

Engaging Non-Science Majors in Chemistry through Current Scientific Topics

K. Hess, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 225. Designing a course for non-science majors based on "What's That Stuff?". **K.S. Anliker**

8:25 226. From children's books to poster sessions: How to sell chemistry to the non-scientist. **M.R. Porter**

8:45 227. Development of a non-science major's course: Preservation of cultural heritage. **J.M. Esson**

9:05 228. Development of a Science of Art course and evaluation of student learning using the Chemical Concepts Inventory. **B. McBurnett**

9:25 Intermission.

9:40 229. Water: An upper division interdisciplinary Honors course on water. **L.K. Steffen**, P. Bayers

10:00 230. Outcomes-driven design of a year-1 chemistry course for non-science students. **F. Lee**

10:20 231. Arctic ice sheet as an introduction to climate change. **G. Lisensky**

10:40 232. First year seminar: Exploration of the chemistry of renewable energy. **K. Hess**

213-DeBartolo Lecture Hall

Engaging Students in Physical Chemistry

J. Selco, C. M. Teague, *Organizers*
D. E. Gardner, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 233. Effect of mathematical software on students' learning experience in quantum mechanics and spectroscopy course at Bridgewater State University. **S. Nellutla**, R. Fonfrel, L. Gross

8:25 234. Compute to learn: Students programming interactive visualizations of physical chemistry concepts. **A.C. Gottfried**, E. Geva, B. Winograd, M. Jafari, A.R. Welden, E. Mulvihill, K. Williams, Y. Lai, Y. Zhou

8:45 235. Cognition, chemistry, and computers: Using computational narratives to teach chemistry principles. **S.M. Singleton**

9:05 236. Stochastic modeling of chemical kinetics taught using literature readings as an active learning exercise in a partially flipped class. **J.H. Gutow**

9:25 Intermission.

9:40 237. Using Mathematica® as a visualization tool in physical chemistry. **S. Cartier**

10:00 238. Python-based computational guided inquiry assignments for physical chemistry. **T.L. Guasco**, S. Neshyba

10:20 239. Introducing problems involving environmental topics to enhance learning and interest in physical chemistry. **B. Findley**

10:40 240. Integrating quantum, inorganic, and analytical approaches to teach bonding and spectroscopy topics. **A.F. Raigoza**

131-DeBartolo Lecture Hall

Enhancing Student Learning & Retention in Introductory "Gatekeeping" Chemistry Courses: Innovative Assignments & Teaching Tools

S. Kradtap Hartwell, *Organizer*
J. Ranga, *Presiding*

8:00 Introductory Remarks.

8:05 241. Adaptive learning technology in general chemistry: Does it support student success? **J.M. Fautch**

8:25 242. Extended collaborative problem solving sessions for success in college general chemistry and beyond. **M.C. Zwier**

8:45 243. Distillation of various pedagogical strategies engage students in developing their skills as learners. **B.R. Flokstra**

9:05 244. Molecular sciences made personal: Developing curiosity in general and organic chemistry with a multi-semester utility value intervention. **J. Zavala**, C. Ray, J.S. Moore, R. Chadha, D.M. Steele

9:25 Intermission.

9:40 245. Preventing mole concepts and stoichiometry from becoming "gatekeepers" in the first-year chemistry courses. **A.P. Bopegedera**

10:00 246. Increase learning by decreasing student dependency on websites that provide worked solutions to homework and lab assignments. **E.L. Brown**, C.L. Aronson

10:20 247. Retention and reinforcement: Building a pre-semester module to improve the success rates of students in first year chemistry courses. **S.A. McCartney**, **R.D. Bethel**

10:40 248. Reflections in general chemistry labs: A teaching tool to connect labs with lectures. **J. Ranga**

206-DeBartolo Lecture Hall

General Papers: Advances in General Chemistry & Upper-Level Chemistry Courses

W. J. Donovan, *Organizer, Presiding*
M. Hands, A. B. Rives, *Presiding*

8:00 Introductory Remarks.

8:05 249. What is organic chemistry bootcamp? **B.M. Fetterly**

8:25 250. The joys and hardships of organic chemistry laboratory bootcamp. **A.E. Fischer**

8:45 251. Communicating climate change science: An interdisciplinary capstone course. **K. Aubrecht**

9:05 252. Design and implementation of an interdisciplinary sophomore-level course focused on increasing scientific literacy and oral and written presentation methods. **E. Smithers**, A. Kovach

9:25 Intermission.

9:40 253. Providing context for the undergraduate chemistry degree in an upper level elective course titled History of chemistry: A materials perspective. **G.D. Claycomb**

10:00 254. Increasing engagement in biochemistry lecture through the chemistry of cooking. **A.J. Bonham**

10:20 255. The biological impact and ethical implications of pesticide use: a short module for upper-division undergraduate biochemistry courses. **L.M. Ryno**, C. Cottine

10:40 Discussion.

216-DeBartolo Lecture Hall

Integrating Laboratory Safety Education Into the Chemistry Curriculum

K. D. Edwards, D. C. Finster, M. R. Wilhelm, *Organizers*
R. D. Link, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 256. Recognizing and understanding laboratory hazards: The "R" of RAMP - A critical component of laboratory safety education. **R.H. Hill**

8:25 257. Safety education across the curriculum: Building a safety system. **S.B. Sigmann**

8:45 258. Moving toward a culture of safety in the general chemistry laboratory curriculum. **L. Yoder**

9:05 259. Spiral approach to safety training in lower division chemistry laboratories. **R.D. Link**, **K. Edwards**, T. Endean, A. Reath, M. Nguyen, C. Ramirez

9:25 Intermission.

9:40 260. What is a risk assessment and how do I teach my students to do them? **M.R. Wilhelm**

10:00 261. Simplifying rules on laboratory appropriate attire: Using scrubs as required PPE in lower-level teaching labs. **A.N. French**, M.A. Patwardhan

10:20 262. Public-domain chemical health and safety information in PubChem. **S. Kim**, J. Zhang, A. Gindulyte, P.A. Thiessen, E. Bolton

10:40 263. Adding safety to the curriculum through student research projects. **S.D. Wiediger**

210-DeBartolo Lecture Hall

Mom the Chemistry Professor: Personal Accounts & Advice from Chemistry Professors who are Mothers

Cosponsored by WCC
K. A. Woznack, *Organizer*
R. S. Cole, G. H. Webster, *Presiding*

8:00 Introductory Remarks.

8:05 264. Equilibrium and stress: Balancing one marriage, a “two-body problem,” and three children. **S. Bretz**

8:25 265. From pre-med to U.S. Professor of the Year...with a family. **A.K. El-Ashmawy**

8:45 266. Chemistry in the family: A mother's journey. **C.B. Frech**

9:05 267. Safety challenges and motherhood in the academic chemistry research laboratory: Results from a qualitative study. **M.G. Grunert Kowalske**

9:25 Intermission.

9:40 268. On my terms: Navigating life and motherhood as a chemistry professor. **S.E. Mason**

10:00 269. From mom the chemistry professor to mom the professor and administrator: Maintaining balance in academia. **S.O. Obare**

10:20 270. Navigating my way to academia and motherhood...without a GPS. **G.H. Webster**

10:40 Panel Discussion.

215-DeBartolo Lecture Hall

More Bang for Your Buck: (More) Effective Active Learning Methods in General Chemistry

M. Blaser, *Organizer, Presiding*
B. Balasubramanian, *Presiding*

8:00 Introductory Remarks.

8:05 271. All carrot, no stick! An iterative approach to active learning in freshman chemistry courses. **B. Balasubramanian**

8:25 272. Application of active learning techniques in large introductory and general chemistry classes. **C. Beck**

8:45 273. Really being ACTIVE in the active learning classroom. **M. Newsome**

9:05 274. Engaging students in a large lecture General Chemistry course: Pacing learning activities for aqueous equilibria with the creative use of a classroom response system. **C. Labrake**

9:25 Intermission.

9:40 275. Improving an active learning general chemistry course. **T.M. Clark**

10:00 276. Promoting active learning outside the classroom. **S. Pazicni**

10:20 277. Active learning in hybrid-online general chemistry. **D. Miller**

10:40 278. Constructing explanations during and outside of a non-majors chemistry class: Which improves student learning? **M. Atkinson**, S. Krishnan, L. McNeil, J.A. Luft, N.J. Pienta

126-DeBartolo Lecture Hall

Research in Chemistry Education

T. J. Bussey, *Organizer*
N. M. Becker, *Presiding*

8:00 Introductory Remarks.

8:05 279. Design, implementation, and assessment of blended learning (flipped classroom) activities in large enrollment general chemistry and organic chemistry courses. **J.F. Eichler**

8:25 280. Evaluating the effectiveness of a concept map oriented chemistry curriculum on student performance in a flipped organic and general chemistry classroom. **B.S. Kumar**, L. Cain

8:45 281. Intra-Text Links and their usage in Online Chemistry Textbooks: What does the data tell us from over 2 million visitors? **J.R. Cerone**, J. Shorb

9:05 282. Development of communication skills and professional identity in chemistry through international online collaborative learning. **B. McCollum**, L.A. Morsch, D. Skagen, B. Shokoples

9:25 Intermission.

9:40 283. Comparison of student visual attention to conceptual and algorithmic information in worked examples to student problem-solving strategies. **E. Day**, L.K. Kendhammer, N.J. Pienta

10:00 284. Investigating how students of different achievement levels differ in deep and surface approaches when solving problems. **D.M. Bunce**, D.K. Dillner, M.J. Schroeder, S. Lin, M.A. Teichert

10:20 285. Examining the evidence base of evidenced-based instructional practices through meta-analysis. **M. Rahman**, S.E. Lewis

10:40 286. Chemistry teaching and learning through a transformative learning lens. **A. Flaherty**

217-DeBartolo Lecture Hall

Student-Centered Inquiry Learning with an Emphasis on Process Skills in the Classroom & Laboratory

G. H. Webster, *Organizer*
R. M. Whitnell, *Presiding*

8:00 Introductory Remarks.

8:05 287. Rhodamine B isomerization: An inquiry-based general chemistry experiment connecting thermodynamics, intermolecular forces, and chemical equilibria. **N.A. Crumpton**, M.C. Zwier

8:25 288. Instrument building, characterization, and use in advanced instrumental analysis. **T.J. Bixby**

8:45 289. The SPIRAL (Strengthening Process, Inquiry, Reflection, and Application in the Laboratory) Project. E. Bucholtz, S. Fiddler, M.P. Garoutte, T.A. Herzog, A.B. Mahoney, M.D. Perry, C.M. Teague, M.T. van Opstal, G.H. Webster, **R.M. Whitnell**

9:05 290. Integration of scientific process skills and green chemistry into organic chemistry laboratory. **J.B. Easter**

9:25 Intermission.

9:40 291. Assessing the use of Process Oriented Guided Inquiry Learning in general chemistry lecture. **M. Grimminger**

10:00 292. Active learning strategies to prepare students for standardized exams. **A.L. Thomas**

10:20 Panel Discussion.

140-DeBartolo Lecture Hall

Supplemental Support Initiatives for Introductory Chemistry Student Success

A. L. Miller, *Organizer*
L. J. Anna, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 293. A new approach using study skill education, writing interventions, and deliberate practice as part of supplementary instruction improves course performance and affect in general chemistry. **C. Stanich**, M. Pelch, E. Theobald, S. Freeman

8:25 294. Helping students who dig themselves a hole on exam one. **J.R. Pribyl**, **M. Hadley**

8:45 295. Foundations in chemistry course at Siena College. **L.J. Tucker**, D.F. Moriarty, J.L. O'Donnell

9:05 296. Engaging undergraduates in a chemistry prep course by making the skill mastery more adaptive and the content more career-relevant. W. Zhang, **A. Alexander**, G. Mazzone, D. Meiser

9:25 Intermission.

9:40 297. Methods for incorporating inverted pedagogy, active and collaborative learning activities, and learner preference into chemistry lecture and laboratory courses. **S.M. Kennedy**

10:00 298. Introducing a recitation and flipped classroom approach to the general chemistry sequence at Roberts Wesleyan College, a small primarily undergraduate institution. **J.R. Taylor**

10:20 Discussion.

129-DeBartolo Lecture Hall

Technology Integration in Chemistry Education & Research (TICER): Electronic Lab Notebooks, E-texts, Digital Annotation, Scientific & Digital Literacy

Cosponsored by CHED
T. Gupta, *Organizer*
R. Belford, *Presiding*

8:00 Introductory Remarks.

8:05 299. Using OneNote for teaching: In the classroom and lab. **J.C. Rienstra-Kiracofe**, M. Van Duzor

8:25 300. Science around the world: Coupling an at-home lab kit with an electronic laboratory notebook. **J. Houck**

8:45 301. Cultivating digital literacy with mobile devices: Organizing, creating and evaluating information in undergraduate laboratories. **A.R. Van Dyke**

9:05 302. Optical structure recognition (OSR) as a means to grade student work in organic chemistry. **E.C. Bucholtz**, C. Stephens

9:25 Intermission.

9:40 303. Using Doceri as a means to effectively engage in a large lecture course. **S.R. Neal**

10:00 304. Interactive e-book introduces new ways to teach and learn general chemistry. **L.S. Van Der Sluys**, P. Maslak, M.J. Bojan

10:20 305. Use of hypothesis annotation service in digital eTextbooks like LibreText. **R.E. Belford**, D.S. Larsen

207-DeBartolo Lecture Hall

The Application of Non-Traditional Qualitative Frameworks in Chemistry Education Research

A. T. Kararo, C. Randles, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 306. Adaptation of a quantitative assessment rubric to qualitatively analyze students' reasoning: An approach for characterizing students' explanations of chemical phenomena. **C. Minter**, M. Cooper

8:25 307. Resolving the complexity of organic chemistry students' mechanistic reasoning through the lens of a framework derived from philosophy of science. **I. Caspari**, N. Graulich

8:45 308. Viewing undergraduate research experiences through the lenses of hermeneutics and conversation analysis. **S.L. Johnson**, G.M. Bodner

9:05 Discussion.

9:25 Intermission.

9:40 309. The ‘knot of contradictions’: Dialectical tensions that describe the varied experiences and shifting attitudes of students in relation to the lab curriculum. **S.G. Cessna**

10:00 310. Using social network analysis to describe and strengthen implementation of guided inquiry experiments in physical chemistry. **S.S. Hunnicutt**, A. Grushow, M.N. Muniz, R.M. Whitnell

10:20 Discussion.

10:40 Concluding Remarks.

214-DeBartolo Lecture Hall

The Effects & Research on Peer Leaders in Peer-Led Instructional Methods

A. Chase, *Organizer*
R. Gibbons, *Presiding*

8:00 Introductory Remarks.

8:05 311. Meeting persistent challenges: Peer Partnership Learning (PPL) in a first-year chemistry course. **C. Dummer**

8:25 312. Using learning assistants to enhance classroom instruction and improve student performance. **M.D. Perry**, N. Sanguantrakun

8:45 313. Implementing a unique peer supplemental instruction program at an access institution: Focus on gateway STEM courses and transferrable STEM skills. **B. Shepler**, C. Achat-Mendes, C.L. Anfuso, J. Awong-Taylor, C. Brown, J. Curry Savage, A. D'Costa, S. Dekhane, J. Hurst-Kennedy, C. Johnson, T. Leader, K. Pinzon, D.P. Pursell, C. Runck, R. Simmons, E. Sudduth, T. Mundie

9:05 314. Supplemental Instruction: What's your function? **D. Wren**

9:25 Intermission.

9:40 315. How do you scale that? Training undergraduates to support active learning across numerous large lecture hall classes. **S. Sparks**, C. LaBrake

10:00 316. Retrospectively assessing PLTL: A look back on ten more years of success with the workshop model. **N.B. Hammond**, R. Frye, K. Trenshaw, M.C. Barone, C. Xu, A. Park, V. Roth

10:20 Concluding Remarks.

316-DeBartolo Lecture Hall

Training Professional Teaching Assistants: GTA Pedagogical Courses & Boot Camps

J. Monahan, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 317. Student perceptions of GTAs in an inquiry-based general chemistry laboratory: An exploratory study of the impact of a teaching methods course. **H.G. Sturtevant**, L.B. Wheeler

8:25 318. Introducing teaching, research and professional skills through a revised graduate seminar course. **C. Reck**, M.R. Porter

8:45 319. Graduate teaching assistant training to facilitate effective undergraduate learning in chemistry. **G. Hurst**, R. Smith

9:05 320. TA teaching effectiveness for active learning: The impact of using active learning strategies in TA training. **K.J. Ho**

9:25 Intermission.

9:40 321. Training science graduate student TAs. **A. Paterno**

10:00 322. Developing graduate teaching assistants in a medium sized chemistry program: A two-pronged approach. **J. Monahan**, D. Sokic-Lazic, C.S. Bagwill

10:20 323. Training practices for GTAs as an introduction to the teaching profession with a focus on teaching and learning. **L. Funari**, M.J. Bojan

10:40 324. On-going Teaching Assistant (TA) training at Ohio State: Enhancing the professional development of all TAs though the leadership of Head TAs. **K.A. Moga**, T. Weaver, J.W. Uebler

205-DeBartolo Lecture Hall

Using Specifications Grading to Assess Learning Outcomes in Chemistry

H. J. Fletcher, *Organizer, Presiding*
E. Baldauff, *Presiding*

8:00 Introductory Remarks.

8:05 325. Implementing specifications grading in a medium sized (~60 students) general chemistry sequence classroom. **D. Stasko**, J.N. Woodford, M.W. Ducey, S.L. Hiley

8:25 326. Merging traditional content frameworks and the Anchoring Concepts Content Maps: Implications for programmatic assessment. **J.R. Raker**, K.L. Murphy, K.A. Marek, T.C. Pentecost, J.J. Reed, S. Srinivasan, J.M. Trate

8:45 327. Implementing specification grading in a second-semester flipped general chemistry course. **B.D. Gute**, J. Wainman

9:05 328. Implementing specifications grading in biochemistry. **H.J. Fletcher**

9:25 Concluding Remarks.

201-DeBartolo Lecture Hall

Views from the Classrooms of Award Winning Chemistry Teachers

D. Cullen, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 329. Being myself in the classroom. **L.E. Slocum**

8:25 330. Adjusting to being an adjunct: Is there life after retiring from high school teaching? **K.A. Kitzmann**

8:45 331. Visible teaching and learning. **S. O'Brien**

9:05 332. Advanced Placement chemistry demos. **G. Glugoski-Sharp**

9:25 Intermission.

9:40 333. Offer a chemistry-education research group--NOT a chemistry club. **M. Jansen**

10:00 334. Assessment for improved learning. **E. Posthuma-Adams**

10:20 335. What do I want my students to know? Going beyond chemistry content. **P.D. Price**

10:40 Concluding Remarks.

MONDAY AFTERNOON

136-DeBartolo Lecture Hall

Active Learning in Organic Chemistry: Assessment & Technology to Facilitate Active Learning

Financially supported by Chemistry Collaborations, Workshops and Communities of Scholars (cCWCS)
A. Leontyev, V. M. Maloney, C. Welder, *Organizers*
J. L. Muzyka, *Presiding*

2:00 Introductory Remarks.

2:05 336. OpenOChem to facilitate active learning. **J.L. Muzyka**, C. LeBlond, E.C. Bucholtz

2:25 337. Guided inquiry activity to build molecules and investigate isomerism. **A.K. Sharma**, R. DeCicco

2:45 338. Creating an active learning environment and providing formative assessment in "organic chemistry" large enrollment lecture courses using iPads with airserver. **M. Chatterjee**

3:05 339. Active learning, the expansion sets: Using immediate feedback multiple-choice quizzes and Box.com as learning tools in the organic chemistry classroom. **R. Jeske**

3:25 Intermission.

3:40 340. Mechanisms, the platform: Combining formative assessment and data analytics for organic chemistry. **J. Winter**

4:00 341. Mastery reaction games: Nuance and challenge! **B. Piehler**, S.A. Dandekar

4:20 342. Active learning in Organic Chemistry: Development of a Spartan molecular modeling activity on carboxylic acid derivatives. **S.M. Strickland**, M. Brock

4:40 343. Understanding the structures and stability of organic molecules using molecular modeling. **H.A. Zhong**

204-DeBartolo Lecture Hall

Chemical Education in the 2nd-3rd Grade Classroom

R. Allen, K. Morris, *Organizers*
L. Nyers, L. Sernyk, *Presiding*

2:00 Introductory Remarks.

2:05 344. You Be The Chemist programs. **L. Sernyk**

3:25 Intermission.

3:40 345. Making sense of classroom investigations through writing and talking. **L. Nyers**, S. Disch

205-DeBartolo Lecture Hall

Chemical Education in the 4th-6th Grade Classroom

R. Allen, K. Morris, *Organizers*
M. McGrail, T. Strieder, *Presiding*

2:00 Introductory Remarks.

2:05 346. Engaging urban youth in chemical engineering design through service learning. **T. Strieder**

3:25 Intermission.

3:40 347. Exploring matter in the 'Canister Conundrum': determining mass indirectly. **M. McGrail**

206-DeBartolo Lecture Hall

Chemical Education in the 7th-8th Grade Classroom

R. Allen, K. Morris, *Organizers*
J. J. Bellina, A. Harlacher, *Presiding*

2:00 Introductory Remarks.

