OrganicERs Newsletter Vol. 11 No. 2

Organic Education Resources
a community of teaching scholars
www.organicers.org

In This Issue

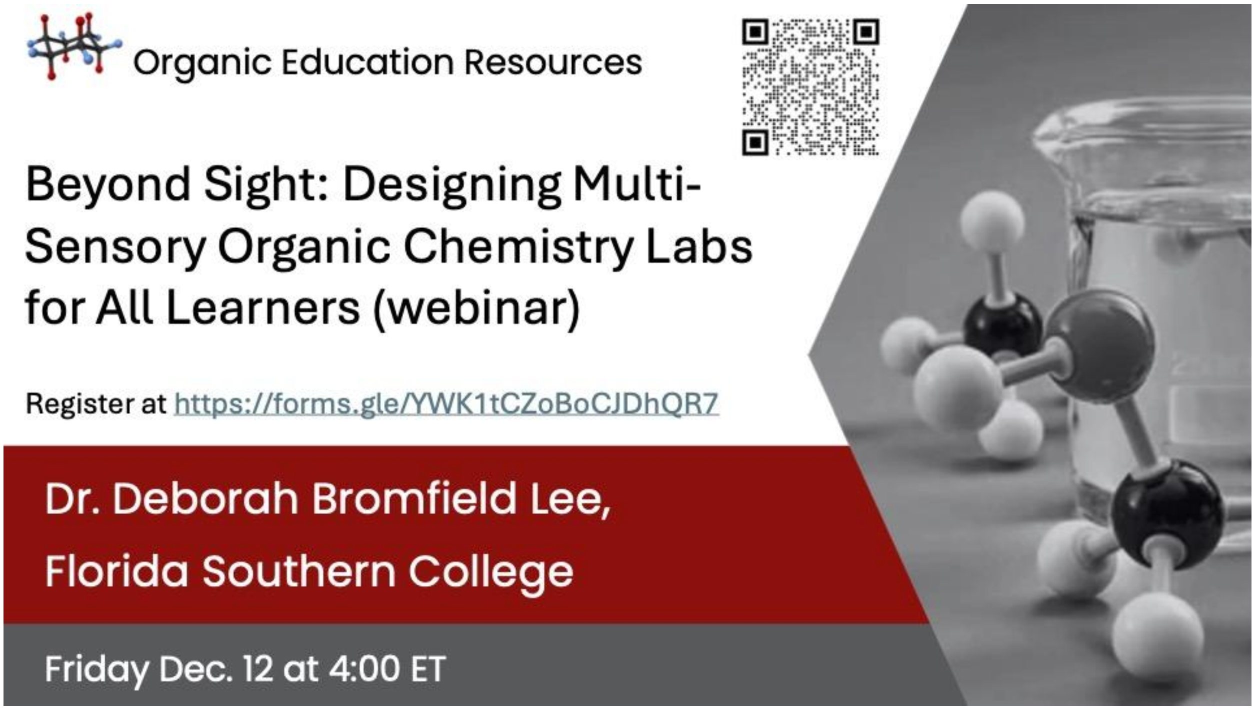
Accessibility for Students with Visual Impairments

The Department of Justice issued a revised ruling under the Americans with Disabilities Act, requiring that all web and digital content be accessible for students by April 24, 2026. Although material should be accessible for students with any disabilities, adapting digital content for Blind and Low Vision students may require more effort. Here are three resources that may help you start the process.

- The first is an announcement, abstract and link to a registration form for a webinar on 12/12/25 at 4 PM given by Deborah Bromfield Lee which focuses on the lab experience.

- Members of OrganicERs have also developed the following list of articles providing ideas for helping students.

- Visualizing the Invisible: How AI is Making Chemistry Accessible to All Students by Julia Winters at alchemie. This article presents work on developing software that makes organic structures accessible to students.



Abstract

Traditional chemistry labs rely heavily on visual observation, creating barriers for students with visual impairments and limiting engagement for diverse learners. To address this, multi-sensory experiments were developed that incorporate senses beyond sight—such as smell, touch, and hearing—to explore chemical concepts, perform quantitative analyses, and practice standard techniques. These inclusive approaches enhance conceptual understanding, correct misconceptions, and improve memory retention by leveraging integrated sensory input. Experiments were adapted from conventional undergraduate organic labs using safe, inexpensive chemicals and standard equipment, ensuring accessibility without compromising accuracy. Rigorous safety protocols were implemented to minimize hazards when engaging non-visual senses. This work provides a framework for creating inclusive pedagogy, engaging laboratory experiences that support students with disabilities while benefiting all learners.

