The Art, Practice, and Joy of Engaging and Educating the Public through Scientific Demonstrations: Celebrating the Legacy of Bassam Z. Shakhashiri

29th ACS Biennial Conference on Chemical Education, UW-Madison
Three Sessions: Wednesday, July 29 and Thursday, July 30, 2026
Chemistry Building Room S429

Chaired By Tom Kuntzleman

Symposium Abstract:

For more than half a century, Bassam Z. Shakhashiri has inspired and educated countless teachers, students, and the general public through the power of science demonstrations—vivid, memorable, and human ways of connecting with chemistry. This symposium reflects the broad scope and influence of his work. Presenters will share demonstrations that promote engagement; innovative uses of demonstrations to foster conceptual understanding and curiosity; and strategies for safely and effectively incorporating demonstrations into teaching and outreach. Analyses of the pedagogy of demonstrations and reflections on their role in shaping public attitudes toward science will be explored. When approached through the lens of demystifying the magic, demonstrations can entertain while also educating the public and inspiring future scientists, aligning with the conference context of centering authentic phenomena and the intersectional attribute of public engagement and science literacy. In honoring Professor Shakhashiri's legacy, this symposium celebrates not only the joy of participating in chemistry, but also the belief that science is best learned—and loved—when it is seen, heard, experienced, and most of all, shared.

Session I (210a) on Wednesday, July 29 in Rm S429 Chemistry

3:30pm **Introductory Remarks: Bassam Shakhashiri**

3:35pm **SCIENCE IN MOTION—Fostering Community Appreciation of Science**

Gery Essenmacher, Wisconsin Initiative for Science Literacy, Emeritus, UW–Madison, and **Cecilia Vollbrecht**, Assistant Professor of Chemistry, Kalamazoo College

What do you get when you combine a large box truck and a team of eager scientists? You turn it into the Science is Fun truck and take it out into the community! As part of the Science in Motion program developed by Professor Bassam Shakhashiri, the truck was outfitted and used to transport chemicals and equipment to various sites for both hands-

on and participant viewed demonstrations. We will discuss many aspects of the truck's adventures and lessons we learned along the way. For example, how we managed to transport some of the more challenging materials e.g., dry ice and compressed gas cylinders, safely. Or how we dealt with the unexpected that comes up when you take science out of the lab and on the road. One of our goals was to show up at non-traditional venues and we will discuss how we were received at these. What demonstrations drew those passing by to stop and check out our set-up? What demonstrations were most popular? What demonstrations led to useful conversations with different potential audiences ranging from young school age children to older adults? And how did we try to relate the understanding derived from demonstrations to personal and global issues? For instance, we will discuss how using dry ice, a fish tank, and children's bubbles can morph into a discussion on global warming.

3:55pm **Chemistry In the Museum: Engaging the Public Through Demonstrations and Conversations**

David Sittenfeld, Museum of Science, Boston

Dr. Bassam Shakhashiri has had a profound impact upon the field of informal chemistry education. I have had the pleasure of learning from and collaborating with Dr. Shakhashiri for over 25 years as part of my work at the Museum of Science, Boston. Dr. Shakhashiri's inspirational work has informed several decades of public engagement activities across the Museum's educational platforms, from in-person demonstrations to online videos. These activities ultimately catalyzed a national public engagement project with the American Chemical Society, supported by a large-scale grant from the National Science Foundation, that utilized design-based research to study and disseminate an empirically informed learning framework for the design and facilitation of hands-on chemistry activities. The activities and learning framework were distributed to 250 sites around the United States through physical Let's Do Chemistry kits, and have been used by thousands of informal chemistry educators around the world. In my presentation, I will share ways in which Professor Shakhashiri's foundational work in the chemistry education field continues to transform the way that science museums around the world engage their audiences about chemistry, including the ways that informal educators connect science to policy.

