



# Advancing Chemistry & Communicating Chemistry:

*Looking Around and Looking Ahead with Bassam Shakhshiri*

Presidential Symposium Co-Sponsored by the Division of Chemical Education

American Chemical Society Fall National Meeting

Monday, August 11, 2014

Moscone Center, San Francisco, California

# Advancing Chemistry and Communicating Chemistry...

*For the benefit of Earth and its people*

**Today our biggest challenge is to help sustain Earth and its people in the face of:**

- Population Growth
- Finite Resources
- Malnutrition
- Spreading Disease
- Deadly Violence
- War
- Climate Change
- And the denial of basic human rights, *especially the right to benefit from scientific and technological progress.*

We advance chemistry through research, education, and innovation. Basic research in science greatly increases our understanding of nature, triggers creative waves of invention and innovation, and prompts technological breakthroughs that can serve society well in the future. Solutions to the world's problems demand thinking "outside the box" and encouraging radical innovation, both coupled with transformative changes in education.

We must aim to effect comprehensive, fundamental, and systemic change in our own attitudes and in our behavior as scientists and as responsible citizens. Purposeful communication of the critical role of science and technology in society can help alter attitudes of the general public and can also foster collaboration among people across geographic boundaries to work together to solve global grand challenges. We have the talent and the capacity to succeed, but as scientist-citizens we must also help develop the will to take action.

**"Science and society have what is essentially a social contract that enables great intellectual achievements but comes with mutual expectations of benefiting the human condition and protecting our planet."**



**S**cientist by training, teacher and public servant by trade, advocate by conviction, optimist by nature: that is how Bassam Z. Shakhshiri describes himself. He is professor of chemistry and the first holder of the William T. Evjue Distinguished Chair for the Wisconsin Idea at UW-Madison. A native of Lebanon, Bassam is the son of the late Dr. Zekin A. Shakhshiri and Adma N. Shakhshiri. The Shakhshiris—father, mother, son and two daughters, Amal and Maha—came to the United States in 1957 when Bassam was 17 years old, with one year at the American University of Beirut behind him. He earned an A.B. degree in chemistry at Boston University ('60), served as a teaching fellow at Bowdoin College for one year, and earned M.Sc. and Ph.D. degrees in chemistry at the University of Maryland ('64 and '68, respectively).

After a year of post-doctoral research and two years as a junior member of the chemistry faculty at the University of Illinois-Urbana, Bassam joined the faculty of the UW-Madison in 1970. In 1977 he was founding chair of the UW System Undergraduate Teaching Improvement Council. In 1983 he was the founding director of the Institute for Chemical Education (ICE) and in 2002 he founded the Wisconsin Initiative for Science Literacy (WISL).

From 1984-1990 Bassam served as NSF Assistant Director for Science and Engineering Education. As NSF chief education officer he presided over the rebuilding of all NSF efforts in science education after they had been essentially eliminated in the early 1980's. His leadership and effectiveness in developing and implementing programs in science education contributed to shaping national STEM initiatives.

Bassam is the recipient of over 40 awards, including the 2002 AAAS Award for Public Understanding of Science and Technology, the 2007 National Science Board Public Service Award and the 2013 Carl Sagan Award for Public Understanding of Science from the Council of Scientific Society Presidents.

In 2012 Bassam served as president of the American Chemical Society, and formed the ACS Presidential Commission on Graduate Education in the Chemical Sciences, the ACS Climate Science Working Group, and the ACS Global Water Initiative Working Group. Bassam and his wife June live in Madison. Their daughter Elizabeth, a 2007 alumna of UW-Madison, received her law degree from the University of Michigan Law School in Ann Arbor in 2010; she and her husband Bob live in Chicago.