2:05 348. Playing with fire: Energy misconceptions. **J.J. Bellina**

3:25 Intermission.

3:40 349. Use brain-based strategies to create routines which help all students learn. **A. Harlacher**

203-DeBartolo Lecture Hall

Chemical Education in the K-1st Grade Classroom

R. Allen, K. Morris, *Organizers*
S. Sparrow, D. Wirth, *Presiding*

2:00 Introductory Remarks.

2:05 350. Building a house: Properties of solids. **S. Sparrow**, **S. Hoover**

3:25 Intermission.

3:40 351. Primary chemistry in 3D. **D. Wirth**

208-DeBartolo Lecture Hall

Chemistry Education Research: Graduate Student Research Symposium

J. Harshman, C. Hensen, *Organizers*
K. J. Lazenby, *Presiding*

2:00 Introductory Remarks.

2:05 352. Investigation of student causal mechanistic explanations about nucleophilic substitution. **O.M. Crandell**, M. Cooper

2:25 353. Decorating with arrows part two: It's a mechanism not magic. **S. Houchlei**, O.M. Crandell, M. Cooper

2:45 354. What are students' learning gains and experiences when using the OrgChem101.com Organic Mechanisms module? **M. Carle**, R. Visser, A.B. Flynn

3:05 Intermission.

3:20 355. Investigation of bonding representation and quantum chemistry concepts through multiple levels of the curriculum. N. Schleper, **S.D. Wiediger**

3:40 356. Reasoning about chemical energy in biochemical contexts. **X. Chen**, V. Talanquer

4:00 357. Analysis of student interactions due to specific instructor facilitation interventions in Process Oriented Guided Inquiry Learning - Physical chemistry classroom. **D. Liyanage**, S.S. Hunnicutt

4:20 358. Faculty social networks and institutional change initiatives. **J.D. McAlpin**, S.E. Shadle, J.P. Ziker, B. Couch, M.N. Stains, L.B. Prevost, J. Skvoretz, J.E. Lewis

311-DeBartolo Lecture Hall

Collaborative & Cooperative Learning

J. Chamberlain, B. McCollum, *Organizers*
L. A. Morsch, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 359. International Network for Chemistry Language Development (INCLD) as a model for online collaborative learning in organic chemistry. **B. McCollum**, L.A. Morsch, M.T. Wentzel

2:25 360. Collaborative generation of videos for use in chemistry laboratories. **M.T. Gallardo-Williams**

2:45 361. The 80/20 group testing model for collaborative learning spaces: What we have learned about how students influence each other's thinking. **J.R. Pollard**, J. Tashiro

3:05 362. Evaluation of practices for Teaching Assistants in active learning classrooms. **J.K. Robinson**

138-DeBartolo Lecture Hall

Current Research on the Undergraduate Chemistry Laboratory

N. L. Burrows, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 363. Students perceptions in the organic chemistry teaching laboratory. **J.L. Grutsch**, G.M. Bodner

2:25 364. Development of a Science Laboratory Assessment Framework and its use in chemistry and interdisciplinary curriculum improvement. **J. Shorb**, S. Mattioli, K.Y. Neiles

2:45 365. Determining students' achievement of program outcomes in response to an open-inquiry laboratory course. **A. Harrison**, R.S. Cole

3:05 366. Learning in the tertiary level chemistry laboratory: What we have learnt from phenomenology research. **S. Sandi-Urena**

3:25 Intermission.

3:40 367. Extending general chemistry student success through a virtual laboratory program. J.T. Mason, **G.I. Gellene**

4:00 368. Incorporation of a project-based lab curriculum into a hybrid chemistry lab for non-science majors. **U. Swamy**, **J. Carmel**

4:20 369. Are the interactions, learning outcomes and student satisfaction the same in face-to-face and remote-access chemistry laboratories? **J. Wei**, M. Mocerino, D. Treagust, M. Zadnik, A. Lucey, E. Lindsay

4:40 370. Evaluating the outcomes of virtual acid-base experiments in general chemistry. **C. Hensen**, J. Barbera

310-DeBartolo Lecture Hall

Engaging Non-Science Majors in Chemistry through Current Scientific Topics

K. Hess, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 371. ***Withdrawn***.

2:25 372. Plants in medicine: An integrated lab-lecture project for non-science majors. **A. Neuman**, B. Harmon

2:45 373. Engaging non-science majors using their love of crime TV. **M.L. Pajski**

3:05 374. Forensic science and radioactive waste - using current science topics to pique student interest. **K. Endebrock**, K. Braley

3:25 Intermission.

3:40 375. Using chemistry as a medium for science education: Development and implementation of an online nonmajors course. **T.M. Pappenfus**

4:00 376. Introduction to the Chemistry of Materials for non-science majors. **J.E. Mihalick**

4:20 377. Engaging engineering majors in general chemistry through pragmatic examples. **C. Knutson**

4:40 378. Exploring the applications, environmental impact, and green chemistry of selected elements: A guided inquiry-based-discovery team project. **S. Kinyanjui**, S.A. Dandekar, C. Anguiano Virgen

213-DeBartolo Lecture Hall

Engaging Students in Physical Chemistry

D. E. Gardner, C. M. Teague, *Organizers*
J. Selco, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 379. Implementation of guided inquiry laboratory activities throughout the physical chemistry curriculum. **C.M. Teague**

2:25 380. Making gold nanoparticles green: A POGIL physical chemistry experiment. **M. Pacheco**, **R.E. Goacher**

2:45 381. Are the molecules that make a solution red big or small? A POGIL-PCL revision of the cyanine dye experiment. **S.S. Hunnicutt**, A. Grushow, M.N. Muniz, R.M. Whitnell

3:05 382. Infrared spectroscopy (FTIR) and POGIL are combined in physical chemistry laboratory modules. **S.A. Winget**

3:25 Intermission.

3:40 383. Student learning outcomes in POGIL-PCL environments: Initial results and future directions. **M.N. Muniz**, S.S. Hunnicutt, A. Grushow, R.M. Whitnell

4:00 384. "I wish I could take p-chem lab forever!" — inquiry laboratory experiences with a research flavor in physical chemistry. **M.C. Zwier**

4:20 385. Encouraging student experimental design: Fluorescence quenching of quinine. **D.E. Gardner**

4:40 1122. Embedding research and soft skills into a physical chemistry laboratory project to prepare students for life after graduation. **A. Bills**

131-DeBartolo Lecture Hall

Enhancing Student Learning & Retention in Introductory "Gatekeeping" Chemistry Courses: Best Teaching Practices & Alternative Assessment Methods

S. Kradtap Hartwell, *Organizer*
L. Ye, *Presiding*

2:00 Introductory Remarks.

2:05 386. Improving student achievement in introductory chemistry: Learner-centered assessment is needed. **L. Ye**, A. Gilewski

2:25 387. Learning Teams: Improving students' outcomes in general chemistry. **S.M. Black**

2:45 388. Evaluation of a peer-led team learning-blended classroom reform on student success in large organic chemistry courses. **J. Mutanyatta-Comar**, S.R. Mooring

3:05 389. Improving student thinking, STEM self-efficacy, and study habits through a guided-inquiry approach in general chemistry II. **K. Asala**

3:25 Intermission.

3:40 390. Using the best of the best: choosing a mix of teaching pedagogies that enhance student learning and motivation to increase the rate of successful completion in introductory courses. **D.A. Storer**

4:00 391. Up an incline! Best teaching practices and strategies in a general chemistry course leading to success with a diverse student audience. **B.L. Brabetz**, J.T. Sprague, N.A. Law

4:20 392. Improving student success in General Chemistry one-step at a time. **K. Casey**, L.J. Tracey, K. Miller, E. Gabbard

4:40 393. Lowering DFW rates in large introductory chemistry classes through implementation of remediation and retention techniques. **C. Beck**

207-DeBartolo Lecture Hall

Learning About Quantitative Research in Chemistry Education Research

Cosponsored by CHED
J. Harshman, *Organizer*
L. K. Kendhammer, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 394. Moving beyond alpha: Alternative sources of reliability evidence for quantitative chemistry education research. **R. Komperda**, T.C. Pentecost, J. Barbera

2:45 395. Getting started with eye tracking for chemistry education research. **J.R. Vandenplas**

3:25 Intermission.

3:40 396. Rasch Modeling and Item Response Theory in chemistry education research: The why and how. **T.C. Pentecost**

4:20 397. "There are __ types of people in this world": Providing the empirical evidence for groups of people through cluster analysis. **J. Harshman**

202-DeBartolo Lecture Hall

Metacognitive Strategies for Supporting Students in Learning Chemistry

B. Meacham, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 398. Swiss army survey: A post-examination multi-tool for metacognition, self-study assessments, peer-comparisons, and early-term evaluations. **H. Hopgood**

2:25 399. Teamwork and reflection techniques. **K. Drury**

2:45 400. Literacy? But I teach STEM! **S. O'Brien**

3:05 401. Exam wrappers in general chemistry: Research on dosage, delivery, and use. **E.D. Weiss**, L. Vuocolo, S. Gadgil

3:25 Intermission.

3:40 402. Developing metacognition in special education inclusion and standard level classes. **A.N. Serkin**

4:00 403. Strike a phase: Modeling in the high school chemistry classroom using virtual and "old school" tools. **R. Johnson**

4:20 404. Sneaking in metacognition: A just in time workshop model. **K.A. Trick**

4:40 405. Using metacognitive skill reports generated by the LearnSmart active-reading platform as an intervention for underperforming general, organic, and biochemistry (GOB) students. **J.B. Owen**

210-DeBartolo Lecture Hall

Mom the Chemistry Professor: Personal Accounts & Advice from Chemistry Professors who are Mothers

Cosponsored by WCC
K. A. Woznack, *Organizer*
R. S. Cole, G. H. Webster, *Presiding*

2:00 Introductory Remarks.

2:05 406. Moving from industry to academia while mothering. **S.M. Dimick Gray**

2:25 407. Single parenthood and academia: Managing the dilemmas, crushing the stigmas, and embracing the enigma. **M. Kelley**

2:45 Panel Discussion.

215-DeBartolo Lecture Hall

More Bang for Your Buck: (More) Effective Active Learning Methods in General Chemistry

M. Blaser, *Organizer, Presiding*
T. Shelton, *Presiding*

2:00 Introductory Remarks.

2:05 408. The G-I-G Model for incorporating active learning in general chemistry. **C.T. Cox**

2:25 409. Three-pronged approach to active learning: Lecture breakout sessions, textbook, and recitation. **M. Queen**

2:45 410. Two-stage exams and "two-stage" polling questions: Effects of peer feedback on student learning. **T. Shelton**

3:05 411. Chemistry demonstrations: An active-learning tool for enhancing students' conceptual understanding. **D. Wiegand**, T. Francis, M. Mack

3:25 Intermission.

3:40 412. Use of PhET simulations for more effective active learning activities. **S. Dunham**, S.U. Dunham

4:00 413. General chemistry: Lab practical - identifying an ionic compound. **W.M. Daniel**, X. da Silva Tavares, J. McGarrah, D.R. Rosenthal

4:20 414. General chemistry pedagogy to engineering students via polymer structure-property relationships. **C.L. Aronson**, L.D. Bienski

216-DeBartolo Lecture Hall

Promoting Teaching & Learning Chemistry through Engaging Case Studies

L. Wang, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 415. Using case studies in General, Organic, and Biological (GOB) laboratory to increase applicability. **M. Grimminger**, E.T. Bell-Loncella

2:25 416. Using a real world medical case as a capstone project for an introductory chemistry course consisting of predominantly pre-health majors. **W.D. Urban**

2:45 417. Useful resources for developing chemistry case studies. **J.E. Mihalick**

3:05 418. Promoting teaching and learning through engaging case studies. **L. Wang**, W. Patterson, D. Rubenstein, I. Peng, I. Lovelace

3:25 Intermission.

3:40 419. Making the learning of acid-base concepts more relevant: A research study. **M. Hugerat**, S. Hugerat, R.F. Abu-Much

4:00 420. Using the scientific method as a template for learning from case studies. **G. Reck**, C. Reck

4:20 Roundtable Discussion.

126-DeBartolo Lecture Hall

Research in Chemistry Education

T. J. Bussey, *Organizer*
R. Sansom, *Presiding*

2:00 Introductory Remarks.

2:05 421. Longitudinal and cross-disciplinary performance of instruments for measuring student attitude, self-concept, and metacognition. **C.F. Bauer**

2:25 422. Exploring chemistry conceptual understanding and curricular beliefs of college students conducting chemistry outreach. **J.M. Pratt**, E.J. Yezierski

2:45 423. Students' attitude towards chemistry in higher education in Singapore. **L. Sellou**, K. Chua

3:05 424. On the measurement and modeling of achievement gaps in chemistry education: A fifteen-year retrospective analysis. **M. Mack**, R. Harris, S. Freeman, E. Theobald, J. Bryant

3:25 Intermission.

3:40 425. Development of self-explaining skills at college level: Longitudinal study via latent transition analysis. **A. Villalta-Cerdas**

4:00 426. Analysis of an atoms first pilot at the United States Naval Academy. **D.K. Dillner**, O. Bair, M.J. Schroeder, M.A. Teichert, T.S. Thomas

4:20 427. Characterization of conceptualization and use of Lewis structures by novices and experts. **G. Loria**, **D. Jinesta**, S. Sandi-Urena

4:40 428. Learning to learn: Fostering student success in general chemistry. **C.J. Luxford**

140-DeBartolo Lecture Hall

Supplemental Support Initiatives for Introductory Chemistry Student Success

L. J. Anna, *Organizer*
A. L. Miller, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 429. Measuring the expectations of new chemistry students. **D.P. Williams**

2:25 430. Supplemental instruction: How beneficial is it? **S. Hutchison**

2:45 431. Supplemental peer Instruction in a time of change. **J.N. Orvis**

3:05 432. Revising an introductory chemistry Peer-Assisted Study Session program to increase student participation. **S. Clark**

3:25 Concluding Remarks.

129-DeBartolo Lecture Hall

Technology Integration in Chemistry Education & Research (TICER): Use of Molecular Models & Modeling, Augmented Reality & Structure Recognition

Cosponsored by CHED
T. Gupta, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 433. Taking molecular modeling beyond the ball and stick. **D. Beautreau**

2:25 434. Augmented reality chemistry: Transforming 2-D molecular representations into interactive 3-D structures. **D. Behmke**, D. Kerven, R. Lutz, J.E. Barker Paredes, R. Pennington, E. Brannock, J. Bailey, M. Deiters, K. Stevens, R. Westervelt, M. White

2:45 435. Investigating the effect of augmented reality applications in an elementary science methods class. **M. Shapiro**, L. Annetta

3:05 436. Teaching chemistry with a pen-enabled computer successfully increases student engagement and active learning in the classroom and beyond. **S.L. Porello**

3:25 Intermission.

3:40 437. Flipping the classroom using Lightboard technology: The technological story. **A.M. Azman**

4:00 438. Revolutionizing undergraduate labs with benchtop NMR: An active learning approach. **M.T. Zamora**, S. Riegel, J. Araneda

4:20 439. Spartan ligand creation: A new molecular modeling activity. **G.L. Powell**

214-DeBartolo Lecture Hall

The Effects & Research on Peer Leaders in Peer-Led Instructional Methods

A. Chase, *Organizer*
P. Varma-Nelson, *Presiding*

2:00 Introductory Remarks.

2:05 440. Investigating the attitudinal and metacognitive effects on peer leaders in the Teaching Internship Program. **E.L. Atieh**, D.M. York

2:25 441. PLTL workbooks support innovation in STEM learning. **J.E. Becvar**, G.B. Saupe, A. Dreyfuss

2:45 442. Benefits from participation in a Writing-to-Learn program on undergraduate Writing Fellows. **J.A. Schmidt-McCormack**, G.V. Shultz, A. Gere

3:05 443. Development of a Peer-Led Undergraduate Research Initiative (PLURI) module in organic chemistry teaching laboratory. **S. Laulhe**, R.E. Minto, A. Chase

3:25 Intermission.

3:40 444. Audiovisual investigation into the content knowledge of organic chemistry peer-led study group facilitators. **J.R. Boothe**, R. Barnard, L.J. Peterson, B.P. Coppola

4:00 445. Peer leaders' beliefs about learning: An exploratory study. **A. Clark**, J.R. Raker

4:20 446. The long-term professional effects of being a peer leader in a peer-led team learning course: A mixed-methods exploratory study. **A. Chase**, A.S. Rao, P. Lakmala, W. Wright, G. Kline, **P. Varma-Nelson**

4:40 Panel Discussion.

217-DeBartolo Lecture Hall

To Green or Not to Green? Approaches for Including Green Chemistry in a Traditional Academic Setting: Teaching, Research & Service

A. S. Cannon, G. Hurst, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 447. Green chemistry snowball effect: How sharing green chemistry advanced my career. **J.E. Wissinger**

2:25 448. Using green chemistry and sustainability to create synergy in your teaching, research, and service. **L. Bastin**

2:45 449. An unexpected journey. **D.G. Kovacs**

3:05 450. Early career perspective on implementing green chemistry in a traditional academic setting. **N.J. O'Neil**

3:25 Intermission.

3:40 451. Two decades of green chemistry at Millikin University. **G.D. Bennett**

4:00 452. How Wolverines went green: From research to curriculum to a green B.S. program. **N.B. Kingsley**, J.L. Tischler

4:20 453. Incorporating Green Chemistry into organic chemistry laboratory curriculum: Strategies, challenges and successes. **I.B. Nejad**

4:40 454. The green formula for international green chemistry education at the high school, university and professional levels. **G. Hurst**, A. Matharu, L. Summerton, C. Beauvais, J. Clark

316-DeBartolo Lecture Hall

Training Professional Teaching Assistants: TA Evaluation, Mentoring, & Engagement

J. Monahan, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 455. Understanding GTA teaching practices and learning environment: Case studies of GTA teaching practice. **L. Schroeder**

2:25 456. Creating the perfect mixture: Enhancing the professional teaching identity of chemistry GTAs. **C. Barnes**, T. Francis, P. Hillesheim, F. McGaskey, S.R. Neal

2:45 457. Transforming laboratory teaching assistants as teaching leaders. **A. Flaherty**, T. Overton

3:05 458. How to grow a garden from a single seed: Empowering and centralizing laboratory based graduate teaching assistants via a structured doctoral training program. **B. Ryan**

3:25 Intermission.

3:40 459. Reformed training for a reformed laboratory: Early adventures in preparing and supporting TAs in a project-based general chemistry course. **E.M. Duffy**, M. Cooper

4:00 460. Engaging graduate students in curriculum expansion. **S. Mang**

4:20 461. Professional training in grading for laboratory teaching assistants: Analysis using a growth model study. **G. Ramasubramanian**, T.J. Greenbowe, D.B. Exton

4:40 462. How to use an experiential learning course to develop undergraduates to assist in the large lecture classroom. **K.R. Woodrum**, A.S. Soult

201-DeBartolo Lecture Hall

Using Manipulatives in a Chemistry Classroom

A. Putti, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 463. Manipulating ions to comprehend limiting reactant problems. **D.R. Rosenthal**

2:25 464. My acid can beat up your acid: A particulate level activity on acid dissociation. **A. Putti**

2:45 465. Demonstrating a simple model of a mass spectrometer in the high school or college classroom. **C. Husting**

3:05 466. Using particulate manipulatives for conceptual understanding of equilibrium ICE tables. **J. Benigna**

3:25 Intermission.