4:15pm **Building Blocks into Chemistry Demonstrations**

Dean Campbell, Professor of Chemistry & Biochemistry and Co-Director, Center for STEM Education, Bradley University

Physical models provide visual and tactile support to often invisible concepts in chemistry and related fields. These models vary widely in cost and composition. Building blocks, a medium with which most students are familiar, can be used to produce models ranging from atomic-scale chemical structures to macroscale instrumentation. Two types of colorful building blocks with varying modeling capabilities include LEGO bricks and Lux Blox. LEGO bricks, with their tube-and-stud connectivity, are more well-known, have a wider variety of component parts, and have excellent space-filling capabilities. Lux Blox

primarily use flat squares and triangles that connect along their edges to form surfaces, both in the form of regular shapes as well as more complex structures. Both types of building blocks can build two- and three-dimensional models of unit cells of chemical structures with fractional atoms in their cell borders. Both types can be used to represent aspects of polymer chemistry at the molecular level and structures with features such as chirality and negative Poisson's ratios. Chemical instruments that can be modeled with these building blocks include scanning probe microscopy, chromatography, and spectroscopy. All of these models can be used in demonstration settings and interconnected with other chemical demonstrations. Small, robust models can be passed from person to person to allow viewing and interaction from many angles. Lux Blox and their models tend to be larger than those associated with LEGO bricks, enabling the Lux Blox models to be used in larger group settings. Lux Blox connections hold up better to repeated flexure, enabling them to produce more dynamic models. A collaboration with Lux Blox is currently producing models, video content, and associated content, as well as assessing their utility in educational settings such as demonstrations.

4:35pm **Safe Approaches for Chemical Demonstrations**
Ryan M. Johnson, Chemistry Instructor, United States Air Force Academy

Everyone wants to be *that* chemistry teacher…the one who has the classroom full of awe and wonder at explosions and fire and excitement! Who wouldn't be!? But ensuring that chemistry demonstrations are done in a safe, effective, and efficient manner are key to providing an unforgettable chemistry experience for students, without needlessly putting them at risk. In this session, we will discuss excellent ways to prepare and execute fun, exciting demonstrations while also ensuring student and teacher safety.

4:45pm **The Wisconsin Idea Demands That We Engage Everyone**
Levi Hogan, Former Wisconsin Initiative for Science Literacy Intern and Research Assistant

In Wisconsin, we have The Idea that education should influence people's lives beyond the borders of the University, and by extension, the state and even the country. A necessary ingredient for this is trust built through public engagement, meeting folks where they are and fostering connections between science and society. To accomplish this, a variety of forums and modalities of communication should be encouraged. A few examples from my time working with Bassam will be discussed, including teacher workshops, presentations outside of Madison, online media, and celebrating the arts.

4:55pm **Closing Remarks: Levi Hogan**

Session II (210b) on Thursday, July 30 in Rm S429 Chemistry

8:30am **Introductory Remarks: Tom Kuntzleman**

8:35am **Chemical Demonstrations—Clarity and Communication**
Michael Boll, Teacher, Niles North High School

Doing science demonstrations can obviously lead to the "Oooohs" and "Aaaaahs" that we hope will get students interested in science. However, using the demonstrations to illustrate the correct scientific principles and fostering true communication are goals we should strive to perfect as part of our demonstrations. The collapsing can demonstration and a related demonstration will be used to discuss the need for proper scientific understanding, and the contributions of Dr. Shakhashiri will be shown. New methods of communicating two-ways with students during demonstrations will also be presented, and their origins and connections to CHEM TIPS which was developed by Dr Shakhashiri will be discussed.

8:55am **The Art of Chemistry Demonstrations**
Tom Kuntzleman, Assistant Professor of Teaching, Wayne State University

The research on best practices in chemical education is deeply important to our work as chemical educators. Even so, I submit that the purpose of doing live chemistry demonstrations is multifaceted and, in my opinion, should not solely be centered on increasing student outcomes in learning chemistry. In my experience the most surprising benefit of doing live chemistry demonstrations is the way they positively touches human beings—both the observer AND the demonstrator! As such, chemistry demonstrations are dynamic works of art. In this vein, I will present simple experiments I have used in attempts to connect with others. Along the way, I'll reflect on how being a chemical demonstrator has changed me as a human being.