# Speakers & Abstracts



## Opening Remarks

*Thomas J. Barton*



## Recruiting the next generation of chemists through hands-on research experiences

*Harry B. Gray*

Mentoring future scientists and doing groundbreaking laboratory research are not mutually exclusive. They actually strengthen each other. Our NSF Solar Fuels Center for Chemical Innovation has implemented a robust outreach program consisting of 3 components. In the Solar Energy Activities Lab (SEAL), high school and college students in our Solar Army search for robust metal-oxide materials with tools and coaching by CCI scientists. CCI investigators follow up with more advanced theoretical and experimental work on these and related materials, while gaining fresh insights and perspectives from training and guiding the students. In Juice-from-Juice, CCI scientists are training teachers to make dye-sensitized solar cells using natural pigments from fruits and vegetables. This maps well into the high school STEM curriculum by teaching fundamental concepts in chemistry, physics, and biology. The third program targets middle school kids from disadvantaged backgrounds who have not had much exposure to chemistry. By having a meaningful scientific experience before entering high school, these kids are more likely to pursue STEM careers than otherwise. We have been working with Informal Science Educational professionals, high school “near peer” mentors, evaluators, and local museums to provide a groundbreaking model of chemistry informal science education outside the classroom. These types of symbiotic relationships are important steps toward the goal of a scientifically literate citizenry.



## The (sometimes poisonous) chemistry of communication: How do we reach people who don't think chemistry is relevant to their lives?

*Deborah Blum*

It's easy to communicate chemistry to those already interested or to a science literate audience. But how do we reach people who didn't study chemistry or who believe it has little to do with them? This talk, from the perspective of a long-time science writer, will explore the techniques, the stories, and the occasional homicidal events which illustrate the fascination of this branch of science.



## Bassam and the development of teaching as research, active learning, and the new traditions required for effective education

*John C. Wright*

Bassam Shakhshiri had a profound role in my development as a professor at a major research institution and my ability to address the challenges facing chemistry and society. Shortly after my arrival at Wisconsin, Bassam visited me to discuss a faculty member's responsibilities, namely that a faculty member has a long-term commitment to teaching excellence as well as research excellence. Although I did have that >

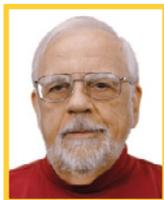
commitment to teaching, my real role in advancing teaching excellence did not become clear for 20 years, when the challenges facing chemistry and society became clear. I noticed two problems: excellent students often couldn't connect their mastery of course material on examinations with their abilities in the laboratory and poorly performing students could not grasp the course material. The second profound influence was the obvious success of John Walters (St. Olaf College) in addressing these challenges. The key was involving students in an authentic, challenging, and supportive academic environment where they would succeed and take ownership for their work. There are many ways to create this environment and much of this presentation will focus on my exploration of different strategies, all involving active learning. The talk will also present the results of an extensive evaluation of the effectiveness of different teaching strategies on the problem solving competence of undergraduate students.



### **On the importance of becoming fascinated**

*Larry R. Faulkner*

Looking around and looking ahead with Bassam Shkhashiri inevitably requires thought about why “Science is Fun” —indeed about how science became fun for those of us who committed ourselves to it, and how it can remain fun, once it becomes a vocation. This presentation will focus on fascination and ignition in the lives of young people, especially those in middle school, high school, and the earliest undergraduate years. How do these transformations happen? What experiences improve the chances of achieving them? The lifelong contributions, and certainly the values, of Bassam Shkhashiri will be central to the discussion.



### **Planting trees**

*Jerry Bell*

A society grows great when old men plant trees in whose shade they know they shall never sit.” This proverb, attributed to the Greeks, is particularly appropriate for those of us of a certain age who ponder what trees we may have planted or might still plant. Many of mine are a result of my personal and professional relationships with Bassam over more than four decades. These are firmly rooted in our shared conviction that engagement with phenomena is fundamental to teaching, learning, and appreciating scientific (and other) concepts. This outlook has led to: a wide variety of hands-on workshops and institutes that incorporate both content and pedagogy for teachers at all levels; the participant-based-programming of the fourth Biennial Conference on Chemical Education; a textbook based on classroom activities and observations; a web-based resource for understanding climate changes in an energy-imbalanced, carbonated world, and; outreach to encourage as many as possible to take actions to adapt to and mitigate climate change.