Register at https://forms.gle/YWK1tCZoBoCJDhQR7

OrganicERs Curated List of Accessibility Articles

- Articles by Deborah Bromfield Lee
  - "A Qualitative Organic Analysis That Exploits the Senses of Smell, Touch, and Sound," by Deborah Bromfield Lee and Maria T. Oliver-Hoyo, *J. Chem. Educ.* **2007,** DOI:10.1021/ed084p1976
  - "An Esterification Kinetics Experiment That Relies on the Sense of Smell," by Deborah Bromfield Lee and Maria T. Oliver-Hoyo, *J. Chem. Educ.* **2009**, DOI: 10.1021/ed086p82

- “Multi-sensory Chemical Equilibrium Investigation as a Learning Lab Experience,” by Maria Oliver-Hoyo and Deborah Bromfield Lee, *The Chemical Educator* **2010**, DOI: 10.1333/s00897102276a
- “Tactile Models for the Visualization, Conceptualization, and Review of Intermolecular Forces in the College Chemistry Classroom**,”** by Deborah Bromfield Lee and Grace A. Beggs, *J. Chem. Educ.* **2021**. DOI: 10.1021/acs.jchemed.0c00460
- “Modifying an Organic Chemistry Esterification Teaching Lab to Be Accessible to Blind and Visually Impaired (BVI) Students,” by Deborah Bromfield Lee and Jarah Nelson, *J. Chem. Educ.* **2024**. DOI: 10.1021/acs.jchemed.3c01081

- Articles by other authors
  - “Accessible Teaching and Learning in the Undergraduate Chemistry Course and Laboratory for Blind and Low-Vision Students,” by Alfred T. D’Agostino *J. Chem. Educ.* **2022**, DOI: 10.1021/acs.jchemed.1c00285
  - “The Current State of Literature on the Education of Blind and Visually Impaired (BVI) Students in Chemistry and STEMM in Higher Education,” by Jarah T. Dreamerson and Erin K. H. Saitta, *J. Chem. Educ.* **2025**, DOI: 10.1021/acs.jchemed.5c00269
  - “Adapting Advanced Inorganic Chemistry Lecture and Laboratory Instruction for a Legally Blind Student,” Miecznikowski et al, *J. Chem. Educ* **2015**, DOI: 10.1021/ed500489c
  - “Introductory Organic Chemistry (First-Semester) for Blind and Visually Impaired Students: Practical Lessons and Experiences,” Njardarson, *J. Chem. Educ* **2023**, DOI: 10.1021/acs.jchemed.3c00616
  - “Using Tactile Learning Aids for Students with Visual Impairments in a First-Semester Organic Chemistry Course,” by Thomas Poon and Ronit Ovadia, *J. Chem. Educ.* **2008**, https://pubs.acs.org/doi/10.1021/ed085p240
  - “The Lewis Structure Explorer: Accessible by Design,” by Wegwerth et al, *J. Chem. Educ.* **2024**, DOI: 10.1021/acs.jchemed.4c00187

- Articles beyond organic chemistry
  - “Adaptive Instructional Aids for Teaching a Blind Student in a Nonmajors College Chemistry Course,” by Debra Boyd-Kimball, *J. Chem. Educ* **2012**, DOI: 10.1021/ed1000153
  - “A Paradigm of Practicable Equity and Inclusion: Heeding the Call to Shift Both Mindsets and Methods,” Christian S. Hamann, *J. Chem. Educ.* **2023**, DOI: 10.1021/acs.jchemed.2c00459
  - “Making Participation Accessible to All: Evaluating the Redesign of a General Chemistry Lab Course from a Blind Student’s Perspective,” by Lenzer et al, *J. Chem, Educ* **2025**, DOI: 10.1021/acs.jchemed.5c00178