3:40 467. Modeling electrochemical cells. **L. Cummings**, D. Cullen

4:00 468. You don't always need a model kit: Everyday materials in the chemistry classroom. **C. Morgan**

4:20 469. Manipulatives as a catalyst for learning. **L.R. Marek**

MONDAY EVENING

Duncan Hall, Rasmus Balcony

BCCE 2018 Poster Session

K. L. Haas, *Organizer*

5:30 - 8:30

470. Biennial Conference on Chemical Education: A place to share information about the teaching and learning of chemistry. **J.M. Sophos**, J. Carmel, R.S. Cole, S.J. Donnelly, I.J. Levy, S.R. Mooring, M. Orgill, A. Putti, C. Sorensen-Unruh, D.G. Sykes, V.M. Williamson

471. The Committee on Computers in Chemical Education: 25 years of ConfChem online conferences. **X. Prat-Resina**, R.E. Belford, J.L. Muzyka, T. Gupta, J. Telford

472. InChI Open Education Resource. R.E. Belford, **E.C. Bucholtz**, A.P. Cornell, J. Cuadros, V.F. Scalfani, M.A. Walker

473. Training students in spatial reasoning using physical and virtual models. **C.J. Conway**

474. Role of design elements versus content elements in technology development projects. **J. An**, T. Holme

475. Using molecular visualization and computational docking to understand the interactions between neuraminidase and oseltamivir and how mutations can decrease the overall effectiveness of treatment. **T.C. Grattan**

476. Peer-produced bite-sized chemistry learning & teaching activities using web-based worldwide research resources. **P. Hoare**

477. Bringing Reaxys into the classroom. **R.E. Belford**, E.C. Bucholtz, T. Gupta, D.D. Ridley, M.A. Fosu, T. Géoui, N.D. Katz

478. Uping your game: Improving instructor created videos with illustrations and animations. S.E. McVicar, **M.A. Erdmann**

479. Effects of using chairs! Mobile app on students' learning of the ring flip of cyclohexane. **M.G. Carranza**

480. Use of QR codes to assist pencil-paper problem solving in organic chemistry. **R. Biggs**, H. Ramji

481. What can undergraduate students learn from a biochemistry animation? **K. Wee**, R. Tasker, G.M. Bodner

482. Collaborating with Undergraduates to Contribute Pedagogical CoRe's. **K.L. Haas**

483. Writing about ethics: Lessons from the integration of ethics writing assignments into chemistry courses. **K.L. Haas**, K. Eggleson, R.W. Foley, A. Sunda-Meya

484. Teaching science writing and communication: A cross-disciplinary course collaboration. **T.A. French**, S. Read

485. Online video lectures as a learning tool in undergraduate chemistry courses. **P. Mosley**, D.A. Canelas

486. Understanding students' perceptions of their science identity in an undergraduate chemistry course. **P. Mosley**, L.A. Posey

487. Working to improve retention and graduation rates for underprepared freshmen. **L.M. Liable-Sands**, A.E. Martin

488. Study of the relationship between students' identities and their ideas of who contributes to chemistry. **J. Mora**, S.E. Nielsen

489. Effect of stereotype threat and cognitive dissonance on students' attitudes towards chemistry. **T. Merrill**, S.E. Nielsen

490. Grit and pathways of the undergraduate STEM student. **A. Overstreet**, S. Knottenbelt

491. Characterizing undergraduates' attempts to transfer energy ideas from physics to chemistry. A. Harding, **E.J. Borda**, S. Fowler

492. Student success in non-major chemistry versus performance in mathematics prerequisite courses. **J.T. Brockman**, Z. Wang, Y. Zhang, J. Chin

493. Examining how preservice elementary teacher's views of science influence their science teacher identity constructions. **J.E. Nardo**, M. Ryu

494. Use of analogies in the teaching of some difficult concepts in chemistry in Nigeria Technical Colleges. **A.M. Akinsete**

495. Assessing campus climate for innovative STEM teaching: Beliefs and behaviors. **A.L. Wrenne**, R.S. Cole, J. Russell, W. Jacobson, J. Florman, S. Van Horne

496. Peer-led undergraduate research initiative (PLURI) in organic chemistry: Initial findings and future directions. **A. Kelley**, **J. Matthews**, J. Floreancig, K. Singh, B. Walbridge, R.E. Minto, A. Chase, S. Laulhe

497. A case for ad-hoc peer-instruction programs in chemistry courses. **D. Ramella**, M.K. Velopolcek, K.P. Winters

498. Transferrable skills gained from experience as a peer-leader in a PLTL program: Development of a quantitative instrument from qualitative data. **W. Wright**, G. Kline, A. Chase, P. Varma-Nelson

499. Active learning in large lecture classrooms: Integrating technology, media and taxonomy from theory to practice on a large scale. **J. Maynard**

500. Just-in-time teaching to engage general, organic, and biochemistry students. **M. Lenczewski**

501. Exploring the essence of success in collaborative learning using phenomenology. **C. Pinder**, **E. Campbell**, **S. Falcione**, L.A. Morsch, B. McCollum, J. Chamberlain, K. Davis, M. Macias

502. Emergence of different perspectives of success in collaborative learning. **S. Falcione**, **E. Campbell**, **C. Pinder**, M. Macias, K. Davis, B. McCollum, L.A. Morsch, J. Chamberlain

503. Evaluation of student perceptions of a flipped second semester general chemistry course. **E. Roth**, G.M. Bodner, R. Tasker

504. Students' perceptions of and engagement in the flipped learning environment: A multi-institution focus group and survey-based study. **N. Naibert**, C. Hensen, E. Geye, R. Komperda, J. Barbera, M.M. Phillips

505. Successes and failures of the flipped classroom approach. **D.V. Perera**

506. POGIL approach to teaching wave-particle duality in undergraduate physical chemistry courses. **C. Johnson**, T.A. Madison, J. Simon, S. Garrett-Roe

507. Inter-classroom cross-talk and collaboration: Infographics and peer review with a graduate organometallics course and a first-year chemistry seminar. J.R. Robinson, **K. Hess**

508. Learning chemistry through art analysis. **H. Jayathilake**

509. When chemistry and art collide-- student designed organic chemistry infographics. J.A. Nikles, **S.E. McVicar**

510. ***Withdrawn***.

511. Course based undergraduate research experiences in biochemistry. **G.B. Ray**, V. Mariani

512. Qualitative analysis of student open-ended responses to a CURE experience in analytical chemistry. **K. Klay**, J.H. Tomasik, D.J. Lecaptain, K.A. Cissell

513. Organic chemistry II– biochemistry I research module: Synthesis and analysis of thiophene derivatives as potential inhibitors of *Mycobacterium tuberculosis* antigen 85C. **T.J. Sucheck**, G. Longstreet, A. Young

514. Enabling and disabling factors in conducting a year-long group research project with Health Science majors. **N. Rajan**, C. Chen

515. Development of a new research-based general chemistry laboratory. **E.J. Myers**, X. Wang, Y. Liu

516. ***Withdrawn***.

517. Survey on undergraduate students' goals and achievement strategies for laboratory work. **S. Santos-Diaz**, S. Hensiek, T. Owings, M.H. Towns

518. Introduction of infrared spectroscopy to health care students in organic chemistry: three component analysis of ointment bases by FTIR. M.J. Maresch, **K. Elliott**, **J. Whitling Dumm**, B. May

519. Synthesis of the natural product anethole from anisole: A multistep synthesis experiment for the undergraduate organic chemistry laboratory. **B.L. Kedrowski**

520. Investigating steric effects in S_N2 substitution reactions: Reactions of acetaminophen with alkyl halides. **B.A. Hathaway**, D.J. Ball, M.K. McAllister

521. Simple improvements on two elimination experiments in organic chemistry. **B.A. Hathaway**

522. ***Withdrawn***.

523. A new visual test for ethanol composition. **C.A. Liberko**

524. Identification of highlighter dyes using 3D fluorescence spectroscopy. **D.M. Miller**, J. Hoffner

525. Anodization of aluminum: An exploration of the physical and chemical properties of aluminum. **G. Harakas**

526. Design of cooperative, project-based laboratory experiences to promote understanding of stoichiometry in college-level general chemistry courses. **I. Almaguer**, **A. Bui**, W. Fernandez, A. Villalta-Cerdas

527. Introducing electrochemistry with simple, fast, and user-friendly bipolar electrochemistry experiments. S.M. Rapp, B.M. Branham, **K.N. Knust**

528. Integrated emission and absorption spectroscopy experiment for general chemistry. **P.S. Szalay**, L.A. Zook-Gerdau, D.V. Perera, S. Barrett

529. Peer-enhanced experiential research in the general chemistry laboratory. **S. Brown**, K. Nicholson

530. Using molecular modeling to investigate protein-ligand binding and drug discovery. A guided and open inquiry general chemistry experiment. **T.A. Madison**, B. Murray, E.P. Wagner

531. An in-house laboratory manual for the undergraduate biochemistry laboratory: Time and cost-savings and fundraising initiative. **J.W. Dumm**

532. Developing research skills in honors general chemistry through a guided and open inquiry experiment on nanoparticles. **T.A. Patil**, B. Ryoo, K.C. Gronborg, T.A. Madison, E.P. Wagner

533. Using particle in a box theory and experiments to enhance critical thinking and open inquiry in the general chemistry laboratory curriculum. **A. Larimer-Picciani**, E.P. Wagner

534. Lead contamination of eggshells and contents. **R.C. Dudek**

535. Development and implementation of a one-year, research-based general chemistry laboratory curriculum. **A. Ayebaze**, **K. Davis**

536. Revising the chemistry curriculum in response to MCAT2015 with a fluorescence experiment. **L. Huma**, D.J. Wink

537. Adapting an enzyme kinetics laboratory for a non-majors course. **J. Frey**, J. Callus, J. Meyer, C. Harwood, M.H. Towns

538. Thermodynamics of an electrochemical reaction using instructional grade amplifiers and A-to-D converters as an experimental design exercise in physical chemistry laboratory. **J.H. Gutow**

539. Using thermo-solvatochromism to measure the impact of temperature on solvent stabilization. **B. Findley**, A. Boucher

540. Studies in SPIRAL: Case studies in development and testing of POGIL laboratory experiments. **M.T. van Opstal**, T.A. Herzog, R.M. Whitnell, G.H. Webster, M.P. Garoutte, S. Fiddler, M.D. Perry, E.C. Bucholtz, C.M. Teague, A.B. Mahoney

541. Developing an inexpensive ultra-high purity water system for instructional purposes. **D.F. Fraley**

542. Development of an inexpensive Raman spectrophotometer. D.J. Bogen, **M.V. Wilson**

543. Forensic analysis of gunshot residue by gas chromatography-mass spectrometry. **K. Vanfossen**, L.H. Mielke

544. Development of a forensic science laboratory sequence with emphasis on instrumental analysis. **L. Grochowski**, J.D. Powell

545. A first-semester general-chemistry laboratory practical that incorporates techniques, calculations and illustrations. **M.A. Erdmann**, W.T. Higgins

546. "Spark" your natural interest in air pollution. A guided and open inquiry general chemistry experiment. **B. Murray**, T.A. Madison, E.P. Wagner

547. Measuring undergraduate students' beliefs and intentions towards environmental issues as predictors of their environmental responsible practices. **T.E. Owoyemi**, A.O. Bailey

548. Effect of green chemistry activities in fostering understanding of Carbon (IV) oxide production and students' motivation towards learning of secondary school chemistry. **T.E. Owoyemi**, **U.C. Nwaorgu**, **F.I. Umanah**

549. Statistical analysis of environmental sampling methods. **L.A. Zook-Gerdau**

550. Green laboratory experiment showing the difference between ionic and molecular compounds. **J.P. Lanorio**

551. From a renewable energy workshop to a first year seminar class. **R. Ahmed-Schofield**

552. ACS Committee on Community Activities (CCA): Resources for outreach and civic engagement. **M.B. McGinnis**

553. The impact of septic systems on Long Island's aquifer water quality: Interdisciplinary study. **S. Sambasivan**, C.J. Foley, A.N. Migues, N. Leonhardt, M. Altizer Evans, N. Nieman, E. Merenda, P. Maritato

554. Anthocyanin dye-sensitized nanocrystalline energy lab/inquiry-based learning experiences. **P. Cleaver**, H. Huang, S.K. Lunsford

555. Illicit drugs curriculum at United States Coast Guard Academy. **J.D. Brown**

556. Michaelis & Menten revisited: Refining a student enzyme video project in biochemistry. **R.D. Reif**

557. Sophomore-level foundational biochemistry lecture and lab course for chemistry, biochemistry, and biology majors. **S.J. Siegel**

558. Promoting scientific thinking in a first semester majors general chemistry course. **A. Curtis**, A. Hunter, A.E. Palmer

559. Teaching kinetics through differential equation constructed Berkeley Madonna^{TM} flow chart model. **F.M. Chen**

560. Activities for teaching names and formulas of simple ionic compounds. **H. Ostrander**, **L.K. Lee**

561. Learning by teaching. **H.N. Currie**

562. Design and implementation of three-dimensional performance tasks relating molecular structure and properties in a first semester general chemistry course. **J.A. Conrad**, J. Darr, D.L. Richter-Egger

563. Impact of faculty-led workshops on student performance in general chemistry. **K.E. Anderson**, W.E. Brenzovich, J.R. Ingle

564. Implementation of ALEKS, a responsive-adaptive learning system, in freshman chemistry. **M. Mahalingam**, E. Fasella

565. "ChemisTri-naming Puzzle" as a didactic game for chemical nomenclature in general chemistry. **P. Ramirez**, A. Ponce, J. Ayala, J.E. Becvar, G.B. Saupe, W. Lee

566. Research to practice: General chemistry testing feedback. **J.L. Schneider**, D.S. Rose, M.A. Teichert, K.L. Murphy, P. Kendeou, S. Srinivasan, A. Chatterjee

567. Using formative assessments to investigate long-term retention of important knowledge and compare it to short-term mastery. **P.K. Hammen**

568. Adaptation of an intermolecular forces laboratory for a non-majors general chemistry course. **J. Callus**, J. Frey, J. Meyer, C. Harwood, M.H. Towns

569. But do they read? Strategies for encouraging student engagement with the textbook in General Chemistry. **J.R. Ingle**

570. Investigating students' deep-learning strategies, their perception of classroom teaching and their relationship to student success in general chemistry. **A.A. Solis**, C. Luong, A. Ishikawa, S. Villafane-Garcia

571. Can affect compensate for cognitive? Exploring prior knowledge as a mediating variable linking self-efficacy and performance in general chemistry. **G. Hunter**, S. Pazicni

572. Adoption of engaging instructional practices in undergraduate STEM course: A literature review of results from observational and survey-based studies. **A.J. Dood**, **A. Clark**, **C. Zumalt**, R. Gibbons, S. Srinivasan, J.R. Raker

573. Addressing the call for high-quality lessons: Evaluating PhET-published chemistry activities. **C.J. Loeffler**, J.M. Pratt, A.G. Schafer, E.J. Yezierski

574. Using metacognitive strategies to improve student learning outcomes in introductory and advanced-level chemistry courses. **E.M. McCorquodale**, H.B. Miller, M.C. Srougi

575. An investigation in the awareness of desirable difficulties in undergraduate chemistry courses. **E. Uhl**, T.C. Pentecost

576. Measuring student planning as a way of understanding their strategies with multiple representations. **J.D. Polifka**, T. Holme

577. Applying the AVID curriculum to general chemistry topics. **M. Nydegger**

578. Assessing students' difficulties with statistics and measurements in analytical chemistry. **A. Nguyen**, A. Tran, S. Villafane-Garcia

579. Principles of semiotics applied to the analysis of use and interpretation of Lewis structures by chemistry majors. **D. Jinesta**, **G. Loria**, S. Sandi-Urena

580. Using the emergent models heuristic to describe and support a preliminary local instructional theory for the guided reinvention of the classification of chemically important point groups. **A. Bergman**, T.A. French

581. The Effects of productive struggle with inquiry focus on student engagement. A. Blecking, **C. Blaser**

582. Student Understanding in acid-base chemistry concepts. **N.A. Kilpatrick**, S.R. Mooring

583. Reasoning used by general and organic chemistry students to categorize a compound as an acid or a base. **S.A. Wood**, M. Orgill

584. PRECHI - It's not just for the choir anymore! **S. Martinus**

585. Student understanding of electrophilic aromatic substitution. **A. Hjerstedt**

586. Crowdsourcing curly arrows: Can technology enabled classes enable students in a foundation organic chemistry module? **B. Ryan**

587. Studying abroad without leaving your own campus in the International Network for Chemistry Language Development: INCLD. **B. Ekwonwa**, **I. Ripley**, **A. Roberts**, B. McCollum, L.A. Morsch, M.T. Wentzel

588. The influence of attitude in sophomore organic chemistry. **E.L. Whitteck**, M. Hopfinger, E. TeSelle

589. Bridging organic chemistry spatial abilities through a hands-on, in-class activity. **J.R. Prado**

590. Chemistry in context: Stories as a sandbox for first semester organic chemistry concepts. **J.C. Axelson**

591. What is an organic substance? **L.J. Silverberg**

592. Moving past rote assignment of functional groups: Teaching concepts of infrared spectroscopy using a physical model. **L.C. Wright**, M. Oliver-Hoyo

593. Enantiomeric excess game: Understanding enantiomeric access through coins counting analogy. **N. Sanguantrakun**, M.D. Perry, B. Barth

594. How organic chemists' understandings of resonance progress over time: A pilot study. **S. Barakat**

595. Interdisciplinary approach to chemistry demonstrations. **A.B. Ormond**, F. Barker

596. Transforming the year 1 chemistry learning experience. **S. Fergus**, S.B. Kirton

597. Leadership experience in undergraduate chemistry. **H.C. Maire-Afeli**

598. Recognition of chemistry contents that promote entrepreneurial skills in Nigeria Technical Colleges: A way of improving students' learning of chemistry. **K. Oloruntegbe**, A.M. Akinsete

599. Engaging partners in the design of professional development in STEM education. J. Adams, R. Boniak, **C. Patel**

600. Implementing active learning in a high-need urban middle school – An example of an effective embedded professional development model for science teachers. **S. Alam**, A. Blecking

601. Homegrown, collaborative, faculty-led professional development. **T.J. Lund**, S. Anthony, A. Bettencourt-McCarthy

602. Weekly activity to improve consistency in TA lab report grading. **P. Lotshaw**, G. Ramasubramanian, T.J. Greenbowe, D.B. Exton

603. Exploring how graduate teaching assistants' negotiate their identities-in-practice within general chemistry labs. **M.M. Wu**, **J.E. Nardo**, M. Ryu

604. Teaching assistants' perceptions and use of external representations when teaching acid-base titrations in introductory chemistry laboratory courses. **N. Millick**, M. Orgill

605. Introduction of undergraduate preceptors in the organic teaching labs at the University of Arizona. **B. Anglin**, V. Sousa

606. Using argument-driven inquiry to prepare freshman students for research. **S.P. Yang**, K.J. Ho

TUESDAY MORNING

136-DeBartolo Lecture Hall

Active Learning in Organic Chemistry: Research on Active Learning

Financially supported by Chemistry Collaborations, Workshops and Communities of Scholars (cCWCS)
A. Leontyev, C. Welder, *Organizers*
V. M. Maloney, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 607. Effect of the Active Learning in Organic Chemistry workshops on teaching practice. **G.J. Bachinski**, S. White, J. Houseknecht

8:25 608. Evaluating the effectiveness of a combined POGIL/flipped classroom model of instruction in organic chemistry. **M.P. Dematteo**, M.L. Greer

8:45 609. From flipping one-third to two-thirds of the organic chemistry course – is more flipping better? **J.C. Shattuck**

9:05 610. Effect of partial flipped classroom approaches on student learning in organic chemistry. **M.D. Casselman**, J.F. Eichler, I. Marcus

9:25 Intermission.

9:40 611. Effects of flipping and traditional classroom on performance of students in Carbon Compound I (ISE 301) course. **K. Oloruntegbe**

10:00 612. Organic reaction mechanisms concept inventory. **S. Nedungadi**, R.M. Hyslop, C.E. Brown, M.D. Mosher

10:20 613. Constructivism and personal epistemology development in organic chemistry students. **D.A. Canelas**, M.M. Barger, A.C. Perez, L.L. Linnenbrink-Garcia

10:40 614. Investigating two-stage exams in organic chemistry. **J. Wickenden**, J.J. Stewart

216-DeBartolo Lecture Hall

A Day in the Life of My Classroom

A. F. Johnson, O. Odeleye, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 615. Adventures of a first-year teaching-emphasis educator. **O. Odeleye**

8:25 616. A day in my chemistry classroom at an urban community college. **A.R. Babij**

8:45 617. Combining lecture, flipping, and assigned readings to promote student engagement in a quantum mechanics course. **D.M. Miller**

9:05 618. A day in the life of my classroom - over 30 years in the making. **L.D. Montes**

9:25 Intermission.

9:40 619. Developing an active learning teaching philosophy: Baptism by fire. **A.L. Thomas**

10:00 620. Eliciting student participation daily in general chemistry. **A.E. Fischer**

10:20 621. ***Withdrawn***.

10:40 622. Reflections on journey to effective teaching practices in introductory chemistry classrooms. **J.R. Oh**

203-DeBartolo Lecture Hall

Aligning Assessment Practices with Inquiry Learning

A. G. Schafer, E. J. Yezierski, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 623. Using assessment items to enhance particulate-level conceptions of atomic mass and relative abundance using the isotopes of "Candium" activity. M. Treon, **A.G. Schafer**, E.J. Yezierski

8:25 624. Assessment development and analysis for a chemical reaction inquiry activity. **K.R. Jones**, E.J. Yezierski, A.G. Schafer

8:45 625. Developing assessments to evaluate oxidation-reduction reaction learning outcomes. **B.J. Becker**, E.J. Yezierski, A.G. Schafer

9:05 1133. Developing assessments for a lesson addressing relative mass and Avogadro's Law. **S. Kimberlin**, E.J. Yezierski, A.G. Schafer

205-DeBartolo Lecture Hall

Chemistry & Community Outreach: Ideas & Events: Safety, Outcomes & Programs

P. M. Morgan, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 627. Keep your outreach safe. **M.R. Wilhelm**

8:25 628. Chemistry demonstration outreach: Practical tips and target audience. **A. Miller**

8:45 629. Student learning gains from participation in community outreach events. **P.M. Morgan**

9:05 630. Supporting science learning at Nathaniel Rochester Community School, a high needs elementary school in Rochester, NY. **J.R. Taylor**

9:25 Intermission.

9:40 631. Science concepts illustrated: The SCI Squad. **M.L. Miller**, L. Browning

10:00 632. Chemistry for girls: Three years in the making. **S.M. Taylor**

10:20 633. Becoming advocates for science: Development and growth of a local university outreach program. **M.D. Garrett**

10:40 Panel Discussion.

208-DeBartolo Lecture Hall

Chemistry Education Research: Graduate Student Research Symposium

J. Harshman, C. Hensen, *Organizers*
Y. Liu, S. C. Ryan, *Presiding*

8:00 Introductory Remarks.