### **The evolving societal climate for science**

*Alan J. Leshner*

Society's views about science seem to have both some marked constants and some varying levels of ambivalence over time. Traditional approaches to engaging with the rest of society are working less and less effectively, and we need some new strategies. This talk is about some of the lessons learned from trying out different approaches to public engagement with science.

... continued on page 8

# SYMPOSIUM SCHEDULE

## MORNING SESSION

- 8:00 a.m.**      *Opening Remarks, **Thomas J. Barton***  
Distinguished Professor Emeritus of Chemistry  
Iowa State University  
2014 ACS President
- 8:15 a.m.**      *Recruiting the next generation of chemists through hands-on research experiences, **Harry B. Gray***  
Arnold O. Beckman Professor of Chemistry, CalTech  
Founding Director, Beckman Institute
- 8:40 a.m.**      *The (sometimes poisonous) chemistry of communication: How do we reach people who don't think chemistry is relevant to their lives?, **Deborah Blum***  
Helen Firstbrook Franklin Professor of Journalism  
School of Journalism and Mass Communication  
University of Wisconsin-Madison
- 9:05 a.m.**      *Bassam and the development of teaching as research, active learning, and the new traditions required for effective education, **John C. Wright***  
Andreas C. Albrecht Chair  
Department of Chemistry, University of Wisconsin-Madison
- 9:30 a.m.**      *On the importance of becoming fascinated, **Larry R. Faulkner***  
President Emeritus, University of Texas-Austin
- BREAK**
- 10:05 a.m.**      *Planting trees, **Jerry Bell***  
Faculty Associate, Wisconsin Initiative for Science Literacy  
Department of Chemistry, University of Wisconsin-Madison
- 10:30 a.m.**      *The evolving societal climate for science, **Alan I. Leshner***  
AAAS Chief Executive Officer  
Executive Publisher, *Science Magazine*
- 10:55 a.m.**      *Looking forward at the scientific enterprise, **Cora B. Marrett***  
Deputy Director, National Science Foundation
- 11:20 a.m.**      *Bassam as irritant, **George Whitesides***  
Woodford L. and Ann A. Flowers University Professor  
Department of Chemistry and Chemical Biology  
Harvard University

## AFTERNOON SESSION

- 1:30 p.m.**      *Power of a lecture demonstration*, **Richard Zare**  
Marguerite Blake Wilbur Professor in Natural Science  
Department of Chemistry, Stanford University
- 1:55 p.m.**      *Communicating chemistry—A 60-year story*, **Ron Perkins**  
Retired Chemistry Teacher, Greenwich High School, Greenwich, CT  
Founder, Educational Innovations
- 2:20 p.m.**      *Back to the future*, **Brian P. Coppola**  
Arthur F. Thurnau Professor of Chemistry  
Associate Chair of Education Development and Practice  
Department of Chemistry, University of Michigan
- 2:45 p.m.**      *Chemistry to science to learning to life: There are no boundaries with Bassam*, **Rodney Schreiner**  
Senior Scientist, Department of Chemistry  
Associate Director, Wisconsin Initiative for Science Literacy  
University of Wisconsin-Madison

## BREAK

- 3:20 p.m.**      *Not just so: Telling stories in chemical research and the teaching of chemistry*, **Roald Hoffmann**  
Frank H. T. Rhodes Professor of Humane Letters Emeritus  
Cornell University
- 3:45 p.m.**      *Some news about chemistry in the news*, **Nadia Drake**  
Science Reporter, *National Geographic Phenomena*
- 4:10 p.m.**      *Strengthening research and educational partnerships with scientists in developing countries: It's good for everyone*,  
**Geraldine Richmond**  
Presidential Chair and Professor of Chemistry, University of Oregon  
AAAS President-Elect
- 4:35 p.m.**      *Growing up Shakhashiri: What I've learned (and am still learning) from my Dad*, **Elizabeth Reynolds**  
Honorary Fellow, Wisconsin Initiative for Science Literacy  
Department of Chemistry, University of Wisconsin-Madison
- 5:00 p.m.**      *Advancing chemistry and communicating chemistry... For the benefit of Earth and its people*, **Bassam Z. Shakhashiri**  
William T. Evjue Chair for the Wisconsin Idea  
Director, Wisconsin Initiative for Science Literacy  
Department of Chemistry, University of Wisconsin-Madison

# Speakers & Abstracts ... continued



## Looking forward at the scientific enterprise

*Cora B. Marrett*



## Bassam as irritant

*George Whitesides*

One of Bassam's passions—and one that is enormously important for chemistry in the long run—is to try to catalyze a rethinking of the role and structure of graduate training and education in research universities. This talk will sketch some of the conclusions from the discussions he is provoking, suggest (with admiration) the strategies he has used, and consider what still needs to be done.