- “Interlocking Toy Building Blocks as Hands-on Learning Modules for Blind and Visually Impaired Chemistry Students,” by Melaku et al, *J. Chem. Educ.* **2016**, DOI: 10.1021/acs.jchemed.5b00252
- “Implementation of Protocols to Enable Doctoral Training in Physical and Computational Chemistry of a Blind Graduate Student,” Minkara et al *J. Chem. Educ.* **2015**. DOI: 10.1021/ed5009552
- “A Closer Look at Acid–Base Olfactory Titrations,” by Neppel et al. *J. Chem. Educ* **2005.**
- “Making chemistry accessible for learners with vision impairment,” by Zoe Schnepp and Robyn Watson, *Communications Chemistry* **2023**, DOI: 10.1038/s42004-023-01033-x
- “Creating Atom Representations Using Open-Source, Stackable 3D Printed Interlocking Pieces with Tactile Features to Support Chemical Equation Writing for Sighted and Visually Impaired Students,” by Ishu Singhal and B.S. Balaji, *J. Chem. Educ.* **2020**, DOI: 10.1021/acs.jchemed.9b00255
- “Seeing Chemistry Through Sound: A Submersible Audible Light Sensor for Observing Chemical Reactions for Students Who Are Blind or Visually Impaired,” by Cary Supalo et al. *Assistive Technology Outcomes and Benefits* **2006**.
- “Examining the use of adaptive technologies to increase the hands-on participation of students with blindness or low vision in secondary-school chemistry and physics,” by Cary Supalo et al. *Chemistry Education Research and Practice* **2016**, DOI: 10.1039/C6RP00141F
- “From Abstract to Manipulatable: The Hybridization Explorer, A Digital Interactive for Studying Orbitals,” by Sarah E. Wegworth et al, *J. Chem. Educ.* **2021**, *92* (2), 665-661, DOI: 10.1021/acs.jchemed.0c00847

- Resources
  - September 2025 issue of C&EN issue focuses on Trailblazers: Chemists with disabilities solve problems in new ways.

Visualizing the Invisible: How AI is Making Chemistry Accessible to All Students

Julia Winter

Can you see a molecule?

The answer is no, no one can. Molecules exist at a scale far too small for human perception. Every diagram, every model, every "picture" of a molecule is a representation of something invisible to all of us.

This creates an interesting situation for chemistry education: we're all learning to visualize the invisible. Sighted students look at diagrams. Students who are blind or have low vision navigate those same structures through different means. But everyone is working with representations of things they'll never directly perceive.

The real question isn't "How do you see molecules?" It's "How do we make these invisible structures understandable for everyone?"

For students who are blind or have low vision, traditional approaches to accessing molecular diagrams haven't worked well. This challenge has driven one of our most ambitious development projects to date.

The Challenge

Visual models are the foundation of chemistry education precisely because the molecules themselves are invisible. Our tools already allowed students who use screen readers to draw and explore these models using keyboard-accessible interfaces. But there was a critical missing piece: the immediate spatial understanding that sighted students usually take for granted. When you can see the screen, you grasp the entire workspace instantly: what's there, where it is, how it's arranged. For blind students navigating with a keyboard, each structure has to be assembled piece by piece in their minds. Whether they'd built a molecule themselves or were exploring an existing diagram, they needed a way to access that same holistic view.

A student builds a molecule in Alchemie's Lewis Structure tool, using our screenreader-accessible Keyboard Controls, an alternate interface for construction that doesn't require click and drag gestures.

Traditional alternative text (the descriptions screen readers provide for images) wasn't cutting it. A paragraph long description of a complex molecule overwhelms users with information, making it nearly impossible to process and remember. We needed something better.

The Breakthrough

Working closely with Nicole, our accessibility consultant, we discovered that the format of descriptions mattered just as much as their content. Nicole's feedback was eye-opening: paragraph descriptions created cognitive overload. What she needed was control and the ability to get a quick overview and then dive into specific details when necessary.

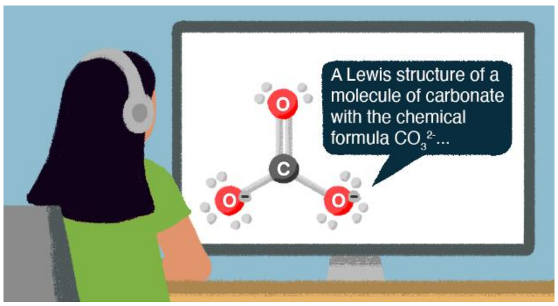


Illustration of a student listening to the lengthy alt text of a simple molecule.