8:05 634. Creating science and chemistry identity measures for use in the college classroom. **K. Hosbein**, J. Barbera

8:25 635. Professors' perspectives on metacognition development in their classrooms. **A.N. Heidbrink**, M. Weinrich

8:45 636. Faculty conceptions of teaching while participating in a student-teacher-scientist-partnership model for engaging with the NGSS science and engineering practices. **J.L. Spencer**, L. Bricker, C. Dershimer, G.V. Shultz

9:05 637. Comparing different approaches to the implementation of a new chemistry curriculum. **Y. Hou**, V. Talanquer

9:25 Intermission.

9:40 638. Teaching assistants topic-specific pedagogical content knowledge in ^{1}H NMR spectroscopy. **M. Connor**, G.V. Shultz

10:00 639. Comparison of student and faculty responses to electrophilic aromatic substitution reaction problems. **A. Hjerstedt**

10:20 640. Identifying the knowledge and skills that chemists require in workplace. **Q. Cui**, J. Harshman

10:40 641. Using expert data to understand the thermodynamics and kinetics of protein folding in biochemistry: Implications for instruction. **K.A. Jeffery**, N.J. Pelaez, T.R. Anderson

214-DeBartolo Lecture Hall

Communication in Chemistry: Engaging Students with Oral Communication in Lecture & Laboratory Classes

G. Crawford, *Organizer*
K. D. Kloepper, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 642. Linking oral communication in chemistry to the AAC&U Value Rubric. **G.E. Potts**

8:25 643. Reciprocal peer teaching in the instrumental analysis laboratory. **N.M. Karn**

8:45 644. Engaging adult non-experts with communications projects based on *Don't Be* Such *a Scientist*. **S.K. St Angelo**

9:05 645. Growing student confidence in communication from INCLD: International Network for Chemistry Language Development. **L.A. Morsch**, B. McCollum, M.T. Wentzel, B. Ekwonwa, I. Ripley

9:25 Intermission.

9:40 646. Alternatives to traditional written lab reports: An approach to unlock understanding. **V.M. Berns**

10:00 647. Integrated teamwork minor for chemists. **J.D. Fair**, A.E. Kondo

10:20 648. From cornerstone to capstone: Building the communication skills of our college student population. **B.G. Trogden**

10:40 Panel Discussion.

138-DeBartolo Lecture Hall

Current Research on the Undergraduate Chemistry Laboratory

N. L. Burrows, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 649. Helping students connect macroscopic and submicroscopic domains in laboratory work using the CORE learning cycle. **M.R. Bruce**, A.E. Bruce, J. Walter

8:25 650. How CORE empowers students to use analogical reasoning in written work to make sense of chemical laboratory experiments. **J. Walter**, M.R. Bruce, A.E. Bruce

8:45 651. Effect of TA characteristics on female engineering students learning general chemistry with a reformed curriculum. **C. Payne**, K. Crippen, L. Imperial

9:05 652. Implementation and evaluation of an online course to enhance teaching practice in laboratory classes in higher education. **C. McDonnell**, N. Brouwer, M. Mocerino, I. Maciejowska, G. Fleerackers

9:25 Intermission.

9:40 653. Objective structured chemistry examinations (SChemEs): Developing methods of assessment to improve laboratory-based skills. **S. Fergus**, S.B. Kirton

10:00 654. Improving the “Do It Right!” (DIR) system: Insights from the last two years. **D.J. Slade**

10:20 655. Scaffolding instruction on the effects of pK_a on titration curve shapes: A multi-term process. **J.R. Casey**

10:40 656. Teaching the principles of graphing in the age of Excel®. **A.A. Russell**

213-DeBartolo Lecture Hall

Engaging Students in Physical Chemistry

D. E. Gardner, J. Selco, C. M. Teague, *Organizers*
S. M. Singleton, *Presiding*

8:00 Introductory Remarks.

8:05 657. Investigating the structure of multi-histidine Cu(II)-coordination compounds through electron spin resonance spectroscopy in the physical chemistry laboratory course. **K.C. Gronborg**, S.K. Saxena, E.P. Wagner

8:25 658. Paired wet-dry labs for teaching quantum mechanics. **K.D. Fulfer**

8:45 659. Greetings from sunny Florida: Synthesis of fluorescent carbon quantum dots from citric acid for outreach or laboratory activities. **S. Barba**, N.J. Ruzycki

9:05 660. A quantum dot sensitized solar cell for the physical chemistry laboratory curriculum. **T.M. Ticich**

9:25 Intermission.

9:40 661. Physical chemistry laboratory experiment of contact angle measurement from modified surfaces. **T. Alivio**, R.D. Davidson, S. Banerjee, **S. Lim**

10:00 662. Testing the adiabatic flame model. **R.C. Dudek**

10:20 663. Physical chemistry laboratory experiment of measuring polarizability and rotational diffusion coefficient of gold nanorods. **S. Lim**, N.L. Hogan, M. Sheldon

10:40 664. Pyrene luminescence quenching by iodide cation and pyrene excimer formation: New time-resolved laser photolysis lab experiments for teaching chemical kinetics. **B.H. Milosavljevic**

131-DeBartolo Lecture Hall

Enhancing Student Learning & Retention in Introductory "Gatekeeping" Chemistry Courses: Best Teaching Practices & Alternative Assessment Methods

S. Kradtap Hartwell, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 665. Gateways to completion: Reconceptualizing general chemistry I to enhance student success at Eastern Michigan University. **A.F. Johnson**

8:25 666. Comparison study of the Gradual Release of Responsibility teaching model to a standard lecture model in a large enrollment introductory chemistry course. **N. Lapeyrouse**, C. Yestrebsky

8:45 667. Improving college chemistry student success through retrieval practice. **S.R. Trevino**, M. Osterloh, E. Trevino

9:05 668. Motivating students using exam grade recovery opportunities. **B.L. Baldock**

9:25 Intermission.

9:40 669. Aligning students learning styles and chemistry instruction with weekly course evaluations. **K. Arnold**, J. Smith

10:00 670. Student analytical reasoning of mole concept and stoichiometry assessment items. **V.R. Ralph**, S.E. Lewis

10:20 671. Components of specifications grading in general chemistry: Lessons learned. **L.J. Martin**

10:40 Discussion.

206-DeBartolo Lecture Hall

General Papers: Advances in General Chemistry Lecture & Lab

W. J. Donovan, *Organizer, Presiding*
B. Fernandez Solano, *Presiding*

8:00 Introductory Remarks.

8:05 672. Interactive strategies implementation to promote attention, interest, and generation of explanations in large enrollment general chemistry courses. **B. Fernandez Solano**, S. Sandi-Urena

8:25 673. A library assignment using a Chemical and Engineering News cover article in general chemistry. **B.E. Taylor**

8:45 674. Resources for general chemistry equivalent to a textbook. **S. Gupta**

9:05 675. Rebuilding a general chemistry curriculum. **T. Miller**

9:25 Intermission.

9:40 676. Beyond Flipped: The individualized honors chemistry classroom. **K. Smith**

10:00 677. Connecting the macroscopic, microscopic and symbolic perspectives of limiting reagents through a single lab activity. **J.M. Weaver**

10:20 678. Ways to improve student enagagement in the classroom. **M. Shedd**

10:40 Discussion.

202-DeBartolo Lecture Hall

Get To Know the USNCO: Chemistry Excellence at the High School Level

M. Barranger-Mathys, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 679. USNCO mentor preparations. **M. Barranger-Mathys**

8:25 680. The US National Chemistry Olympiad exams as a resource for teaching chemistry. **S.N. Brown**

8:45 681. The International Chemistry Olympiad: Going for gold is not what it's about. **N.M. Szczepanski**

9:05 682. The IChO turns 50: The history and future of the International Chemistry Olympiad. **J.L. Kiappes**, G. Magyarfalvi, P. Holzhauser

9:25 Concluding Remarks.

217-DeBartolo Lecture Hall

Green Chemistry in High School, College & University Curricula (& Beyond!): Green Chemistry in the Organic Laboratory

A. Dicks, *Organizer*
L. Bastin, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 683. Bismuth subsalicylate (Pepto Bismol™) as a green catalyst for sustainable polymer experiments. **J.E. Wissinger**, A.M. Luke, R. Bartz

8:25 684. Two green chemistry alternatives for classic organic reactions. K. Hess, **P. Lee**, R. Hopson

8:45 685. Liquid carbon dioxide as solvent for chromatography and TLC. **B.W. Baldwin**, T.S. Kuntzleman

9:05 686. Naturally dyed "Onsies". **S. Sutheimer**

9:25 Intermission.

9:40 687. Comparing the energy efficiency of microwave and conventional reflux heating: The Suzuki Reaction. **A. Dicks**

10:00 688. Sequential process for synthesizing substituted N-phenylmaleimide derivatives and their subsequent use as a substrate in a Diels Alder reaction in an undergraduate organic chemistry laboratory. **M. Nigam**, S. Martinus, L. Bastin

10:20 689. Implementation of a mini-research experience using renewable or recycled chemical feedstocks. **P.S. Workman**

10:40 690. Guide to green chemistry experiments in the undergraduate organic chemistry labs. **D. Ward**, A.S. Cannon

215-DeBartolo Lecture Hall

Helping Students Learn Chemistry: Visualizations, Analogies, Games, & Toys

J. Selco, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 691. Understanding dimensional analysis and stoichiometry using a card game. **S.K. Keyser**

8:25 692. What on earth do carrots have to do with diamonds and gold? **D.J. Schauer**

8:45 693. Top ten: Analogies and images that make chemistry stick. **K.D. Revell**

9:05 694. Transparent assignments in preparatory chemistry paired with PhET simulations for greater learning benefits and smaller rates of withdrawal. **K.A. Kaiser**

9:25 Intermission.

9:40 695. Communicating chemistry content in Braille and tactile graphics in the twenty-first century. **C.A. Supalo**

10:00 696. Building a library of analogies and graphics to assist general chemistry students, including visually impaired students. **A.A. Carter**

10:20 697. Simulations to help students learn chemistry. **J. Selco**

10:40 698. Graphical representations of equilibrium systems. **G. Lisensky**

140-DeBartolo Lecture Hall

Improving Student Learning Strategies in Chemistry Courses

T. M. Clark, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 699. Managing learning with activities inside and outside a flipped classroom. **S.W. Sendler**, P.S. Marks, R. Smith

8:25 700. Training of Learning Assistants to support student learning in a collaborative classroom. **A. Graham**

8:45 701. Implementing student-centered learning practices in an analytical chemistry course. **K. Roth**

9:05 702. Investigating forensic and medicinal research: A special topics course for Walsh University's science majors. **A.J. Heston**

9:25 Intermission.

9:40 703. Writing lab reports: guided transition from high school to college. **D.R. Rosenthal**

10:00 704. Redesigning the first-year chemistry sequence for efficiency and effectiveness. **L. Grochowski**, **J.D. Powell**, **M.A. Puccio**, **N. Smelkova**

10:20 705. Analysis of study skills used by two-year college students in general chemistry. **A. Palmer**, O. Kutai

10:40 706. An investigatory study into how students' use graded material. **W.E. Schatzberg**

207-DeBartolo Lecture Hall

Learning About Quantitative Research in Chemistry Education Research

Cosponsored by CHED
L. K. Kendhammer, *Organizer*
J. Harshman, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 707. Using factor analysis to interpret survey results. **J. Chan**

8:45 708. Analyzing networks to assess students' conceptual knowledge. **A.L. Wrenne**, D.M. Bunce

9:25 Intermission.

9:40 709. Meta-Analysis 101: How to assess the effectiveness of flipped learning. **A. Leontyev**

204-DeBartolo Lecture Hall

Research-based Activities in Chemistry Classroom & Laboratory

M. Li, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 710. Designer dyes: Individualized compounds in the sophomore chemistry laboratory by the reaction of two diazonium salts with a bifunctional reactant. **J.F. Lomax**, S.Q. Lomax, P. Bolton, M.F. Campbell

8:25 711. Progressing toward research experiences in honors general chemistry using guided and open inquiry laboratory experiments. **E.P. Wagner**, T.A. Madison, D. Folmsbee, B. Murray, A. Larimer-Picciani, T.A. Patil, B. Ryoo

8:45 712. Experimental inquiry and design in general chemistry: Flipping the laboratory. **A.E. Shinnar**

9:05 713. Research-oriented general chemistry course to prepare freshman for research. H. Guo, **K.J. Ho**

9:25 Intermission.

9:40 714. Magnification of "nanoworld": Nanotechnology as a topic for achieving sustainable change in science education. **R.F. Abu-Much**

10:00 715. Research-based activities in environmental chemistry. **M. Li**

10:20 716. Introduction of online electronic laboratory notebooks into honors general chemistry. **T.A. Patil**, E.P. Wagner

10:40 717. Amphiphilic structure of soap as a model for learning about drug delivery: A case study for freshmen and high school students. **R.F. Abu-Much**

126-DeBartolo Lecture Hall

Research in Chemistry Education

T. J. Bussey, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 718. Students' understandings of spontaneity and entropy in the contexts of dissolving and precipitation. **T.N. Abell**, S. Bretz

8:25 719. Energy released or absorbed? Missing a mechanism. **V. Talanquer**

8:45 720. In search of appropriate analogies for potential energy in chemical systems. **M.L. Nagel**, B. Lindsey

9:05 721. Organic chemistry students' interpretations of the surface features of reaction coordinate diagrams. **M. Popova**, S. Bretz

310-DeBartolo Lecture Hall

Science Online: Creating Engaging & Interactive Virtual Classrooms

K. Mock, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 722. Engaging students online. **K. Mock**

8:25 723. Developing and evaluating online general chemistry instruction using the Knowledge Integration framework. **W.J. Farina**, A. Bodzin

8:45 724. Create chemistry: Spark student engagement with digital tools. **J. Houck**

9:05 725. Impact of Distance Learning and Hybrid Teaching cCWCS workshop on our chemistry online course. **S.R. Svojanovsky**

9:25 Intermission.

9:40 726. Engaging students and fostering success in an online chemistry for engineers course. **P.S. Marks**, R. Smith

10:00 727. Teaching chemistry online: A tale of three programs. **M.E. Morgan**

10:20 728. Creating a virtual lab for an online introductory chemistry course. **A. Veenis**, M. Shoemaker

10:40 729. Using home laboratory kits to create an engaging online classroom. **E. Pearsall**

210-DeBartolo Lecture Hall

Supporting Under-Represented Minorities to Increase Undergraduate Retention & Success

R. J. Lesuer, K. Mardis, *Organizers*
A. G. Van Duzor, *Organizer, Presiding*
R. LeSuer, *Presiding*

8:00 Introductory Remarks.

8:05 730. The Chi-Sci Scholars program: Developing community at a minority serving institution. **K. Mardis**

8:25 731. Enhancing STEM retention and graduation through a holistic model of science engagement at a liberal arts college. **J.G. Kaup**, **J. Wheeler**

8:45 732. Supporting at-risk students in chemistry: Impact of the NSF S-STEM Chemistry Scholars Program on transforming the chemistry major at the University of North Carolina Asheville. **S.A. Wasileski**, A.L. Wolfe, J.M. Schmeltzer, B.E. Holmes, H. Holt

9:05 733. Impact of two interdisciplinary NSF S-STEM grants on the chemistry program at Columbia College. **J.P. Baker**, A. Oxley

9:25 Intermission.

9:40 734. Impacts and lessons learned from the NSF S-STEM Program at Idaho State University Department of Chemistry. **L.M. Goss**, C.M. Evilia, A.W. Holland, J.H. Kalivas, J.J. Pak

10:00 735. Science identity and underrepresented minority STEM organizations. **S. Nealy**, M. Orgill

10:20 736. Effects of gender and sexual orientation on belonging uncertainty in general chemistry. **J.A. Kroll**, K. Plath

10:40 737. Student and professor cultural assumptions and their impact on learning. **H.R. Fynewever**, M. Brantuo, L. Schutt

311-DeBartolo Lecture Hall

Teaching Chemistry in the Context of Forensic Science

L. Huang, *Organizer*
A. S. Harper-Leatherman, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 738. Permanganate oxidation of DNA nucleotides: An introductory redox laboratory framed as a forensic investigation. **S. Testa**, J.P. Selegue, A.N. French, B.A. Criswell

8:25 739. Learning community courses: Bridging the gap between the sciences and humanities through forensic science. **M.D. Garrett**

8:45 740. Developing an interdisciplinary learning activity incorporating forensic science and forensic nursing. **A.S. Harper-Leatherman**, L.N. Roney

9:05 741. Pedagogy mashup: Implementation of team-based learning, a flipped approach, and distributed practice strategies in a forensic chemistry course. **T. Legron-Rodriguez**

9:25 Intermission.

9:40 742. Chemistry and crime and the cCWCS forensic science workshop for introducing chemical concepts with a forensic science theme. **L.J. Kaplan**

10:00 743. cCWCS forensics science workshop: How forensics science has been incorporated into the curriculum eight years later. **R.P. Beeton**

10:20 744. Catching criminals with chemistry: Engaging non majors through forensic science. **W. Case**

10:40 745. Encouraging engagement of forensic science students in the chemistry classroom. **D.K. Hoover**

201-DeBartolo Lecture Hall

Teaching Nuggets for AP & General Chemistry

P. D. Price, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 746. Three things we're teaching wrong, and how to teach them right. **L. Hoyt**

8:25 747. How writing can promote conceptual understanding. **M.L. Miller**

8:45 748. Promoting student argumentation. **K. Mauger-Sonnek**, R.S. Cole

9:05 749. Building the skill of scientific argumentation: How peer review in science builds student engagement and success. **M. McGrail**

9:25 Intermission.

9:40 750. Great labs for the study of rates of chemical reactions. **M. Jansen**

10:00 751. How to help students evaluate errors in experiments. **K. Drury**

10:20 752. Beach ball challenge. **J.D. Bracken**

10:40 753. Stoichiometry, gas laws, and a target lab. **J.D. Bernstein**

129-DeBartolo Lecture Hall

Technology Integration in Chemistry Education & Research (TICER): Technology Based Assessment & Evaluation

Cosponsored by CHED
T. Gupta, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 754. Ensuring test takers can use new chemistry assessments made possible by technology. **J.D. Polifka**, T. Holme

8:25 755. Incorporating Plicker (paper clicker) questions in general chemistry courses to enhance active learning and limit distractions. **B. McBurnett**

8:45 756. The impact of a 'scaffolded' approach to improve student learning & problem-solving skills in general chemistry. **M. Mahalingam**, E. Morlino, E. Fasella

9:05 757. Enhancing students' laboratory experiences in undergraduate chemistry. **R. Lamichhane**, A. Maltese, C. Reck

9:25 Intermission.

9:40 758. Effectiveness of pre-laboratory instruction for general chemistry using 360 videos and virtual reality technology. **Z.A. Jimenez**, **P. Martino**

10:00 759. Effects of implementing a hybrid wet lab and online module lab curriculum into a general chemistry course: Impacts on student performance and engagement with the chemistry triplet. **S.M. Irby**, E.J. Borda

10:20 760. Game-Based Learning (GBL): Implementation in a large enrollment classroom. **T. Gupta**

316-DeBartolo Lecture Hall

Training Professional Teaching Assistants: Utilizing LAs & Active Learning GTAs

J. Monahan, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 761. Authentic training of teaching assistants for high enrollment general chemistry courses. **L.K. Stoll**, L. Lamont, S.B. Block, B.J. Esselman, J.S. Hamers

8:25 762. Incorporation of active learning strategies in a large inorganic lecture course. **M.R. Porter**

8:45 763. Using a team approach: Undergraduate learning assistants enhance large chemistry lecture classes. **L.S. Van Der Sluys**, S.A. Dykstra, T.C. Pontius

9:05 764. Science & Engineering Center: Learning Assistant training in an interdiciplinary help-center. **D.G. Mitchell**

TUESDAY AFTERNOON

216-DeBartolo Lecture Hall

A Day in the Life of My Classroom

A. F. Johnson, O. Odeleye, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 765. "It was a terrible mistake": Chemistry, literacy and STEM. **V. Dipinto**, A. Tournis

2:25 766. Making students responsible for learning: My method of blending classroom instructions. **M. Koralegedara**

2:45 767. Constructivist's creation of a student-centered activity on specific heat to encourage peer tutoring. **D.R. Rosenthal**

3:05 Intermission.

3:20 768. I'm not going to lecture you: Reducing attrition in general chemistry by redesigning the class format. **E.A. Jensen**

3:40 769. Engagement strategies in large classroom general chemistry courses. **S.M. Kroner**

4:00 770. Using clickers for peer instruction in large enrollment lectures of general chemistry. **D. Cruz-Ramirez de Arellano**, R. Zhang

4:20 771. Enhancing memory retention in general chemistry by using the spiral curriculum. **M. Klemp**

202-DeBartolo Lecture Hall

Beyond AP: 2nd-Year Chemistry Electives in High School

T. Marx, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 772. Organic chemistry in high school: Initiation and propagation. **H.S. Joshi**

2:25 773. Survey in biochemistry: A study in food science. **E. Posthuma-Adams**

2:45 Discussion.

3:05 774. Experiencing chemistry through forensics, food science, materials science, and outreach in the local community. **M. Bunda**

3:25 Intermission.