9:15am **Participant-Paced Demonstrations**
Jerry Bell, Honorary Fellow, Wisconsin Initiative for Science Literacy and Professor Emeritus of Chemistry, Simmons University

Demonstrations have been used to engage audience attention and interest in science lectures for centuries. The potential for accomplishing their purpose is enhanced if the audience members themselves carry out the procedure. In a teaching environment, a further enhancement is possible by having the audience members (usually students) themselves do the analysis of their observations to come to an understanding of the scientific basis of what they observed and perhaps its consequences outside the classroom. Let's see if we can put this into practice.

9:35am **Fire, Fear, and Fascination: Using Spectacle to Humanize Chemistry**
Kate Biberdorf, Professor for Public Understanding of Science, University of Notre Dame

For generations, scientists like Michael Faraday and Bassam Z. Shakhashiri have used chemistry demonstrations to transform classrooms and public spaces into arenas of curiosity, wonder, and discovery. In this spirit, Kate the Chemist presents Fire Breathing, a high-impact demonstration that merges theatrical spectacle with intentional science communication to explore how dramatic demonstrations can deepen public engagement while advancing scientific understanding. Fire Breathing captures immediate attention through awe and perceived danger, creating a powerful emotional entry point into chemistry. This presentation examines how carefully designed demonstrations can move audiences beyond passive amazement toward meaningful learning. By "demystifying the magic," the demonstration becomes a vehicle for discussing combustion chemistry, fuel properties, energy transfer, and risk assessment, while simultaneously modeling best practices in safety culture and responsible demonstration design. Honoring Shakhashiri's enduring philosophy that chemistry is best experienced rather than merely described, this presentation argues that demonstrations like Fire Breathing serve not only as entertainment, but as gateways to science literacy, confidence, and belonging. When audiences see chemistry come alive through demonstrations that are safe, authentic, and joyful, they are invited to see themselves as participants in science rather than observers of it.

9:55am **Closing Remarks: Jerry Bell**

Session III (210c) on Thursday, July 30 in Rm S429 Chemistry

10:30am **Introductory Remarks: Kate Biberdorf**

10:35am **Engaging the Public through Scientific Demonstrations: Celebrating the Legacy of Bassam Z. Shakhashiri: The Christmas Lectures**
James Maynard, Lecture Demonstrator, Department of Chemistry, UW-Madison

For over 50 years, Bassam Z. Shakhashiri has led his department, his college, the nation, and the world with his efforts to promote learning, science literacy and the appreciation of science as a part of society. His seminal work, "Chemical Demonstrations: A Handbook for Teachers of Chemistry" series has informed and inspired generations of scientists. My talk will highlight our years of working together to achieve these admirable goals in the form of

the annual Xmas lecture “Once upon a Christmas Cheery, in the Lab of Shakhashiri” and our shared experiences in education, outreach and fellowship. As a former student, I will briefly address time in class with Professor Shakhashiri.

10:55am **What’s the Scoop on Cellulose? A Tasty and Tactile Polymer Chemistry Workshop for Blind and Low Vision Learners**