This insight led us to reimagine how we deliver alternative text for complex structures. Instead of forcing screen reader users to listen to long, linear descriptions, we created an expandable, hierarchical system powered by AI. The hierarchy is as follows:

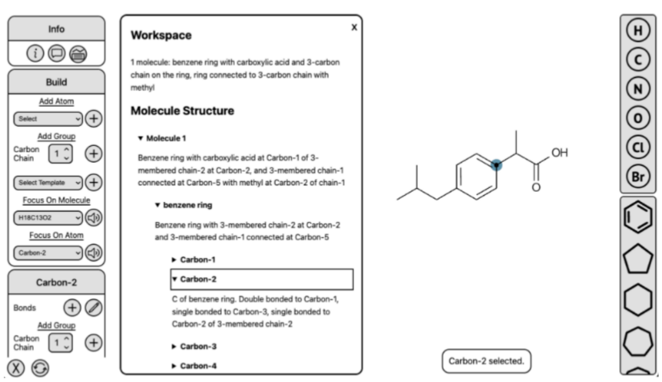
Workspace level: A quick overview of what's on screen

Molecule level: Summary of the overall structure

Feature level: Details about specific parts like carbon chains or functional groups

Atom level: Granular information about individual atoms and their connections

Users could now navigate through layers of information, choosing their own path based on what they need to know.



Screenshot of expandable alt text list within the Keyboard Controls (left) and the molecule that it represents (right) all in the Alchemie Sketcher tool.

Making It Work

The technical challenge was substantial. We needed our AI system to be accurate enough for educational use while generating descriptions in real-time as students work. Here's what we built:

Intelligent naming: Instead of calling atoms "Carbon-1, Carbon-2" based on when they were added to the workspace, our system follows chemical logic, naming them based on how they connect in the actual molecule.

Structured communication: We developed a comprehensive method for translating visual molecular structures into data the AI can understand—atoms, bonds, features, and connections—all organized in a way that ensures accurate descriptions.

Built-in safeguards: Through careful prompt engineering, we prevent the AI from making assumptions or fabricating information when data is unclear.

The results speak for themselves: our system now covers all major functional groups taught in organic chemistry courses, including complex protonated intermediates and the spatial relationships of stereochemistry. Description generation takes 5-45 seconds for new molecules and just 1-3 seconds for structures we've seen before.

Real Impact

This isn't just about compliance with accessibility standards, it's about educational equivalence. Students who are screen reader users should have the same opportunity to learn, explore, and succeed in their STEM courses.

We have completed this AI-based alt text architecture across our core organic chemistry applications: Sketcher, Mechanisms, and Multi-Molecule Sketcher. We also plan to integrate refreshable tactile technology, such as Cadence, for a multisensory learning experience. The next phase of research involves systematic user testing with screen reader users.

The implications extend far beyond chemistry. The framework we've developed could transform accessibility across all STEM disciplines where complex visual information creates barriers to learning. From biology diagrams to physics models to engineering schematics, the potential applications are extensive.

As we continue this work, we're reminded that innovation comes from listening to the people who will actually use what we build. Nicole's feedback didn't just improve our product, her insights revolutionized the entire approach to accessibility.

Where Should Accessibility Live?

We're building solutions to make ChemDraw-generated structures accessible to all students. Should these tools integrate with your LMS (Canvas, Blackboard, D2L)? Work as a ChemDraw add-on? Function within Microsoft Office?
Your input matters. Complete this brief anonymous survey to tell us how you share course materials with students and where accessibility tools would be most useful."

(Funding for this R&D has come from the National Science Foundation.)

BCCE 2026 OrganicERs Announcement

The 2026 Biennial Conference on Chemical Education will be held July 26-30 in Madison, Wisconsin and OrganicERs will be there. We hope that you will be too! Sixteen OrganicERs leaders have submitted 10 abstracts for events that we hope you will consider attending, most with the **Active Learning in Organic Chemistry** prefix:

- Dee Jacobs, Matt Casselman, Richard Mullins, and Lucas Tucker have proposed two symposia. Please consider submitting abstracts to present your work at these symposia when the call for abstracts comes out.
    - **Rethinking Assessment** - This symposium focuses on assessment practices that move beyond traditional, high-stakes exams toward models emphasizing growth, transparency, inclusion and rethinking the systems that measure and support learning. Presentations may highlight mastery- or specifications-based grading systems that reward persistence and iteration; portfolio or project-based assessments that capture longitudinal learning; collaborative testing and peer review that build communication and metacognition; or oral, reflective, or authentic performance tasks that assess synthesis and reasoning rather than rote recall. Both well-established and developing work are welcome, from classroom-tested systems supported by data to in-progress or exploratory designs seeking community feedback. Presenters should discuss the pedagogical rationale, implementation strategies, and observed or anticipated impact on student learning, skill development, engagement and motivation, or equity and belonging, supported by qualitative or quantitative evidence.
    - **Instructional Innovation** - This symposium highlights innovative instructional approaches that strengthen conceptual and mechanistic reasoning, problem-solving, and student belonging in organic chemistry by rethinking the full learning cycle—how class time is used, how students engage independently, and how feedback connects the two. Presentations may showcase flipped-classroom models, process-oriented guided inquiry activities, and collaborative or team-based learning environments, as well as technology used to enhance these approaches—for example interactive visualization tools, adaptive learning systems, AI-assisted feedback, or hybrid learning formats—that support metacognition, problem-solving, and knowledge transfer. We invite presentations that report data on well-tested innovations, describe evolving classroom practices, or present emerging approaches seeking constructive feedback on early-stage projects. Contributors are encouraged to describe the learning challenges or areas of growth their work addresses, the design and implementation of their instructional approaches, any considerations related to access, scalability, or inclusivity, and the

outcomes—observed or anticipated—including effects on engagement, performance, or understanding.

- Justin Houseknecht and Cathy Welder are organizing the **Organic Education Resources Community of Practice** Birds of a Feather. Plan to join like-minded colleagues to learn more about and meet members of the OrganicERs community.
- **Seven Active Learning in Organic Chemistry workshops have been proposed.** See the BCCE website for more information once a list of accepted workshops has been published.

Opportunities for Students when They Join the ACS Division of Organic Chemistry

American Chemical Society Division of Organic Chemistry

Amy Howell, Division of Organic Chemistry Chair

We know you have students in your classes and labs who are doing great stuff in organic chemistry. Perhaps they're trying to iron out a tricky synthesis or are excited about a mechanism that just clicked into place. These are precisely the students who belong in the American Chemical Society (ACS) Division of Organic Chemistry (DOC). Founded in 1908, the Division of Organic Chemistry is one of the oldest and most active divisions within the ACS. For over a century, the division has supported the advancement of organic chemistry by fostering collaboration among scientists in academia, industry, and government, and by providing resources to help the next generation of chemists grow and succeed.

The Division offers a variety of benefits specifically oriented to undergraduate students, including:

Access to Awards and fellowships, such as the DOC Summer Undergraduate Research Fellowships (SURF) and the Undergraduate Award in Organic Chemistry.

Undergraduate student travel awards to ACS meetings and the National Organic Chemistry Symposium (NOS).

Networking opportunities with organic chemists across the nation.

Career development resources, virtual symposia (live and recorded), recorded lectures from NOS, and newsletters featuring research highlights.

Virtual Symposium series that feature presentations from leaders in the field on cutting-edge research.

Undergraduates can join the division for an **annual fee of $5** if they are ACS student members. Otherwise, the fee is $20 and they would be classified as affiliate members. Please share this opportunity with your students, especially those considering graduate study or careers in chemistry. Membership in the Division of Organic Chemistry provides invaluable professional connections, recognition, and educational resources that can make a real difference early in their scientific careers. Thank you for helping us support and inspire the next generation of organic chemists.

More information about membership (https://www.organicdivision.org/faq/#join.) and other DOC programs can be found at: https://www.organicdivision.org

Dichloromethane Replacement

As many in the OrganicERs community know, the EPA's 2024 risk-management rule will phase out nearly all consumer, commercial, and industrial uses of DCM within the next two years and continued use in academic labs - including our teaching labs - will only be allowed under a stringent Workplace Chemical Protection Program with regular exposure monitoring and very low exposure limits. Given DCM's carcinogenicity, acute toxicity, and environmental impacts, many departments are opting to eliminate it from teaching laboratories rather than implement this costly monitoring protocol and infrastructure. If you have not yet begun or completed revising your courses, a recent *RSC Sustainability* perspective and two *JCE* articles provide concise guidance for going DCM-free, including solvent-free or microscale options and greener solvent systems for extractions, chromatography, and reactions that are commonly used in teaching laboratories. Across these examples, ethyl acetate emerges as a particularly versatile replacement in many teaching-lab contexts, along with other safer solvents (e.g., MTBE, 2-MeTHF, and aqueous and CO_2-based systems).