3:40 775. Scientific Research and Design elective. **R. Allen**

4:00 776. Applying chemistry in advanced high school electives. **T. Marx**

4:20 Discussion.

213-DeBartolo Lecture Hall

Biochemistry Education: Discussions of the Lecture Learning Environment

T. J. Bussey, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 777. Investigating students' views of the big ideas for their general chemistry and introductory biology courses. **L. Santiago Caobi**, B.A. Pardinas, A.T. Kararo, K.P. Kohn, M. Cooper, S.M. Underwood

2:25 778. Creating assessments to investigate student understanding of core chemistry ideas in introductory biology. **B.A. Pardinas**, L. Santiago Caobi, A.T. Kararo, R.L. Matz, K. Parent, A. Gotwals, S.M. Underwood

2:45 779. Empirically refining a hypothetical learning progression on acid/base chemistry. **A.M. Mercer**, A. Wolfson, J.E. Lewis

3:05 780. Assessing students' abilities to transfer acid-base knowledge between introductory biochemistry lecture and second-term general/organic chemistry laboratory. **J.R. Casey**, **H.L. Tienson-Tseng**

3:25 Intermission.

3:40 781. Investigating student understanding of noncovalent interactions in undergraduate biochemistry. **S. Feola**, A.M. Mercer, J.A. Loertscher, V.M. Thorsell, P. Lemons, J.E. Lewis

4:00 782. Come on down! Creative approaches to the standard enzyme research project. **K.T. Lane**

4:20 783. Using Jmol in a protein structure writing assignment. **S. Dew**

4:40 Concluding Remarks.

205-DeBartolo Lecture Hall

Chemistry & Community Outreach: Ideas & Events: Programs, Events & Activities

P. M. Morgan, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 784. Opening college lab doors to grade schoolers. **S. Chamberlin**, L.M. Mier

2:25 785. Homeschooled chemistry: Collaboration between a university chemistry department and a homeschooling cooperative. **S.B. Boesdorfer**

2:45 786. Chemistry outreach from a UK university: Examples of popular and easily deliverable activities. **P. Hoare**

3:05 787. Fun with forensic chemistry. **A.A. Hazari**

3:25 Intermission.

3:40 788. Bringing NMR spectroscopy into the high school classroom. **J.L. Bonjour**, J. Frost, D. Frasco

4:00 789. Demonstration extensions involving color-changing goldenrod paper. **D.J. Campbell**, D.K. Schorr

4:20 Panel Discussion.

208-DeBartolo Lecture Hall

Chemistry Education Research about Multiple Representations

S. Bretz, *Organizer*
M. Popova, *Presiding*

2:00 Introductory Remarks.

2:05 790. Multiple representations and understanding: Expert and novice responses to different representations of chemical phenomena and the use of quantitative data to validate eye-tracking experiments. **J. Shorb**, E.G. Lewellyn, R. Edwards, K. Monson

2:25 791. ***Withdrawn***.

2:45 792. Assessment of molecular geometry concept development via a novel open-ended molecular modeling activity in first semester college chemistry. **D.L. Richter-Egger**, J.A. Conrad, C. Cutucache, J. Darr, A. Gift, N. Grandgenett, R. Lomneth, A. Miller, E. Tisko

3:05 793. Determination of the cognitive load of horizontal translation in organic chemistry modeling activities. **J. Calvert**, K.J. Linenberger Cortes, X. Prat-Resina, A. Randolph, C.R. Terrell

3:25 Intermission.

3:40 794. Exploring the student "disconnect" between vocabulary and visualization questions involving acid strength. **M.E. Jewell**

4:00 795. Biochemistry students' understanding of protein structure using molecular visualization software. **A. Szuba**

4:20 796. Sequential versus simultaneous learning domain treatment. **R. Gregorius**

4:40 797. Making connections a qualitative study of electrochemistry. A.J. Phelps, **V. Hunter**

214-DeBartolo Lecture Hall

Communication in Chemistry: Engaging Students with Oral Communication in Lecture & Laboratory Classes

K. D. Kloepper, *Organizer*
G. Crawford, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 798. Reacting to the past: Confession of a skeptic on role-play games in a general chemistry classroom. **M.T. Saraswathiamma**

2:25 799. Connecting first-year students to the primary literature through presentations in a disciplinary writing course. **B.J. McFarland**

2:45 800. Structured presentations that tie chemistry course content to everyday contexts. **A.L. Miller**

3:05 801. Investigating the argumentation skills of deaf students. **A.D. Ross**, T.E. Pagano

3:25 Intermission.

3:40 802. Engaging non-chemistry majors through Pecha Kucha-style presentations in the elementary organic chemistry classroom. **K.L. Yearty**, R.W. Morrison

4:00 803. Developing students' oral communication skills in a *Chemical Communications* course. **J.L. O'Donnell**

4:20 804. Laboratory exit interviews: Promoting engagement and reflection in analytical chemistry. **G. Crawford**, K.D. Kloepper

4:40 Panel Discussion.

136-DeBartolo Lecture Hall

Engaging Students in Organic Chemistry

P. J. Kreke, B. Murray, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 805. Using medicinal chemistry to teach concepts of physical organic chemistry. **S.M. Dimick Gray**

2:25 806. Integrating previous learning from organic chemistry laboratory for a medicinal plants project. **A.B. Waghe**, A.A. Waghe

2:45 807. Teaching carbohydrate and functional group chemistry: An undergraduate laboratory experiment for organic chemistry and biochemistry students. **A.E. Shinnar**

3:05 808. Multidimensional learning approach in medicinal plants laboratory project in organic chemistry. **A.A. Waghe**, A.B. Waghe

3:25 Intermission.

3:40 809. Teaching reaction mechanism: Explain, draw, visualize. **B.T. Burlingham**

4:00 810. The Metacognitive Exam Tool to Help You Learn (METHYL) project for sophomore organic chemistry. **S. Chamberland**, M. Wathen, T. Morris

4:20 811. Vinyl polymerization: Bringing organic chemistry to the everyday lives of students. **B.A. Howell**

4:40 812. Step-growth polymerization: Enhancing the second semester of the beginning course in organic chemistry. **B.A. Howell**

131-DeBartolo Lecture Hall

Enhancing Student Learning & Retention in Introductory "Gatekeeping" Chemistry Courses: Curriculum, Course & Content Management Reform to Support Student Learning

S. Kradtap Hartwell, *Organizer*
E. Kerr, *Presiding*

2:00 Introductory Remarks.

2:05 813. Supporting students learning and retention through supporting undergraduate and graduate teaching assistants. **E. Kerr**

2:25 814. Study of assessment of student learning outcomes in an introductory chemistry course delivered via hybrid (blended/flipped classroom) and Traditional modalities. **S. Sambasivan**, D. Williams, C.J. Foley

2:45 815. Low DFW rate general chemistry. It is possible! **R.T. Hayes**, **D.W. Randall**

3:05 816. Making the big meetings “bigger” and the small meetings “smaller”: Impacts on student learning, success, and persistence in general chemistry. **S.U. Dunham**, S. Dunham

3:25 Intermission.

3:40 817. Teaching too much is teaching nothing: Improving student success and retention in a gateway chemistry class. **M.H. Benko**, K. Johnson, A.R. Babij, K. Vogelsang

4:00 818. Enhancing student learning and retention in organic chemistry: Benefits of an online organic chemistry preparatory course. **S.M. King**, F. Rodriguez, C. Fischer, N. Zhou

4:20 819. Fine-tuning general chemistry and preparatory chemistry placements to maximize student success. **C.A. Ashe**

4:40 820. Increasing student mastery of organic chemistry through planned interface of lecture and laboratory activities. **S.M. Schelble**, C. Magee

206-DeBartolo Lecture Hall

General Papers: Advances in General Chemistry Lecture & Lab: Curriculum Reform, Goals, & Standards

W. J. Donovan, *Organizer*
A. A. Carter, A. B. Ormond, *Presiding*

2:00 Introductory Remarks.

2:05 821. Laboratory practical development and evaluation in general chemistry class. **K. Deavers**

2:25 822. Impact of pre-laboratory simulations on student attitudes of a first year laboratory course. **R.A. Blackburn**, D.P. Williams, B. Villa-Marcos

2:45 823. Reasons why general chemistry students should never be made to do the iodine clock experiment ever again. **M.W. Burand**

3:05 824. Using the "blue bottle" experiment to develop testable hypotheses. **B.L. Haas**

3:25 Intermission.

3:40 825. Focusing on the practical: Promoting context and application in general chemistry. **D.J. Styers-Barnett**

4:00 Discussion.

217-DeBartolo Lecture Hall

Green Chemistry in High School, College & University Curricula (& Beyond!): Green Chemistry Courses

L. Bastin, *Organizer*
A. Dicks, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 827. Civic and political engagement in a non-majors sustainable chemistry course. **A.E. Martin**, L. Bastin

2:25 828. Incorporating green chemistry into the liberal arts college education at St. John Fisher College to increase students' awareness and community-based learning experience. **R.N. Manchanayakage**

2:45 829. Integrating sustainability in an introductory chemistry course for non-science majors. **L.M. Liable-Sands**

3:05 Intermission.

3:20 830. Introducing green chemistry into a small college chemistry curriculum: Progress so far. **M. Koralegedara**

3:40 831. Empowering students through project-based learning in green chemistry. **S.A. Kennedy**

4:00 832. Teaching green chemistry and sustainability in the secondary classroom – a course for in-service high school teachers. **H.S. Christie**, Z. Lachance, J.E. Pemberton

4:20 Discussion.

215-DeBartolo Lecture Hall

Helping Students Learn Chemistry: Visualizations, Analogies, Games, & Toys

J. Selco, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 833. Stated Clearly and the Center for Chemical Evolution: A novel partnership in formal and informal chemistry education. **C. Parsons**

2:25 834. Naturally occurring easy-to-learn visualization tool for multiple acid-base concepts. **M. Menzmer**

2:45 835. New method of teaching hybridization and molecular geometry to general chemistry students. **D.A. Phillips**

3:05 836. Introducing molecular symmetry using Legos: Helping students understand a highly useful, highly abstract concept. **J.A. Orvis**

3:25 Concluding Remarks.

140-DeBartolo Lecture Hall

Improving Student Learning Strategies in Chemistry Courses

T. M. Clark, *Organizer*
A. Palmer, *Presiding*

2:00 Introductory Remarks.

2:05 837. Creating a culture of improving student success: Department-wide implementation of learning strategies in general chemistry. **D.A. Turner**

2:25 838. How to change student behavior when change is hard. **M.W. Stoltzfus**

2:45 839. Promoting metacognitive learning strategies in general chemistry with an in-class intervention. **T.M. Clark**

3:05 840. How can you encourage the best use of online learning systems? A look at student usage of MasteringChemistry and ALEKS with correlation to their achievement in General Chemistry. **E.E. Wilson**, S. Kennedy

3:25 Intermission.

3:40 841. Assignment-based metacognitive strategies for connecting lab and lecture components in General Chemistry. **K.A. Moga**, J.W. Uebler, T. Weaver, T.M. Clark

4:00 842. Improving students' science writing. **L. White**

4:20 843. Three steps implemented that improved the performance of a Chemistry 100 (GOB) Course. **J. Buben**

4:40 844. Reflecting on success in online collaborative assignments through "Letters from a Mentor" in the International Network for Chemistry Language Development: INCLD. **M.T. Wentzel**, B. McCollum, L.A. Morsch

203-DeBartolo Lecture Hall

Innovating Inorganic Chemistry Education at the Intersection of Research & Practice

J. R. Raker, *Organizer, Presiding*
J. L. Stewart, *Presiding*

2:00 Introductory Remarks.

2:05 845. "The Grand Experiment" in teaching inorganic chemistry: Studying the impact of the IONiC community on teaching practices and student learning. **J.L. Stewart**

2:25 846. Teaching inorganic chemistry using the research literature. **A.K. Bentley**, E.R. Jamieson, A.R. Johnson, C. Nataro, J.R. Raker, B.A. Reisner, S.R. Smith, J.L. Stewart, L.A. Watson, N. Williams

2:45 847. Measures of affect in undergraduate inorganic chemistry courses: Results from a multi-institution pilot study. **R. Gibbons**, J.L. Stewart, B.A. Reisner, A.K. Bentley, S. Lin, S.R. Smith, J.R. Raker

3:05 848. Investigation of student understandings of fundamental chemistry ideas in inorganic chemistry. **B.A. Reisner**

3:25 Intermission.

3:40 849. Fast, affordable, more effective: Use of Monowave 50 synthesis reactors for increased student inquiry in the inorganic teaching lab. **J.A. Rood**

4:00 850. Finale experiment in inorganic chemistry: Dichloro*bis*ethylenediaminecobalt(III) chloride, $Co[(en)_2Cl_2]Cl$. **J.P. Lanorio**, J.G. Lanorio

4:20 851. Use of Raman Spectroscopy in upper-division inorganic and spectroscopy courses. **A.L. Eckermann**, J. Shorb, J.G. Gillmore

4:40 Discussion.

207-DeBartolo Lecture Hall

Learning About Theoretical Frameworks in Chemistry Education Research

Cosponsored by CHED
B. K. Dekorver, V. Talanquer, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 852. Choosing a theoretical framework: One data source, multiple potential research projects. **M. Orgill**

2:45 853. Variation theory for the design and study of conflicting molecular animations. **R.M. Kelly**

3:25 Intermission.

3:40 854. Considering empirical research on chemistry students' study habits through varying theoretical frameworks. **S.E. Lewis**

4:20 855. The Resources Framework as a lens for students' beliefs about models and modeling. **N.M. Becker**

5:00 856. Escaping the trap of Theoretical Frameworks based exclusively on European perspectives. **G.M. Bodner**, M. Thompson, C. Hawkins

316-DeBartolo Lecture Hall

Overarching Undergraduate Curriculum Reform

D. R. Mulford, L. Williams, *Organizers*
R. Harris, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 857. Incorporating a focus on standards and standardization into multiple chemistry lab courses at Otterbein University. **C.J. Hayes**, B. Ramos, R. Grote

2:25 858. Aligning the chemistry curriculum for undergraduate life science students through four semesters of instruction. **C. Schnoebelen**, J.A. Chmielewski, C. Hrycyna, G.M. Bodner

2:45 859. Redefining undergraduate chemistry – Chemistry Unbound: Approach, challenges, and assessment. **R.J. Harris**, S. Blakey, F. Frank, J. Kindt, D.G. Lynn, P. Marsteller, F.E. McDonald, T.L. McGill, D.R. Mulford, N.L. Powell, L.C. Williams

3:05 860. Redefining undergraduate chemistry – Chemistry Unbound, the first year. **L.C. Williams**, S. Blakey, F. Frank, R. Harris, J. Kindt, D.G. Lynn, P. Marsteller, F.E. McDonald, T.L. McGill, D.R. Mulford, N.L. Powell

3:25 Intermission.

3:40 861. Developing technical writing skills across the chemistry curriculum. **J.W. Wackerly**

4:00 862. Integrating active learning classrooms and assessment across chemistry, physics and marine science disciplines in pursuit of accreditation by ABET. **J.D. Brown**, J. Gray, E. Page

4:20 863. It's here: A fully online biochemistry degree program at Arizona State University. **I.R. Gould**

4:40 864. Accreditation of chemistry courses as drivers for national curricular reform: Australian perspective. **D. Southam**

204-DeBartolo Lecture Hall

Research-based Activities in Chemistry Classroom & Laboratory

M. Li, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 865. Course-based research experiences in the organic chemistry laboratory: Creating excitement for scientific research. **S.C. Timmons**

2:25 866. Taking the road less traveled: Use of student-guided, multi-step "Sleuth Problems" in General Chemistry recitations. **E.L. Atieh**, D.M. York

2:45 867. Integrated Research Lab at Guilford College: Closing the research circle with alumni collaboration. **A.G. Glenn**, G.H. Webster, R.M. Whitnell, A. Darko

3:05 868. Filling in the blanks: A student-designed, research-based instrumental analysis laboratory. **L. Mier**

3:25 Intermission.

3:40 869. Incorporating current biochemistry research into the general chemistry lab via a research-based lab activity. **J.H. Tomasik**, J. Callus, S.J. Juris

4:00 870. Materials design in the community college: A first principles approach to band gap tunability. **I. Metz**, J.W. Bennett, S.E. Mason

4:20 871. Erasing the pharmaceutical footprint: Undergraduate research in first-semester freshman chemistry lab. **R.E. Nalliah**

4:40 872. Bringing interdisciplinary drug discovery research methods into the organic chemistry laboratory. **A.L. Courtney**, B. Dibenedictis, D. Sheehy, L. Pastorino, J.K. Snyder

126-DeBartolo Lecture Hall

Research in Chemistry Education

T. J. Bussey, *Organizer*
R. Sansom, *Presiding*

2:00 Introductory Remarks.

2:05 873. Spoken Polymer Chemistry. **T. Twardowski**

2:25 874. Resolution of organic chemistry students' reasoning through the lens of a mechanistic framework. **I. Caspari**, N. Graulich

2:45 875. Investigating reaction mechanism problem solving using eye tracking techniques. **M. Weinrich**

3:05 876. Investigating student strategies in organic chemistry. **B. Brando**, A.M. Baranger, A. Stacy

3:25 Intermission.

3:40 877. Measuring conceptual understanding on oxygen binding and delivery in a biochemistry course. **M. Kahveci**, L. Jin

4:00 878. The impact of biochemistry content exposure on the reading and cognitive processing of metabolic pathways. **K.J. Linenberger Cortes**, K. Kammerdiener, A. Randolph

4:20 879. Changing disciplines: Investigation of scale in an introductory anatomy and physiology course. **V. Fisher**, J. Trate, P. Geissinger, A. Blecking, K.L. Murphy

310-DeBartolo Lecture Hall

Science Online: Creating Engaging & Interactive Virtual Classrooms

K. Mock, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 880. Motivational interventions effect on student performance in online general chemistry courses. **A. Holton**

2:25 881. Transforming a traditional POGIL-like general chemistry course into an online course. **N.D. Rovira-Figueroa**

2:45 882. Investigation of student attitudes and understanding in an online versus a face-to-face inorganic chemistry course. **R.M. Theisen**, H.T. Nennig, L.D. Salzer

3:05 Discussion.

210-DeBartolo Lecture Hall

Supporting Under-Represented Minorities to Increase Undergraduate Retention & Success

R. J. Lesuer, A. G. Van Duzor, *Organizers*
K. Mardis, *Organizer, Presiding*
R. LeSuer, *Presiding*

2:00 Introductory Remarks.

2:05 883. Interventions to address achievement gaps in chemistry. J. Bryant, C.F. Craig, S. Freeman, **L.M. Goldman**, S. Keller, M. Mack, C. Stanich, D. Wiegand

2:25 884. Chemistry labs that relate to healthcare and culture. **G. Clark**

2:45 885. Integrating innovative polymer chemistry research into the introductory general chemistry two course sequence: Fostering STEM interest and retention: Part III. **N.Y. Arnett**

3:05 886. The FUTURE program: Engaging underserved populations through early research experiences. **A.J. Reig**, K.A. Goddard, R.E. Kohn, L. Jaworski, D. Lopatto

3:25 Intermission.

3:40 887. The INQUIRE Program (INstilling QUantitative and Integrative REasoning). **S.M. Cass**, R.D. Sweeder

4:00 888. Learning Assistant (LA) programs to support underrepresented students and the impact of collaborative faculty/LA partnerships. **A.G. Van Duzor**

4:20 889. A faculty learning community of general chemistry instructors to improve performance for at-risk students. **L. Shah**, E. Butler Basner, G.T. Rushton

4:40 890. How do you alter a university culture? A summary of interventions aimed at shifting a small college's STEM division for better retention of under-represented groups. **S.G. Cessna**

311-DeBartolo Lecture Hall

Teaching Chemistry in the Context of Forensic Science

A. S. Harper-Leatherman, *Organizer*
L. Huang, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 891. Drugs and DNA: Teaching analytical chemistry with forensic topics. **L. Huang**

2:25 892. Guilty or innocent? Forensic science applications for upper division analytical chemistry courses. **S.E. Gray**

2:45 893. Simulated analysis of illicit drugs by gas chromatography-mass spectrometry. **A.D. Dukes**, J.M. Hollifield

3:05 894. Determination of cocaine on U.S. currency using high-performance liquid chromatography. **D.L. Haas**, B. Argento, K. Tydings

3:25 Concluding Remarks.

201-DeBartolo Lecture Hall

Teaching Nuggets for AP & General Chemistry

P. D. Price, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 895. Chemical kinetics without calculus. **L. Acampora**

2:25 896. Grappling with the effects of mass, specific heat and equipment limitations on the kinetics of calorimeter warming. **J.M. Weaver**

2:45 897. ΔG^{o} and the favorability dance: How to remember the effects of enthalpy and entropy. **R.W. Kugel**

3:05 898. Brian Bondwell--using models to correlate heat energy with potential energy in chemical bonds. **S.G. Sogo**

3:25 Intermission.