Mara Paterson, Postdoctoral Chemistry Researcher, Northwestern University

The vast majority of chemistry education relies heavily on visual information. As a result, blind and low vision (BLV) learners are at a distinct disadvantage when traditional demonstrations and teaching methods are used. Developing lesson plans and hands-on activities that rely on senses such as smell, taste, and touch rather than sight is essential to making chemistry more accessible for the BLV community. We developed a series of BLV-accessible activities that teach fundamental concepts in polymer chemistry while drawing connections to real-world issues such as plastic pollution. This workshop was designed for and facilitated at the Friedman Place, a supportive living community for BLV adults in Chicago. Aiming to connect with the residents and their existing interest in hand-weaving, we used textiles as models for polymer structure to demonstrate relevance and encourage active participation and discussion. Participants then made homemade ice cream and investigated the effects of carboxymethylcellulose, a common polymeric food additive, on flavor and texture, primarily relying on senses of smell and taste. In the final activity, real world samples of thermoplastics and thermosets were used to demonstrate challenges in polymer recycling and introduce a brief discussion of current research efforts towards sustainability. This workshop was also facilitated with groups of sighted high school and undergraduate students. Overall, the activities were engaging for both BLV and sighted learners, with many participants stating that the tactile and edible components were particularly enjoyable and educationally effective. Through this work, we demonstrate the importance of establishing collaborations beyond the scientific community as well as the value of universal accessibility for learners of all ages and abilities.

11:15am **Graduate Student-Led Chemistry Demonstrations: Honoring Traditions and Building a Lasting Legacy**

Casandra Moisanu, Chemistry Graduate Student, Northwestern University

Chemical demonstrations allow the magic of chemistry to be seen (and heard or felt) by a wide audience. For over 30 years at Northwestern University, there was a dedicated position of Chemistry Demonstrator held by Eberhard Zwergel. He was responsible for performing chemistry demonstrations during lectures and he produced an annual Halloween Show full of demonstrations set to music. When Zwergel left the department in 2019, the role of a dedicated chemical demonstrator was not refilled. In recent years, the role of Demo TA (graduate student assigned to do demonstrations as part of their teaching assignment (with the mentorship of a faculty member)) was introduced to maintain the

tradition of performing chemical demonstrations. Giving Demo TAs the opportunity to put together live demonstrations allows them to be creative and learn how to use demos as a tool to communicate lecture concepts. Two years ago, graduate students also revived the Halloween Demo Show; they selected the demonstrations, wrote a script to tie them together, and hosted the show in front of their peers, staff, faculty, undergraduates, and members of the community. Audience members volunteered to participate in some demonstrations, allowing them to experience the wonder of chemistry firsthand. The process of producing the Halloween Demo Show taught graduate students how to make demonstrations accessible to a non-academic audience. Graduate students have also included undergraduates in running outreach events. The process is rooted in maintenance of detailed records, allowing future generations of Demo TAs and Halloween Show organizers to build off what has already been done and keep the great tradition of chemistry demonstrations going. In this presentation, we will discuss the benefits and challenges of moving the responsibility of chemistry demonstrations from an individual staff position to graduate student-led collaborations with faculty members.

11:35am **REACT@TAMU Chemistry: High School Summer Camp for Research Training**
Soon Mi Lim, Instructional Professor, Department of Chemistry, Texas A&M University

The Department of Chemistry at Texas A&M University has been reaching out to local communities through chemistry demonstrations and hands-on activities, many of which are inspired by Dr. Shakhashiri's work. After years of interacting with local schools and responding to requests from high school teachers for a customized program, we developed the Research Exploration and Advanced Chemistry Training (REACT@TAMU Chemistry) summer camp. The purpose of this camp is to provide high-school students scientific and technical training and help them prepare for independent high school research in chemistry and future chemistry-related careers. This six-module, half-day camp took place on the university campus and included a research showcase, chemistry demonstrations, hands-on activities, and technical training in methods commonly used in undergraduate education and research, such as UV/VIS, FTIR, NMR, PCR, and literature searches. One new activity for the camp was the Nylon web-rock competition, designed to encourage teamwork and creativity. Outcomes from the inaugural 2025 camp indicate that the program successfully inspired scientific interest, encouraged college recruiting, and facilitated continued research mentoring for students. By creating a supportive environment where students interact with faculty and current researchers, REACT@TAMU Chemistry celebrates Dr. Shakhashiri's vision of connecting the public and young learners to the joy of chemistry through active participation and meaningful demonstrations. This presentation will discuss the camp's structure, highlight student experiences, and share lessons learned for broadening scientific engagement in the community.

11:55am **Closing Remarks: Bassam Shakhashiri**