How do you (dis)solve a problem like methylene chloride?, James Sherwood

Alternatives to Dichloromethane for Teaching Laboratories, Grice and Vosburg

Elimination of Dichloromethane from the Introductory Organic Chemistry Teaching Laboratory, Wright and Welder

Meet the Some of the Newest OrganicERs Fellows

Kristen Barrett (Rowan University, Glassboro, NJ)

My primary goal in teaching Organic Chemistry is to ignite and instill a genuine love of learning in every student who takes my course. I strive to achieve this by employing a dynamic array of evidence-based pedagogical approaches. This isn't a static curriculum as my teaching methods are continuously evolving and adapting to meet both the diverse needs of students and new technological landscapes. I have committed to creating an active, engaging environment where complex concepts become clear and inspiring. By staying innovative, I ensure that a student's journey through my Organic Chemistry course helps them discover the fascination of molecular science while building transferable skills that last a lifetime.

David Quist

David Quist started teaching at Trine University, a primarily undergraduate institution in Angola, Indiana in 2019. In addition to teaching, he recently became chair of the Department of Chemical and Forensic Sciences in June 2025. While David is an inorganic chemist by training, earning his Ph.D. in Inorganic Chemistry at Johns Hopkins University, he teaches Organic Chemistry I lecture and lab most semesters in addition to frequently teaching Inorganic Chemistry lecture and lab. He is an active member of the Interactive Online Network of Inorganic Chemists (IONiC) and OrganicERs. David has recently dived deeper into pedagogical collaboration by participating in an OrganicERs Faculty Learning Community (FLC) on formative assessments during the 2024-2025 school year and attending the OrganicERs Active Learning in Organic Chemistry (ALOC) summer workshop in 2025. He is excited to continually improve his teaching through collaboration with professors at other schools and share his own insights in alternative grading methods.

Joan Schellinger

Joan Schellinger is an Associate Professor of Chemistry and Biochemistry at the University of San Diego (USD). Originally from the Philippines, she earned her BS from the University of the Philippines and her PhD from the University of California, Davis. Following her doctoral studies, she conducted postdoctoral research in the Department of Bioengineering at the University of Washington.

Dr. Schellinger integrates green chemistry into her courses and designs infographic syllabi to make the content more accessible and engaging. In 2023, she attended the Active Learning in Organic Chemistry (ALOC) workshop, further refining her teaching methods and pedagogy. Since 2016, she has served as the US National Chemistry Olympiad (USNCO) San Diego Local Section Coordinator, nurturing young talent in chemistry competitions, and received the 2016 Outstanding Chemistry Educator Award from the American Chemical Society (ACS) San Diego Section for her excellence in chemical education and outreach.

Outside the classroom, Dr. Schellinger mentors undergraduates on research projects involving vinyl sulfone, peptides, and polymers, seamlessly integrating green chemistry principles to promote sustainable innovation. As part of the USD's AFFIRM Cohort, a National Science Foundation ADVANCE-funded initiative, she promotes inclusivity in STEM through mentorship and equitable teaching practices, fostering leadership and opportunities in the sciences.

Ashley Steelman

Ashley Steelman is a senior lecturer in the chemistry department at the University of Kentucky. She received her B.S. from Western Kentucky University and her Ph.D. from the University of Alabama. At UK she teaches Organic Chemistry I and II courses.

Dr. Steelman is an advocate for active learning in her classroom. She integrates and designs her course content to focus on student participation in the classroom. She understands the importance of self-directed, self-motivated learning of and believes this is how students will succeed in and out of the classroom/college.

Beyond classroom instruction, she is actively involved in STEM education research to enhance the learning experience in her courses. She is devoted to helping to advance organic chemistry resources for students and to have an impact on other educational products that could be useful to students. She is also an active member of the OrganicERs community and has served on the Lexington section of the American Chemical Society in the past 4 years as Secretary, Chair-elect and Chair.

Upcoming Events

ACS Spring 2026, Atlanta, GA & Digital, March 22-26, 2026

Middle Atlantic Regional Meeting, Hershey, PA, May 17–19, 2026

79th Northwest Regional Meeting (NORM), Boise, ID, Jun 28–Jul 1, 2026

28th International Conference on Chemistry Education - 17th European Conference on Research in Chemical Education, Erzurum, Türkiye, July 13-17, 2026

Methods in Chemistry Education Research (MICER), Madison, WI, July 25, 2026

Biennial Conference on Chemical Education, Madison, WI, July 26-30, 2026