3:40 899. There's more to equilibrium than just math. **P.A. Bonvallet**

4:00 900. Improving student understanding of intermolecular forces through active learning: a guided-inquiry activity involving molecular models, computer simulations, and interactive lecture demonstrations. **T.J. Greenbowe**, D.B. Exton, D.R. Sullivan

4:20 901. Introducing a PUG table to simplify the first step of acid/base titration calculations and provide a contrast for the ICE table used in the second step. **A.C. Gottfried**

4:40 902. Mental math: Tips for conquering the calculator-free multiple choice section on the AP Chem exam. **K. Smith**

129-DeBartolo Lecture Hall

Technology Integration in Chemistry Education & Research (TICER)

Diverse Technologilcal Applications in Hybrid, Online & Face-to-Face Instruction

Cosponsored by CHED
T. Gupta, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 903. Who is watching? The use of multimedia videos and animation in an introductory chemistry course. **L. Eaton**

2:25 904. Effective scaffolding for students' out-of-class use of chemistry simulations. **A. Shrode**, **B. Martinez**, D.G. Herrington, R.D. Sweeder, J.R. Vandenplas

2:45 905. Integrating simulations, response systems, and videos in chemistry teaching across face-to-face and online modalities. **Y. Law**

3:05 906. Approaches to teaching chemistry in a 1:1 classroom. **R. Morgan Theall**

3:25 Intermission.

3:40 907. Implementing iPads in the chemistry curriculum. **A. Liang**

4:00 908. Discovering multiple uses of mobile technology for instructional improvement: lessons learned and serendipitous encounters from the cCWCS iPads in Chemistry workshop. **M. Blaser**

4:20 909. Social media in chemistry classroom: Generation-Z perspectives. **T. Gupta**, **M.A. Fosu**

138-DeBartolo Lecture Hall

The 3 Ps of Student Engagement in the Flipped General Chemistry Classroom: Preparation, Participation, & Performance

L. Hibbard, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 910. Preparation and persistence: Impact on student performance in the flipped learning general chemistry course sequence. **L. Hibbard**

2:25 911. Identifying preparation gaps in the flipped classroom to enable effective micro-lectures and other interventions. **J.J. Stankus**

2:45 912. Performance of underprepared general chemistry students in a flipped classroom. **R. Gregorius**

3:05 913. Flipped classroom: Implementations and impacts on student outcomes in general chemistry. **S.A. Reid**

3:25 Intermission.

3:40 914. Combining Case Based Learning (CBL) and online assessments with Flipped Chemistry courses: An analysis of impacts. **J. Thota**, S.R. Mooring, T. Witter

4:00 915. Flipping the classroom in a large lecture setting. **M.J. Bojan**

4:20 916. My flipped classroom and the three P's. **K. Endebrock**

4:40 917. Flipping the AP Chemistry classroom - Pros and cons. **J. Cook Gregory**, T.J. Greenbowe

WEDNESDAY MORNING

203-DeBartolo Lecture Hall

3D Printing in Chemistry Education

C. Adams, A. Leontyev, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 918. Exploring the properties of elements using 3D printed periodic tables. **R.J. Lesuer**

8:25 919. Hands-on 3D printed models of atomic and hybrid orbitals. R. De Cataldo, K. Griffith, **K.H. Fogarty**

8:45 920. Teaching polymer properties through additive manufacturing: Chemistry and engineering. **N.J. Ruzycki**

9:05 921. 3D printing and the chemistry of the periodic table. **A. Ma**, **G. Moran Gonzalez**, **L. Kilgallon**, **H. Carroll**

9:25 Intermission.

9:40 922. 3D printed microfluidics for hands-on undergraduate laboratory experiments. M.T. Vangunten, D.L. Glasco, U.J. Walker, **K.N. Knust**

10:00 923. Teaching about crystal structures in general chemistry using 3-D printed cubic unit cells. **J.B. Schilling**

10:20 924. 3D printing in instrumental analysis laboratory. **E. Mawk**

10:40 925. 3D printed molecular models: Stepping beyond engagement. **J.K. Klosterman**

210-DeBartolo Lecture Hall

Addressing Underrepresented Groups in STEM

D. Cruz-Ramirez de Arellano, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 926. Diversity of graduates and growth in chemistry undergraduate degrees awarded in the U.S.: An exploratory investigation. **R. Gibbons**, J.R. Raker

8:25 927. The Gateway Scholars program: Increasing diversity in chemistry and biology. **L.A. O'Connell**, N.M. Wolfman

8:45 928. A comparison study of representation, retention, and attrition of underrepresented groups in chemistry compared to other science domains. **S.M. Werner**

9:05 929. Peer mentoring, faculty advising, and incorporation in to research as tools for improving retention and student outcome in the sciences. **N.E. Leadbeater**

9:25 Intermission.

9:40 930. Can we use common instruments with diverse populations? Exploration of measurement invariance for African-American female students. **G.A. Rocabado**, N.A. Kilpatrick, S.R. Mooring, J.E. Lewis

10:00 931. Experiences of female engineering students in an undergraduate chemistry for engineers laboratory. **L. Imperial**, C. Payne, K. Crippen

10:20 932. Growing the Roots of STEM. **D.A. Allen**, E. Stearns, M. Bottia, S. Moller, R. Mickelson, M. Dancy

10:40 933. Chemistry performance: Relationship between early college achievement and later coursework. **B. Brando**, A.M. Baranger, A. Stacy

126-DeBartolo Lecture Hall

Alternative Ways to Teach Important Concepts in Organic Chemistry

K. B. Himmeldirk, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 934. Creating CSI experts in NMR analysis: an engaged, group-inquiry exercise in spectroscopy. **S. Chamberland**

8:25 935. Utilizing the scientific method to master NMR spectroscopy: A two-week ^{1}H NMR enrichment program for second semester organic chemistry students. **A.M. Balija**

8:45 936. 2D NMR spectroscopy for second-year undergraduate students. **A. Anderson-Wile**

9:05 937. Exploring the effect of reagent and solvent on the electrophilic addition of bromine to cinnamic acid in the undergraduate organic laboratory. **T.L. Troyer**

9:25 Intermission.

9:40 938. Moving beyond the limitations of VSEPR. **B.J. Esselman**, S.B. Block

10:00 939. Using simplified molecular orbital diagrams to predict and explain reactivity of molecules in organic chemistry. **K. Pate**

10:20 940. Electronic and steric effects: Gateway to making organic chemistry resonate with students. **M. Ilies**

10:40 941. Teaching resonance in organic chemistry. **K.B. Himmeldirk**

140-DeBartolo Lecture Hall

Applications of Learning How to Learn in the Chemistry Curriculum

S. R. Esjornson, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 942. Designing a learning how to learn course. What do we need to teach students about learning? **H.N. Currie**

8:25 943. How can I help? Tools and resources used by General Chemistry I students at two community colleges. **L.B. Bruck**, A.D. Bruck

8:45 944. Will this be on the test? Test blueprints as a tool for communicating learning expectations. **K. Young**, S. Lashley, S. Murray

9:05 1088. Utilizing self-regulated learning activities to promote student self-awareness, goal setting, management and ownership of their learning in a physical chemistry classroom. **A. Bills**

9:25 Intermission.

9:40 946. Presenting metacognition learning strategies to general chemistry 1 & 2 students: Results and responses. **B.R. Flokstra**

10:00 947. How I help students to become their own teachers—I get them to practice. **S.R. Esjornson**

10:20 948. Students reflect on online homework: A comparative research study of general chemistry online homework platforms. **S. Moussa**, **C.P. Kuda-Malwathumullage**, **A. Harris**, D. Polo

10:40 Discussion.

213-DeBartolo Lecture Hall

Biochemistry Education: Discussions of the Lecture Learning Environment

T. J. Bussey, *Organizer*
R. Austin, *Presiding*

8:00 Introductory Remarks.

8:05 949. Understanding perceptions and beliefs biochemistry instructors hold and the influence these factors have on their personal style of teaching. **F.K. Lang**, G.M. Bodner

8:25 950. Measuring cognitive load & impact of modeling activities in undergraduate biochemistry. **C.R. Terrell**, L. Aleuy, J. Calvert, A. Hampton-Ashford, X. Prat-Resina, A. Randolph, K.J. Linenberger Cortes

8:45 951. Introducing active learning strategies to improve student performance on threshold concepts in biochemistry. **M. Kopecki Fjetland**

9:05 952. Deepening biochemistry lecture: An active inquiry bioinformatics module. **E. Ragan**

9:25 Concluding Remarks.

208-DeBartolo Lecture Hall

Chemistry Education Research about Multiple Representations

S. Bretz, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 953. Investigating student utilization of textbook elements in reaction mechanisms through eye tracking technology. **K. Judd**

8:25 954. Investigating students' conceptions of chemical kinetics and reaction coordinate diagrams. **M. Croisant**, S. Bretz

8:45 955. "It's only the major product that we care about in organic chemistry:" An analysis of students' annotations of reaction coordinate diagrams. **M. Popova**, S. Bretz

9:05 956. Symbolic representations in organic chemistry: Identifying errors in Lewis structures and curved arrow notations. **S.M. Ruder**, C.L. Stanford, N. Farhat

9:25 Intermission.

9:40 957. Measuring general chemistry and physical chemistry students' ideas about the electronic structure of the atom: The Quantization & Probability Representations Inventory. **Z. Allred**, S. Bretz

10:00 958. Students' reasoning about representations related to dissolving and precipitation. **T.N. Abell**, S. Bretz

10:20 959. Coordinating students' responses to coupled representation and explanation prompts: the search for mechanistic reasoning in solution formation. **O. Judd**, M. Cooper

205-DeBartolo Lecture Hall

Community Outreach & Civic Engagement throughout All Grade Levels

A. F. Johnson, O. Odeleye, *Organizers*
K. M. Kaleuati, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 960. Demonstration shows: High school students performing science outreach. **C. Fish**, H. Fish, M.L. Cole

8:25 961. Fusion Science Theater: Outreach shows that allow university and high school students to engage young audiences in learning chemistry concepts. **H.W. Kerby**

8:45 962. Halloween themed science demonstrations in the community. **N. Bonde**, M. Flesch, **N. Jocic**, D. Kravchuck, K. Plotzke, J. Prybil, R.M. Chin, D.I. Del Carlo, C.L. Weeks

9:05 963. Developing a Junior Scientist badge with a local youth service – Community based learning with chemistry undergraduates. **C. McDonnell**, V. Murphy

9:25 Intermission.

9:40 964. SLAM program: A multi-tiered approach to STEM outreach. **D. Emmert**

10:00 965. Use of reflection to enhance service learning in environmental chemistry. **S. Radford**

10:20 966. Using a pop-up learning community to engage students in an interdisciplinary examination of climate change. **A.F. Johnson**, K. Ryker, W. Koolage, E. Dority, D. Clevenger, T. Ward

10:40 967. Focus on Flint: Considering the implications of water chemistry gone wrong. **U.J. Williams**

202-DeBartolo Lecture Hall

Creating a Local Professional Learning Community

T. Marx, A. N. Serkin, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 968. "But I have Twitter! What else do I need?" Why teachers need a local professional learning community. **A.N. Serkin**

8:25 969. Partnerships: A key to creating a professional learning community. **P. McBride**

8:45 970. Communities of practice as a model for identifying and disseminating best practices in teaching general chemistry. **J.P. Darr**, J.A. Conrad, D.L. Richter-Egger, C. Cutucache, N. Grandgenett, A. Gift, R. Lomneth, A. Miller, E. Tisko

9:05 Discussion.

9:25 Intermission.

9:40 971. Uneasy lies the head that wears a crown: What it's really like to lead a chemistry department. **K. Weber Stickney**, D.J. Styers-Barnett

10:00 972. So you've decided to host a workshop. Now what? **T. Marx**

10:20 Discussion.

10:40 Concluding Remarks.

316-DeBartolo Lecture Hall

Creativity in the Classroom: Games & Manipulatives that Encourage Learning

S. Pierce, T. J. Terry, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 973. No size fits all: Optimizing the design of game-based classroom activities. **T.W. Stringfield**

8:25 974. Methods to excel at creating your own game-based chemistry classroom activities. **T.W. Stringfield**

9:05 975. Project lockbox: An escape-room-style small class activity for any topic. **R.M. Welch**

9:25 Intermission.

9:40 976. Using games as the active learning methods in biochemistry. **V. Hunter**, M. Sanger, S. Karanja, B. Ooi

10:00 977. Foldables in general and organic chemistry. **S. Pierce**

10:20 978. Baiting the hook with manipulatives. **L.R. Marek**

10:40 979. Chemical explorations: Creative guided inquiry for students in Peer-Led Team Learning workshops. **A. Lazarski**, **M. Smith**, G.B. Saupe, J.E. Becvar

136-DeBartolo Lecture Hall

Engaging Students in Organic Chemistry

P. J. Kreke, B. Murray, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 980. Active learning organic chemistry environment with an adaptive meta-cognitive coach. **I.R. Gould**, E. Beerman, A. Austin, K. VanLehn

8:25 981. Student-led study sessions in organic chemistry: Lessons learned and future directions. **W.E. Brenzovich**, W.G. Hollis

8:45 982. Organic chemistry core competencies: Helping students make connections. **L. Ahlberg**

9:05 983. Implementing the "observe - diagnose - treat" approach for systematic problem solving in organic chemistry. **A.V. Aditya**, M.L. Head

9:25 Intermission.

9:40 984. Re-casting Organic Experiments to engage students in the lab. **D.C. Bromfield-Lee**

10:00 985. Research in the lab: student designed synthesis project. **S.S. Tartakoff**

10:20 986. Rhetorical context in Organic Chemistry I lab reports. **L.J. Martin**

10:40 1298. Spectroscopy poster and building organic compounds in organic chemistry II. **C.F. Hermann**

131-DeBartolo Lecture Hall

Enhancing Student Learning & Retention in Introductory "Gatekeeping" Chemistry Courses: Curriculum, Course & Content Management Reform to Support Student Learning

S. Kradtap Hartwell, *Organizer*
E. Kerr, *Presiding*

8:00 Introductory Remarks.

8:05 987. Introductory chemistry for prepharmacy students: Next steps in curriculum development. **B. Barth**, E. Bucholtz, N. Sanguantrakun, M.D. Perry

8:25 988. Re-configuring the general chemistry I lab course at a small PUI. **L. Bolyard**, B. Neal, A. Cutler, D.J. Styers-Barnett

8:45 989. Leveling the playing field using the laboratory curriculum. **L. Mier**, S. Chamberlin

9:05 990. Updating the curriculum in an introductory chemistry lecture course to address student gaps in mathematical and problem solving skills. **M.K. Maron**

9:25 Concluding Remarks.

214-DeBartolo Lecture Hall

Finalizing Education of Chemistry Majors: How Do We Better Prepare Chemistry Graduates for Careers in Industry & Graduate School?

B. H. Milosavljevic, *Organizer*
A. Bills, *Presiding*

8:00 Introductory Remarks.

8:05 991. Priming the STEM pump: An integrated general chemistry lecture and laboratory course for STEM majors. **M.K. Maron**, **M. Bruehl**

8:25 992. Fostering undergraduate research with a non-traditional student population. **K.R. Ries**

8:45 993. Backward design of a senior-level special topics course on polymers with emphasis on soft skills and industry exposure. **S. Zingales**, G. Guillet

9:05 994. Student-driven laboratory curriculum expansion. **S. Mang**

9:25 Intermission.

9:40 995. How do research advisors develop and support research autonomy in doctoral students? **R. Barnard**, G.V. Shultz

10:00 996. Enhancing Learning by Improving Process Skills in STEM (ELIPSS): Incorporating and assessing key workplace skills in chemistry classrooms. **S.M. Ruder**, R.S. Cole, J. Lantz, G.J. Reynders, C.L. Stanford

10:20 997. Developing and assessing teamwork skills in students. **A.E. Kondo**, J. Fair, M. Macrie-Shuck, K. Keen, K. Cercone

10:40 998. ***Withdrawn***.

310-DeBartolo Lecture Hall

Food Chemistry

K. D. Symcox, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 999. C^4 – Communicating chemistry: Cooking competitions (Cajun, California, Caribbean, and Creole). **J.S. Miller**, G.L. Sacks, D. Golden

8:25 1000. Coke and Mentos: Simple experiment, rich chemistry. **T.S. Kuntzleman**, M.W. Nydegger, D.J. Campbell

8:45 1001. No kitchen, no problem! Ideas for incorporating lab experiences into a chemistry of food and cooking class. **K.A. Daus**

9:05 1002. Does cooking in cast iron increase the iron content of foods? A food chemistry hook in analytical chemistry to build confidence in method development. **E. Lesher**

9:25 Intermission.

9:40 1003. An innovative approach to teaching chemistry abroad to the uninterested. **K.D. Symcox**

10:00 1004. Edible experiments for teaching the delicious chemistry of food. **J.L. Marshall**

10:20 1005. Implementation of a food component into a non-majors chemistry course. **T.F. Henshaw**

10:40 1006. Food chemistry course that gets students talking. **C. Thompson**

206-DeBartolo Lecture Hall

General Papers: Innovations in Student Engagement & Interdisciplinarity

W. J. Donovan, *Organizer*
F. Lee, C. Parsons, G. Tay, *Presiding*

8:00 Introductory Remarks.

8:05 1007. Teaching chemistry in a first-year integrated science course. **F. Lee**, D. Brock

8:25 1008. Promoting success on homework and enhancing problem-solving skills through collaborative learning. **A.T. DAgostino**

8:45 1009. Group Intelligence: an active learning exploration of diversity in (chemical) evolution. **C. Parsons**

9:05 1010. ***Withdrawn***.

9:25 Intermission.

9:40 1011. Bringing peace and justice back to the chemical classroom. **N.C. Kallan**, S.I. Chamberlin

10:00 1012. ***Withdrawn***.

10:20 1013. The chemistry of science fiction – how to reach them and teach them. **K. Kostecka**

10:40 1014. Chemicon: Using characters and consciousness to teach HS chemistry. **J. Barnes-Johnson**

201-DeBartolo Lecture Hall

George R. Hague Jr. Memorial AP Chemistry Symposium

K. A. Kitzmann, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1015. Review of the 2018 AP Chemistry exam. **P.A. Bonvallet**, K.L. Hendren, T.S. Johnson

9:25 Intermission.

9:40 1016. Updates to AP Chemistry resources. **T.S. Johnson**, K.L. Hendren, P.A. Bonvallet

10:00 1017. Implementing best practices to improve scores on the AP Chemistry exam. **K.L. Hendren**, P.A. Bonvallet, T.S. Johnson

10:20 Discussion.

10:40 Concluding Remarks.

217-DeBartolo Lecture Hall

Green Chemistry in High School, College & University Curricula (& Beyond!): Integration of Green Chemistry & Sustainability

L. Bastin, *Organizer*
A. Dicks, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1018. Green chemistry: Preparing students to meet the grand challenges of sustainability. **K. Aubrecht**, J.E. Wissinger, E.J. Brush, J. MacKellar, M. Bourgeois

8:25 1019. Progress report on a roadmap for green chemistry education. **J. MacKellar**, J.E. Hutchison, T. Holme

8:45 1020. Green chemistry and the systems thinking connection. **T. Holme**

9:05 1021. Green chemistry as an antidote to student perceptions of powerlessness. **C.S. Lecher**

9:25 Intermission.

9:40 1022. Infusing inquiry-based green chemistry into the undergraduate laboratory and curriculum. M.A. Abdalla, M.O. Abdalla, W.E. Collier, **M.S. Reeves**, M. Tourne

10:00 1023. Greened: The journey of a college instructor in switching to "all-green" experiments in undergraduate inorganic chemistry laboratories. **M.T. Saraswathiamma**

10:20 Discussion.

215-DeBartolo Lecture Hall

Helping Students Learn How to Learn: Metacognition (& more!) in the Chemistry Classroom

P. Weiss, *Organizer*
M. D. Haak, *Organizer, Presiding*
P. Weiss, *Presiding*

8:00 Introductory Remarks.

8:05 1024. Helping students learn with metacognition: A departmental program for presenting success strategies in the classroom. **E.S. Eitrheim**, **A.L. Waters**, C.B. Frech, L.D. Montes

8:25 1025. Guiding students toward metacognition: Small things we do to get students to think about thinking while reinforcing content. **C.B. Frech**, **L.D. Montes**, E.S. Eitrheim, A.L. Waters

8:45 1026. Integrating learning strategies into general chemistry courses. M.J. Bojan, **A. Herring**

9:05 1027. Scaffolding reflection in the chemistry classroom. **H. Park**

9:25 Intermission.

9:40 1028. Effect of post-exam workshop on learning strategies on subsequent exam scores. **P. Weiss**

10:00 1029. Using assigned readings to advance reading skills in the introductory chemistry class. **R.K. Hayes**

10:20. 1031. Use of Vee Mapping Technque as a metacognitive strategy on gender-related differences in teaching chemistry students in secondary schools in Ondo State, Nigeria. **A.O. Omoniyi**, **O.O. Olajide**

129-DeBartolo Lecture Hall

One-pot Synthesis for Student Success in General Chemistry: Identifying At-Risk Students & Curricular Changes

V. M. Williamson, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1032. Identifying the underprepared first-semester general chemistry I student. **D.S. Mason**

8:25 1033. Identifying the topics posing disproportionate challenges to at-risk students in chemistry. **V.R. Ralph**, S.E. Lewis

8:45 1034. Diagnostic identifiers of at-risk students in first and second semester general chemistry. **W.K. Willis**, V.M. Williamson

9:05 1035. Using ALEKS for placement in general chemistry. **K. Mock**

9:25 Intermission.

9:40 1036. Stretching a first semester general chemistry course to two semesters: A potential remedy for underprepared university students. **S. Testa**

10:00 1037. Lessons learnt from developing and implementing an integrated general chemistry: College algebra course. **Y. Law**, K.A. Campbell, R.L. Roswell, N. Wilson

10:20 1038. Implementation of a preparatory general chemistry course to improve success of first year college students. **K.L. Stone**

10:40 Panel Discussion.

207-DeBartolo Lecture Hall

Qualitative Research in Chemical Education: In Pursuit of Whys & Hows

S. C. Ryan, *Organizer*
T. J. Bussey, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1039. Analysis of patterns in chemical education and engineering education research. **G.M. Bodner**

8:45 1040. From manipulatives and drawings to codes: A grounded theory approach. **S.C. Ryan**

9:25 Intermission.

9:40 1041. Use of pen and paper technology to capture students' thoughts while drawing. **K.J. Linenberger Cortes**, E. Estime

10:20 1042. Data-driven qualitative research: Developing and implementing a novel data collection method for accessing geographically diverse participants and eliciting their ideas. **J.M. Pratt**, E.J. Yezierski

204-DeBartolo Lecture Hall

Research-based Activities in Chemistry Classroom & Laboratory

M. Li, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1043. Incorporating research into a traditional laboratory course. **M. Hunnicutt**

8:25 1044. Global adaptation of a research-oriented *Scientific Writing* course: From Missouri to China. **R. Glaser**, **K. Yang**

8:45 1045. Five years in: Assessing the impacts of CUREs at three regional institutions. **E.M. Bowers**, K. Klay, B.S. Harkness, D.S. Karpovich, D.J. Lecaptain, T. Sivy, J. VanHouten, J.H. Tomasik

9:05 1046. Great Lakes environmental chemistry research an applied activity: Professionals helping high schoolers help the elementary students. **R. Adams**, D.J. Lecaptain, J.H. Tomasik

9:25 Intermission.

9:40 1047. Development and implementation of a course-based undergraduate research experience in quantitative analysis laboratory. **K.R. Evans**, K.C. Lanigan, E. Roberts-Kirchhoff

10:00 1048. The development, implementation, and formalization of an enhanced general chemistry sequence at Oregon State University. **R.L. Nafshun**

10:20 1049. Integration of the Agilent Seahorse into the advanced undergraduate chemistry laboratory. **A.H. Gorensek-Benitez**, S.B. King, A. King

10:40 Concluding Remarks.

209-DeBartolo Lecture Hall

Teaching Large Classes: The Good, The Bad, & The Ugly

A. Paterno, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1279. Chemistry meets theatre: Using music, animations, videos, skits, and props to foster student engagement in a large classroom. **T. Pontius**

8:25 1280. Connecting with students in a large enrollment general chemistry course. **D.B. King**

8:45 1281. Large classes, manipulatives and accessability: Making it work. **S.M. Taylor**

9:05 1282. Nation building in a large enrollment class. **J. Suchocki**

9:25 Intermission.

9:40 1283. Teaching a large lecture nonmajors organic chemistry class at Saint Louis University. **E.L. Whitteck**

10:00 1284. Using student collaboration and technology to improve success in large general chemistry classes. **A. Graham**

10:20 1285. Incorporating active learning into a large lecture class. **D. Sokic-Lazic**

10:40 1286. Engaging large classes using ALEKS, Chem101 app, and Dropthought. **A. Paterno**

216-DeBartolo Lecture Hall

Teaching Transferable Skills in the Chemistry Laboratory Curriculum: Real Research, Real Training

R. Georgiadis, *Organizer*
B. Abrams, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1050. Advanced inorganic chemistry laboratory at Fairfield University. **J.R. Miecznikowski**

8:25 1051. Increasing student engagement through problem solving in senior chemistry labs. **M. Worden**

8:45 1055. Ensuring a successful transition from being a chemistry student to a professional chemist: Redesigning an 'introductory biochemistry laboratory' curriculum for chemistry majors with a guided focus on transferable skills. **D. Vardar-Ulu**

9:05 1052. Investigative lab: Engaging students in unique laboratory experiences throughout the curriculum. **L.H. Mielke**, D.J. Styers-Barnett, K. Weber Stickney, B. Neal, K. Vanfossen

9:25 Intermission.

9:40 1053. Taking a futuristic approach to acquiring research level skills in upper level chemistry laboratories. **V. Monga**, E. Gillis, K. Knox

10:00 1194. Virtual machines: A new way to teach transferable skills in the advanced undergraduate laboratory. **R. Georgiadis**

10:20 1056. Teaching instrumentation with virtual machines: Case study and demonstration. **K. Streu**

10:40 Panel Discussion.

138-DeBartolo Lecture Hall

The 3 Ps of Student Engagement in the Flipped General Chemistry Classroom: Preparation, Participation, & Performance

L. Hibbard, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1057. Improving course flipping over a decade: the efficacy of peer mentoring in improving participation in the general chemistry flipped classroom. **D.J. Casadonte**, A. Miller

8:25 1058. Motivating factors in the flipped classroom: What students are telling us. **D.J. Casadonte**, D. Brandon

8:45 1059. Similar but different: Comparing the flipped learning environment across general chemistry courses. **E. Geye**, R. Komperda, A. Isom, M.M. Phillips, J. Barbera

9:05 1060. Assessing the motivational impacts of the flipped chemistry classroom environment: A multi-institution study. **J. Barbera**, M.M. Phillips, K.D. Duck

9:25 Intermission.

9:40 1061. Flipping out: Groupwork and individual learning in a general chemistry course. **K. Downey**

10:00 1062. Do flipped classrooms and active learning environments work for HBCU general chemistry courses? **M. Tourne**

10:20 1063. Improved engagement and outcomes? The rest of the story. **A.S. Soult**, K.R. Woodrum

10:40 1064. Retrospective look after seven years of the flipped classroom model in a general chemistry course at an HBCU and a community college. **C.M. Taylor**

311-DeBartolo Lecture Hall

Updating the American Chemical Society's Guidelines for Programs that Offer the Bachelor's Degree

Cosponsored by CPT
M. M. Brooks, *Organizer*
E. A. Arriaga, S. A. Reid, B. A. Reisner, R. W. Schwenz, *Presiding*

8:00 Introductory Remarks.

8:05 1065. Enhancing curricular assessment of ACS approved programs. **E.A. Arriaga**

8:25 1066. Student skills statements in the ACS Guidelines for Professional Education in Chemistry. **R.W. Schwenz**

8:45 Discussion.

9:25 Intermission.

9:40 1067. Making a difference: Getting an undergraduate degree from an ACS approved program. **B.A. Reisner**

10:00 1068. Revisiting the evaluation procedures and ACS guidelines for Bachelor's degree programs. **S.A. Reid**

10:20 Discussion.

WEDNESDAY AFTERNOON

203-DeBartolo Lecture Hall

3D Printing in Chemistry Education

C. Adams, A. Leontyev, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 1069. Enriching laboratory learning with inexpensive 3D printed analytical instruments: New designs and activities for active-learning opportunities across the curriculum. **L.A. Porter**

2:25 1070. 3D printing new models for chemical education. **F.A. Carroll**, D.N. Blauch

2:45 1071. 3D printed models for teaching protein primary and secondary structure. **S.M. Kerwin**

3:05 Panel Discussion.

210-DeBartolo Lecture Hall

Addressing Underrepresented Groups in STEM

D. Cruz-Ramirez de Arellano, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1072. Examining the accessibility of curricular materials for general chemistry using the universal design for learning framework. **T. Legron-Rodriguez**, E. Scanlon, J. Schreffler, E. Ibadlit, E. Vasquez, J.J. Chini

2:25 1073. Rasch Analysis of a climate change survey among deaf students. **A.D. Ross**, S. Smith, T.E. Pagano

2:45 1074. Making introductory chemistry course instruction accessible to blind/low-vision students. **A.T. D'Agostino**

3:05 1075. Increasing accessibility through multi-sensory approaches for teaching chemistry to blind students. **A.E. Neybert**, R.W. Schwenz

3:25 Intermission.

3:40 1076. Applying the pyramid of student success in a chemistry course. **J.R. MacArthur**

4:00 1077. Opening access, engendering success: Lessons learned in support of underrepresented students in AP-TIP IN. **K. Morris**

4:20 1078. Identity work of resettled Burmese refugee youth in an afterschool STEM program. **C.E. Wright**, **M. Tuvilla**, M. Ryu

4:40 1079. Addressing underrepresented group in STEM: Nigeria case. **K. Oloruntegbe**

126-DeBartolo Lecture Hall

Alternative Ways to Teach Important Concepts in Organic Chemistry

K. B. Himmeldirk, *Organizer*
K. Pate, *Presiding*

2:00 Introductory Remarks.

2:05 1080. Effectiveness of flipped problem classes and discussion to assist case-study teaching of synthesis. **R.A. Blackburn**

2:25 1081. Writing-to-learn: An alternative way to teach important concepts in organic chemistry. **J.A. Schmidt-McCormack**, G.V. Shultz, A. Gere, A.S. Karlin, A. Sattar, B.C. Thompson

2:45 1082. Innovative, proven techniques for teaching difficult concepts of organic chemistry. **B. Van Kuiken**

3:05 1083. The chemistry-theatre nexus: a transdisciplinary approach for learning in chemistry. **C. Thompson**

140-DeBartolo Lecture Hall

Applications of Learning How to Learn in the Chemistry Curriculum

S. R. Esjornson, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1084. Promoting learning and engagement with short, informal writing activities: Lessons learned after four years of writing-to-learn in general chemistry. **K.T. Ziebart**

2:25 1085. Supporting student learning with rubrics to provide feedback on critical thinking, information processing, and written communication. **G.J. Reynders**, R.S. Cole, C.L. Stanford, J. Lantz, S.M. Ruder

2:45 1086. Mapping out a complex learning landscape: Writing about it helps students find their way. **S.R. Esjornson**

3:05 1087. Measuring far transfer: How well can students apply energy concepts first learned physics, to chemistry? S. Fowler, **E.J. Borda**, A. Harding

3:25 Intermission.

3:40 945. Integrating learning theory into metacognitive instruction using manipulatives. **D.R. Sullivan**

4:00 1089. Art in general chemistry: Impetus for engaged and active learning. **G.R. Khalsa**

4:20 1090. Connecting students to chemistry through art in the liberal arts classroom. **S.E. Hubbard**

4:40 Discussion.

213-DeBartolo Lecture Hall

Biochemistry Education: Discussions of the Laboratory Environment

K. J. Linenberger Cortes, *Organizer, Presiding*
C. R. Terrell, *Presiding*

2:00 Introductory Remarks.

2:05 1091. Teaching general chemistry laboratory courses through research driven biochemistry courses: What works & what doesn't. **S. Ray**, C. Xiao

2:25 1092. Lessons learned from creating an advanced biochemistry laboratory course for multiple majors. **J.W. Karr**

2:45 1093. Implementation of POGIL in the undergraduate biochemistry laboratory. **K.R. Willian**

3:05 1094. Can blended instruction provide a customized biochemistry teaching laboratory experience? **D. Vardar-Ulu**

3:25 Intermission.

3:40 1095. Shift to authentic experiments in student biochemistry lab. **A.K. Sikora**

4:00 1096. Bacterial carbohydrate metabolism: Inquiry-driven biochemistry and molecular biology experiments for investigative learning. **G. Periyannan**

4:20 1097. Protein *N*-Glycans: Incorporating glycochemistry into the undergraduate laboratory curriculum. **V. Kohout**, J.K. Robinson, N.L. Pohl

4:40 1098. Fluorescence spectroscopy and protein binding analysis for real time tracking of fluorescent protein expression. **R.E. Connor**

138-DeBartolo Lecture Hall

Building Bridges and 2YC3 Collaborations: Supporting the Transition of Two Year Students to Four Year Programs

T. T. Duplessis, K. A. Kitzmann, P. Larkowski, *Organizers*
L. J. Anna, A. L. Miller, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 1099. Cultivating chemistry connections for community college students (4Cs) at UC San Diego: Lessons learned from a NSF-REU program. **S. Brydges**, H. Weizman

2:25 1100. Computational chemistry as a bridge to community college research and education. **S.E. Mason**, I. Metz

2:45 1101. Using a maker space and high-altitude ballooning to build student research skills and support degree completion. **T.B. Higgins**

3:05 1102. Building bridges through shared instrumentation. **C.J. Stromberg**, **W. Nellis**, K.H. Bennett, D. Ellis, P. Wood, P. Sheppard, G. Patterson

3:25 Intermission.

3:40 1103. Computational molecular modeling at community colleges via a partnership with the University of Wisconsin-Madison. M.A. Zdanovskaia, B.J. Esselman, N.J. Hill, **C.E. Schwartz**, **A.D. Habib**

4:00 1104. Computational chemistry in community college education and research: Learning about periodic trends and materials design from first principles calculations. **I. Metz**, J.W. Bennett, S.E. Mason

4:20 Panel Discussion.

4:40 Concluding Remarks.

208-DeBartolo Lecture Hall

Course-Embedded Research Experiences in the First & Second Year Curriculum

First-Year Experiences

B. Harmon, *Organizer*
N. L. Powell, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1105. The synergy of course-embedded high school and college research. **D.H. Murray**

2:25 1106. End of the year projects; twenty years of helping students accumulate sufficient failure. **B.W. Baldwin**, T.S. Kuntzleman

2:45 1107. Incorporating a mini-research project into general chemistry lab. **R. Heitmann**

3:05 1108. Course-based research on crystal growth and crystallography for the first-year chemistry laboratory. **S.E. Shaner**, **M.R. Bond**, R. Morgan Theall

3:25 Intermission.

3:40 1109. A full semester class-based investigation of halide perovskites in general chemistry. **T. Weaver**, P. Woodward, K.A. Moga, J.W. Uebler, T.M. Clark

4:00 1110. Using soil analysis and archaeology as a course-embedded first-year chemistry research experience. **D.A. Storer**

4:20 1111. Scientific Computing to incorporate research in freshman curriculum. **A.K. Sharma**

316-DeBartolo Lecture Hall

Creativity in the Classroom: Games & Manipulatives that Encourage Learning

S. Pierce, T. J. Terry, *Organizers, Presiding*

2:00 Introductory Remarks.

2:05 1112. Playing a cooperative ^{1}H NMR board game during office hour: Lessons learned. **Z. Thammavongsy**

2:25 1113. *Chemcompete-I*: A chemistry card game for substitution and elimination reactions of alkyl halides. **D. Jaber**

2:45 1114. Halogens and hydrocarbons: Simple tricks to discuss complex chemical concepts. **J.E. Becvar**, M.D. Alexander

3:05 1115. SpatialAR: Augmented Reality game for learning molecular structure. **J. Winter**

3:25 Intermission.

3:40 1116. Using Nerf® guns to explain equilibrium. **T.L. Troyer**

4:00 1117. Escape challenges and other puzzles in a high school chemistry classroom. **H. Park**

4:20 1118. Exam review in advanced inorganic chemistry based on Jeopardy. **D.L. Swartz**

4:40 1119. Start them off smiling by using games to review prerequisite topics. **T.J. Terry**

214-DeBartolo Lecture Hall

Finalizing Education of Chemistry Majors: How Do We Better Prepare Chemistry Graduates for Careers in Industry & Graduate School?

B. H. Milosavljevic, *Organizer*
M. K. Maron, *Presiding*

2:00 Introductory Remarks.

2:05 1120. Shaping your students for graduate school success. **J.B. Lampe**

2:25 1121. Completing education of chemistry majors: Experience in physical chemistry at Penn State. **B.H. Milosavljevic**

2:45 1123. Scientists across the disciplines: Preparing chemistry majors for careers in academia, industry, and so much more. **O.M. Chesniak**

3:05 Discussion.

310-DeBartolo Lecture Hall

Food Chemistry

K. D. Symcox, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1124. Everybody eats: Using food as a theme in general education science courses. **J.L. Hawk**

2:25 1125. Bringing chemistry to the kitchen: Making and eating food as a way to learn chemistry. **A. Herring**, J.T. Keiser

2:45 1126. Microwave-assisted transesterification of cooking oils and the GC-MS determination of their fat content. **I. Larraza**, R. Malko

3:05 1127. Active learning through a poster presentation on chemical ingredients of oils, edible flowers and herbs: An activity in a large undergraduate chemistry class. **V. Gupta**, S. Kumar, M. Nigam

3:25 Concluding Remarks.

204-DeBartolo Lecture Hall

General Papers: Active Learning & Student Engagement

W. J. Donovan, *Organizer*

2:00 Introductory Remarks.

2:05 1128. Learning through competitive fun in PLTL workshop. **S. Chen**, **D. Chairez**, **R. Floresca**, G.B. Saupe, M. Narayan, J.E. Becvar

2:25 1129. A collaborative and virtual learning environment for professors and students. **J. Biagi**, A. Stracz

2:45 1130. Engaging students with error analysis problems. **J.E. Leibold**

3:05 1131. Active learning in the classroom: Lessons learned and best practices to increase student engagement. **M.W. Stoltzfus**

3:25 Intermission.

3:40 1132. Chem101: Using smart suggestions as a novel digital Input method for chemical nomenclature, formulae, and reactions to enable active learning assessments in First-Year Chemistry. **J.B. Weinberg**

4:00 626. ***Withdrawn***.

4:20 1134. InRIGORating science notebooks using Dinah Zike's Foldables^{R} for strong communication skills. **R. Meyer**

4:40 Discussion.

206-DeBartolo Lecture Hall

General Papers: GOB Courses & Working with General Education, Agriculture & Non-STEM Students

W. J. Donovan, *Organizer, Presiding*
J. Kim, J. P. Moerdyk, *Presiding*

2:00 Introductory Remarks.

2:05 1135. Math preparation for a GOB course as a predictor of success. **W.J. Donovan**

2:25 1136. Using Calibrated Peer Review™ (CPR) to teach scientific writing and critical thinking skills in an introductory chemistry (GOB) course. **B. Lybbert**

2:45 1137. Problem solving in chemistry: Using flipped classroom and Voice Thread. **S. Narayan**

3:05 1138. ***Withdrawn***.

3:25 Intermission.

3:40 1139. Emphasizing relevance in a general chemistry course for Agriculture and Health and Human Science majors. **C. Harwood**, M.H. Towns

4:00 1140. Haber-Bosch: A liberal arts and summative assessment for a one semester general chemistry course. **J.P. Moerdyk**

4:20 1141. Engaging non-science majors in chemistry. **J. Kim**

4:40 1142. Student generated connections to chemistry content to engage non-science majors. **M. Hands**

311-DeBartolo Lecture Hall

General Papers: Issues & Advances in High School Chemistry

W. J. Donovan, *Organizer*
L. Giammatteo, R. W. Schwenz, *Presiding*

2:00 Introductory Remarks.

2:05 1292. Revamp of district chemistry curriculum and implementation of MSS. **D.S. Meyers**

2:25 1293. Helping teachers support molecular-level understanding under the NGSS. **R. Stowe**, M. Cooper, D.G. Herrington

2:45 1294. Untangling chemical bonds and intermolecular forces in AP and General Chemistry. **L. Hoyt**

3:05 1295. Differences between teaching AP chemistry and college general chemistry for atomic structure and periodic properties. **R.W. Schwenz**, S. Thompson

3:25 Intermission.

3:40 1296. Facilitating and supporting a constructivist approach to Professional Development: Insight from six high-school Chemistry teachers. **A. O'Dwyer**

4:00 1297. Assessing chemistry laboratory skills through a competency-based approach in a high-school chemistry course. **L. Giammatteo**, A. Obaya

4:20 Discussion.

201-DeBartolo Lecture Hall

George R. Hague Jr. Memorial AP Chemistry Symposium

K. A. Kitzmann, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1143. Using manipulatives to enhance student understanding of particulate representations in AP Chemistry. **K.K. Holley**

2:25 1144. Using USNCO labs in AP Chemistry. **M.A. Morgan**

2:45 1145. Beyond the cookbook: Adding elements of inquiry to your favorite labs. **L. Cummings**

3:05 Panel Discussion.

3:20 Concluding Remarks.

217-DeBartolo Lecture Hall

Green Chemistry in High School, College & University Curricula (& Beyond!): Green Chemistry In International High Schools

A. Dicks, *Organizer*
L. Bastin, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1146. Creation of a network for the insertion of green chemistry in the curriculum of the various modalities of education of the State of Rio de Janeiro. **F.A. Schoene**, P.R. Seidl, A. Marciniak, L.A. Gomes, L.B. Furtado

2:25 1147. Integrating green chemistry concepts into the senior secondary school chemistry curriculum to promote an environmentally acceptable chemistry curriculum in Nigeria. **A.O. Omoniyi**

2:45 1148. Promoting environmental sustainability through green chemistry: Pre-service and in-service chemistry teachers' knowledge and attitude in Lagos State. **A.S. Adesina**, T.E. Owoyemi

3:05 1149. Green chemistry: Creating wealth from waste. **E.O. Ayeni**, K. Oloruntegbe

202-DeBartolo Lecture Hall

How Do We Know That?

L. Dukerich, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1150. Chemical thinking through models. **V. Talanquer**, J.R. Pollard

2:25 1151. Moving from moles to compounds: How? **L.E. Slocum**

2:45 1152. Ionic and molecular compounds: Helping students develop an evidence based model to differentiate these compounds and their properties. **C. Montero**

3:05 1153. What ions are formed? **L. Dukerich**

3:25 Intermission.

3:40 1154. How do electrons populate energy levels: A student-developed model. **B.R. Royce**

4:00 1155. Replacing the Bohr atomic model with an accessible picture of how atoms and light truly interact. **B. Abrams**

129-DeBartolo Lecture Hall

One-pot Synthesis for Student Success in General Chemistry: Course Innovations for Success

V. M. Williamson, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1156. Amplifying the basics: Mathematics scaffolding and atoms-first curriculum. **C.B. Powell**

2:25 1157. Transformation and interventions for at-risk students. **D. Rush Walker**

2:45 1158. How does timing of homework completing effect retention of knowledge in general chemistry? **M.N. Cosio**, V.M. Williamson

3:05 1159. Allowing students to have VOICES (Voluntary Options In Chemical Education Schedules) in general chemistry I. **R.L. Ford**, D.S. Mason

3:25 Intermission.

205-DeBartolo Lecture Hall

Overcoming challenges through science outreach. Bringing positive science experiences to non-traditional audiences.

G. R. Wyllie, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1160. The importance of positive STEM education in rural communities. **M.J. Crawford**

2:25 1161. Crafting a semester long science program for local high school students with intellectual disabilities. **G.R. Wyllie**, R. Fettig

2:45 1162. Non-visual ways to conduct acid base titrations by blind students. **C.A. Supalo**

3:05 Discussion.

3:20 Concluding Remarks.

136-DeBartolo Lecture Hall

Present & Future Directions in Organic Chemistry Laboratory Courses

N. M. Paul, *Organizer, Presiding*
C. Callam, *Presiding*

2:00 Introductory Remarks.

2:05 1163. Incorporating mini-laboratory projects based on major organic reactions in the organic chemistry laboratory curriculum. **R.N. Manchanayakage**

2:25 1164. Multi-step chiral synthesis module for a second-semester organic instructional laboratory. **S. Murphree**

2:45 1165. Using inquiry-based experiment design to increase student interest in large organic chemistry laboratories. **L.M. Goldman**

3:05 1166. Modelling an authentic research experience: A "plan-your-own" alcohol oxidation laboratory. **A. Dicks**

3:25 Intermission.

3:40 1167. Undergraduate laboratory assistants in large enrollment organic chemistry laboratories. **M.A. Patwardhan**, A.N. French, S. Saryazdi, A. Riddle

4:00 1168. Improved writing of organic laboratory reports with guided, interative practice. **C.S. Bagwill**, J. Hartling

4:20 1169. Gauging the impact of organic chemistry REActivities at a four-year and a two-year institution. **J.P. Anderson**, **D.L. Newman**, B.L. Edelbach, T.G. Goudreau Collison, J.A. Cody

4:40 1170. The use of ChemDraw throughout the organic laboratory curriculum. **R.J. Yoder**, C.S. Callam, N.M. Paul

207-DeBartolo Lecture Hall

Qualitative Research in Chemical Education: In Pursuit of Whys & Hows

T. J. Bussey, *Organizer*
S. C. Ryan, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1171. Evolution of a qualitative study - vacation needed. **R.M. Kelly**

2:45 1172. Computer-aided variation analysis of dynamic external representations: Development and refinement of a qualitative protocol for data collection and analysis. **T.J. Bussey**

3:25 Intermission.

3:40 1173. Writing in the STEM classroom: Faculty conceptions of writing and its role in the undergraduate classroom. **A.C. Moon**, A. Gere, G.V. Shultz

4:20 1174. Characterizing the nature of classroom discourse. **R.S. Cole**

215-DeBartolo Lecture Hall

Research at the Interface of Chemistry & Mathematics Education

K. Bain, M. H. Towns, *Organizers*
J. G. Rodriguez, *Organizer, Presiding*
K. Bain, *Presiding*

2:00 Introductory Remarks.

2:05 1175. Student understanding of catalysts and half-life in the context of zero-order chemical kinetics. **K. Bain**, J.G. Rodriguez, M.H. Towns

2:25 1176. Mathematical knowledge for teaching in chemistry. **L.A. Posey**, P. Mosley, V. Kuechle, K. Bieda

2:45 1177. Embedded math in chemistry: A case study of students' attitudes and mastery. **A.M. Preininger**

3:05 1178. Use of symbolic forms to characterize students' understanding of mathematical expressions in chemical kinetics. **S. Santos-Diaz**, J.G. Rodriguez, K. Bain, M.H. Towns

3:25 Intermission.

3:40 1179. Investigating general chemistry and physical chemistry students' probabilistic reasoning about the electronic structure of the atom. **Z. Allred**, S. Bretz

4:00 1180. Learning to read spectra: Teaching decomposition with Excel in a scientific writing course. **R. Glaser**, A. Muelleman

4:20 1181. Covariational reasoning and mathematical narratives: Investigating students' understanding of graphs in chemical kinetics. **J.G. Rodriguez**, K. Bain, S. Santos-Diaz, F. Ho, M.H. Towns

209-DeBartolo Lecture Hall

Teaching Large Classes: The Good, The Bad, & The Ugly

A. Paterno, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1182. Encouraging student involvement in a large, flipped general chemistry courses using online and in class immediate feed back techniques. **J. Thota**

2:25 1183. Honoring individual teaching philosophies in a coordinated introductory chemistry program. **C. Shepler**

2:45 1184. Supporting learning outside the large lecture hall with rich digital assets: Developing, curating, and disseminating your own online textbook. **P. McCord**

3:05 1185. Teaching for a thousand: Content delivery and exam format strategies for a large-enrollment introductory chemistry course. **E. Pelton**

3:25 Intermission.

3:40 1186. Exploring differences in the assignment of partial credit among chemistry faculty. **C. Kashian**, N.J. Barrows

4:00 1187. Online exam retakes: Improving student attitudes toward large lecture classes by turning an assessment tool into a learning opportunity. **C. Ray**, J. Tomkin

4:20 1188. Methods for creating algorithmic and mathematical problems in course management systems for low-stakes testing. **C.C. Raymond**

4:40 1189. Using JoVE science education videos in a large introductory chemistry course. **R. Ramachandran**, E.M. Sparck

216-DeBartolo Lecture Hall

Teaching Transferable Skills in the Chemistry Laboratory Curriculum: Real Research, Real Training

B. Abrams, *Organizer*
R. Georgiadis, *Organizer, Presiding*

2:00 Introductory Remarks.

2:05 1190. Chemistry inside and out: Engaging students in water chemistry as a course and research program. **N.A. Law**, J.T. Sprague, B.L. Brabetz

2:25 1191. Teamwork training as transferable skills in the chemistry laboratory. **D. Marincel**, M.L. Gilbertson, D. Reyes, E. Salas

2:45 1192. Developing data interpretation skills of undergraduates by correlating honors general chemistry laboratory experiments to primary chemistry literature. **S. Mitra**, S. Garrett-Roe, E.P. Wagner

3:05 1054. Stop writing/teaching lab reports: integrating authentic research-based writing into quantitative analysis courses. **B. Abrams**

3:25 Intermission.

3:40 1193. Students as scientific communicators: Hybridizing workshops from cCWCS and the Alan Alda Center for Communicating Science. **K. Downey**

4:00 1195. Bringing everything together: A chemistry capstone course. **H.V. Clontz**, C.E. Dahm

4:20 1196. Incorporating research training into an advanced laboratory course. **S.M. Kennedy**

4:40 Panel Discussion.

THURSDAY MORNING

210-DeBartolo Lecture Hall

Addressing Underrepresented Groups in STEM

D. Cruz-Ramirez de Arellano, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1197. BioCoRE: cultivating scientists from underrepresented groups. **D.A. Canelas**

8:25 1198. From "underrepresented" to "present", an effort to increase diversity in STEM-research. **K.J. Friedrich**, C.S. Chow, **K.R. Evans**

8:45 1199. Teaching chemistry through research driven course at an early college level: Challenges & successes. **S. Ray**, C. Xiao

9:05 1200. Early research: Strategy for inclusion and student success. **D.H. Murray**

9:25 Intermission.

9:40 1201. Implicit biases for evaluating teaching assistants in chemistry: How does gender and ethnicity impact perceptions of hireability and competence? **R.P. Beeton**, S. Hilwig

10:00 1202. Understanding the experiences of STEM doctoral students from underrepresented minority groups. **M.G. Grunert Kowalske**, A. Proper, K. Tullis, T. Bryson

10:20 1203. The impact of advisor mentoring styles on black women advisees at predominantly white institutions. T. Bryson, **M.G. Grunert Kowalske**

10:40 1204. The social support networks of underrepresented minority STEM graduate students. **K. Tullis**, M.G. Grunert Kowalske

214-DeBartolo Lecture Hall

Building a Culture of Learning for Chemistry Students

D. Albert, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1205. Understanding the 'quality' of peer-to-peer computer-supported collaborative communities in undergraduate science students studying freshman chemistry and physics. **C. Randles**, G.M. Bodner, H.R. Riggle, Y. Chen

8:25 1206. Using the Google GSuite for Education to build a culture of collaboration and creation. **M. Ogden**

8:45 1207. Culture through community: Engaging activities that build lasting relationships with students. J. Phillips, **S. Pierce**

9:05 1208. Investigating the effects of an advanced majors program on student success and sense of community in the general chemistry sequence. **M.L. Head**, J. Louten, K.J. Linenberger Cortes, C.R. Dockery

9:25 Intermission.

9:40 1209. "ChemDiscovery": A freshman-level small-group term project. **S.A. Dandekar**

10:00 1210. Improving student learning in a challenging organic chemistry class through transparent teaching, better student preparation and self-assessment. **H. Zhao**

10:20 1211. Fostering a self-motivating culture of study: The halbe Stunde program. **L.A. Barnhurst**

10:40 Panel Discussion.

138-DeBartolo Lecture Hall

Building Bridges and 2YC3 Collaborations: Supporting the Transition of Two Year Students to Four Year Programs

L. J. Anna, K. A. Kitzmann, A. L. Miller, *Organizers*
T. T. Duplessis, P. Larkowski, *Organizers, Presiding*
K. E. Carrigan, *Presiding*

8:00 Introductory Remarks.

8:05 1212. Forging an unlikely bond: Chemistry and english for STEM majors. **K. Dailey**, M. King

8:25 1213. Save the (due) date! **D.A. Allen**

8:45 1214. One semester allied health (GOB) chemistry at an urban community college. **A.R. Babij**

9:05 1215. Leveraging your location, location, location. **T.J. Terry**

9:25 Intermission.

9:40 1216. Remedial chemistry at Bronx Community College. **J. Molina**

10:00 1217. Changes I have made to improve my online chemistry class. **X. Hood**

10:20 Discussion.

10:40 Concluding Remarks.

202-DeBartolo Lecture Hall

Chemical Education Xchange: Engaging with Contributors

J. L. Holmes, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1218. ChemEdX: Engaging with a secondary science contributor. **D.S. Meyers**

8:25 1219. "Atomsmith": A resource for high school chemistry teachers. **C. Husting**

8:45 1220. Standards-based grading in the chemistry classroom. **L. Stewart**

9:05 1221. Small research projects in the chemistry classroom. **T.S. Kuntzleman**, B.W. Baldwin

9:25 Intermission.

9:40 1222. Building a culture of learning. **E. Posthuma-Adams**

10:00 1223. History, philosophy, and radio programs: Unique activities to help students understand the real nature of science. **K. Underwood**

10:20 1224. Using gas phenomenon to drive inquiry in the introductory chemistry classroom. **R. Johnson**

10:40 Discussion.

208-DeBartolo Lecture Hall

Course-Embedded Research Experiences in the First & Second Year Curriculum: Second-Year Experiences

N. L. Powell, *Organizer*
B. Harmon, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1225. A model for a sophomore level research class. **H.V. Clontz**, C.E. Dahm, K.R. Wilson

8:25 1226. PolyCURE: A course-based undergraduate research experience focused on the synthesis and characterization of novel biomedical polymers. **J.R. Boothe**, J. Spencer, G.V. Shultz

8:45 1227. Bioorganic chemistry of Eumelanin: A course-based research experience. **J.M. Belitsky**, A.H. Aebly, D.P. Hua, L.M. Ryno

9:05 1228. What happens when things do not work? Understanding laboratory research problems and finding ways to surmount them. **K. Vaughan**

9:25 Intermission.

9:40 1229. Embedded research in a lower-division organic chemistry lab course. **L.J. Silverberg**, J. Tierney, K.C. Cannon

10:00 1230. Building laboratory fundamentals and fostering undergraduate research utilizing biochemical promiscuity. **S.I. Chamberlin**

10:20 Roundtable Discussion.

207-DeBartolo Lecture Hall

Discourse Frameworks in Active Learning Chemistry Classrooms

M. Ryu, *Organizer*
A. C. Moon, L. Shah, *Organizers, Presiding*

8:00 Introductory Remarks.

8:05 1231. Effects of classroom design on general chemistry instructors' discourse. **M. Herridge**, V. Talanquer

8:25 1232. Different settings? let us talk: Examining individual student discourse across different social environments. **M.T. Montgomery**, R.S. Cole

8:45 1233. Insights learned from discourse analysis in two different high school learning settings. **M. Ryu**

9:05 1234. How changing discourse patterns in general chemistry classes changed our learning goals and exams. **E.M. Kowalski**, M.Z. Kalainoff

9:25 Intermission.

9:40 1235. Talking the talk: Investigating the use of a mixed-reality teaching simulator to enhance graduate teaching assistant discourse moves in active learning environments. **E. Saitta**, C.M. Doty, D. Nguyen, J.J. Chini

10:00 1236. Professional development of peer leaders in general chemistry with the use of Toulmin's argumentation framework. **U. Kulatunga**

10:20 1237. Talking through the problems: A study of discourse in peer-led small groups. **R. Frey**, M. Repice

10:40 Panel Discussion.

203-DeBartolo Lecture Hall

General Papers: Advances in General Chemistry Lecture & Lab

W. J. Donovan, *Organizer*
M. Hands, A. B. Rives, *Presiding*

8:00 Introductory Remarks.

8:05 1238. Putting thermodynamics earlier and more often in the general chemistry curriculum. **A.B. Rives**

8:25 1239. Implementation of a chemistry laboratory activity to provide context for chemistry content. **M. Hands**

8:45 1240. Engaging students with infographics in the general chemistry laboratory. **K. Mahoney**

9:05 1241. Three kinetics experiments in one using an inexpensive light meter. **R.E. Nalliah**

9:25 Intermission.

9:40 1242. Reimagining the material science tetrahedron. **C.J. Donahue**

10:00 1243. Automated questions using Google forms. **D. Dyck**

10:20 1244. Chemistry demonstration day of the picture. **P. Stemple**

10:40 Discussion.

204-DeBartolo Lecture Hall

General Papers: Data-Driven Decisions: Research & Curriculum Reform

W. J. Donovan, *Organizer*
A. A. Carter, A. B. Ormond, *Presiding*

8:00 Introductory Remarks.

8:05 1245. Using a departmental review to spearhead curriculum changes at a small, women's liberal arts college. **A.A. Carter**, **A.B. Ormond**

8:25 1246. Testing inter-rater consistency for grading exams in in large classes in real time. **M. Moore**, D. Thomas

8:45 1247. Exploring the student "disconnect" between vocabulary and visualization questions involving intermolecular forces and changes of state. **M.E. Jewell**

9:05 1248. ***Withdrawn***.

9:25 Intermission.

9:40 1249. Use and interpretation of hierarchical linear modeling. **J. Tashiro**

10:00 1250. Incorporating neuroscience mini-lessons to become a better learner. **B. Meacham**

10:20 Discussion.

129-DeBartolo Lecture Hall

Performance Expectations in General Chemistry

D. J. Wink, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1251. The ACS General Chemistry Performance Expectations (GCPE) program: From task force to community. **D.J. Wink**, S. Pazicni, A. Donovan

8:25 1252. Redesign of instruction and assessment of chemical kinetics in general chemistry II: improving student learning via practice-oriented performance expectations. **A. Villalta-Cerdas**, **D. Thompson**, **C. Zall**

8:45 1253. Incorporation of a performance expectation into the general chemistry curriculum at a metropolitan university without a chemistry graduate program. **J.P. Darr**, J.A. Conrad, D.L. Richter-Egger

9:05 1254. A general chemistry performance expectation for molecular bonding and intermolecular interactions. L. Vuocolo, **D. Yaron**

9:25 Intermission.

9:40 1255. Transitioning from learning outcomes to performance expectations. D.R. Walker, **K. Biberdorf**

10:00 1256. Development of performance expectations for entropy. **R. Morgan Theall**, M.R. Bond, P.W. Crawford, S.E. Shaner

10:20 1257. Analysis of glass cleaners: a modified lab in GCPE. **H. Zhang**, D.J. Wink

10:40 1258. Siena College general chemistry performance expectations. **L.J. Tucker**, J.W. Karr, D.F. Moriarty

140-DeBartolo Lecture Hall

Persistence in STEM: What Can We Do To Support Students?

B. L. Gonzalez, *Organizer*
S. Villafane-Garcia, *Presiding*

8:00 Introductory Remarks.

8:05 1259. Mathematics fluency as a needed path to STEM success. **B. Mamiya**, A. Chen

8:25 1260. Use of an interdisciplinary approach to enhance the math and problem-solving skills of first-year STEM students. **A. Oxley**, M. Marsh

8:45 1261. Increase STEM persistence by creating a chemistry learning space. **A. Ma**, W. Colon, G. Korenwoski

9:05 Intermission.

9:20 1262. Chemistry self-efficacy: Assessing its relationship with teaching and learning in general chemistry. **S. Villafane-Garcia**, A.A. Solis, C. Luong

9:40 1263. Community engaged learning to improve STEM student retention. **J.L. O'Donnell**, R.E. Kassel, L.J. Tucker

10:00 1264. Using individual-level institutional data to explore persistence, trajectories and outcomes. **M.M. Walczak**, K. Ziegler-Graham

10:20 1265. Impact of curricular and non-curricular research involvement on STEM persistence in a primarily undergraduate institution. **B.L. Gonzalez**, A.M. Ruiz, M. Bolanos, S.R. Kdeiss

136-DeBartolo Lecture Hall

Present & Future Directions in Organic Chemistry Laboratory Courses

N. M. Paul, *Organizer, Presiding*
C. Callam, *Presiding*

8:00 Introductory Remarks.

8:05 1266. Chemistry in the arts: An interdisciplinary look at student-synthesized azo dyes. **K.L. Yearty**, C.N. Cortes, R.W. Morrison

8:25 1267. Multi-outcome retro and forward Diels-Alder experiment. **M. Zhang**, T. Paulsel, R.W. Morrison

8:45 1268. Revisiting the classics: Deeper analysis of alcohol oxidation and EAS nitration reactions for improved student learning. **N.J. Hill**, B.J. Esselman

9:05 1269. Investigating radical reactivity and structure-property relationships with photochemically-synthesized polymers. **M. Croisant**, S. Bretz, D. Konkolewicz

9:25 Intermission.

9:40 1270. Incorporation of modern transition metal-catalyzed C-C and C-N bond forming reactions into the upper-level organic laboratory. **N.J. Hill**

10:00 1271. Introductory exercises for the integration of computational chemistry into the undergraduate organic chemistry laboratory curriculum using WebMO. **B.J. Esselman**, N.J. Hill

201-DeBartolo Lecture Hall

Takin' it to the Streets: Chemistry Outside the Classroom

M. A. Morgan, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1272. Chemistry in academic competitions. **M.A. Morgan**

8:25 1273. ACS Chemistry Clubs: A chance to do more. **C. Morgan**

8:45 1274. Fun with Chemistry. **K. Biberdorf**

9:05 1275. Tips and tricks for creating a successful high school science club. **K.A. Kitzmann**

9:25 Intermission.

9:40 1276. Medicinal chemistry/pharmacology study abroad program for science majors. **L.J. Whalen**, C.A. Johnston, C. Sauer

10:00 1277. Simple experiments in a complex world. **K.E. Koch**

10:20 1278. Real world chemistry: Soaps, bath bombs, and hydroponics. **J.D. Bracken**

10:40 Concluding Remarks.

215-DeBartolo Lecture Hall

Understanding Animations: Is it Really What is Happening?

R. M. Kelly, *Organizer*
S. Akaygun, *Organizer, Presiding*

8:00 Introductory Remarks.

8:05 1287. Let's do better than animations. **D. Doherty**

8:25 1288. Reducing the cognitive load in *VisChem* molecular-level animations, without oversimplification. **R. Tasker**

8:45 1289. How do different ways of representing ion charges and electrons in a particulate-level animation affect students' interpretations of an oxidation-reduction reaction? **M.J. Sanger**, M.H. Cole

9:05 Discussion.

9:25 Intermission.

9:40 1290. Critiquing the animations in variation: Do they help understanding? **S. Akaygun**, E. Adadan, R.M. Kelly

10:00 1291. Exploring how undergraduate students transfer ideas from precipitation reaction animations to their understanding of acid-base neutralization reactions at the particulate level. **B. Wall**, R.M. Kelly

10:20 Concluding Remarks.