## Power of a lecture demonstration

*Richard Zare*

The master of lecture demonstrations is certainly Prof. Bassam Shkhashiri. I want to surprise him (if possible) on this special occasion with a lecture demonstration that I hope will be both in the spirit of his motto "Chemistry is Fun" and instructive.



## Communicating chemistry—A 60-year story

*Ron Perkins*

For 60 years, Ron has studied and communicated Super, Wow, Neat chemistry. From receiving his first gift of a chemistry set in 3rd grade, to that special day when he was given the keys to the chemical supply closet in a Lincoln, NH high school, Ron's goal has been to simplify the complex and to convince all that "Chemistry is a subject full of interest, wonder, and beauty (Scoffern 1839)." Although many older chemists (including Ron) were attracted to chemistry with gunpowder and explosions, most discovered safer, equally interesting chemistry: Michael Faraday's 1860 beauty and complexity of a candle flame; John Scoffern's dangers of common poisons; Professor Lardner's 1859 swinging lantern; Bassam Shkhashiri's . . . In this age of chemophobia, we need to continue to discover safe, equally interesting chemical "hooks." What could be more beautiful than understanding the checkerboard corrosion of a corn silo, the heat treatment of a horseshoe, or the chemistry of a transistor circuit?



## Back to the future

*Brian P. Coppola*

A lot of time, effort, money and good intentions have been spent over the last 30 years on trying to improve science education in the United States. By some reckoning, the community is still trying to solve the same problems over and over again. Of the latest trends, the reduction of education to a set of competencies probably concerns me the most. Getting back to some core values about education—and how to go about communicating these—is the highest priority I can imagine.



## **Chemistry to science to learning to life: There are no boundaries with Bassam**

*Rodney Schreiner*

This year marks the 75th anniversary of Bassam Shakhshiri's birth. It also marks his 45th anniversary as a member of the faculty of the University of Wisconsin-Madison, an anniversary in which he takes far greater pride than in the former. I have been working with Bassam for 44 of those 45 years, during which time he has been my teacher, my mentor, my colleague, and my friend. Those years have been filled with ever expanding experiences in the communication of chemistry and of science. These experiences have involved experiments with technology, with curriculum, and, of course, with demonstrations. Over the years, all of these have seen a gradual evolution and an occasional revolution. They have also reflected a shared growing interest in the shifting relationships between chemistry and the other sciences, between science and the other liberal studies, and between learning and life. I shall describe with examples some of these experiences, experiments, and interests, as well as where I think they may be leading.



## **Not just so: Telling stories in chemical research and the teaching of chemistry**

*Roald Hoffmann*

Scientists are afraid of just-so stories, so they undervalue storytelling. But they can't escape it. Listen to at least their seminars, and what you hear is... stories. With a structure any student of narrative could easily classify. Not mythologies, yet partaking of these. The teaching of science is in a number of ways made more effective by storytelling. I will reflect on the psychological reasons for the importance of narrative in chemical research and teaching, giving examples from research and ones that could be useful in teaching.



## **Some news about chemistry in the news**

*Nadia Drake*

To me, chemistry is innately fascinating. This may be a result of the influence of my uncle Bassam. From my childhood, I remember exploding balloons, Tesla coils, color-changing cylinders of liquid and clouds of foggy dry ice, thanks to him. Now, I approach chemistry as an omnivorous science journalist; and in the science news ecosystem, chemistry sits in a weird place. It's inescapably important in our lives: Chemistry forms the foundation for the materials in our phones and in our clothing, and it offers solutions to rampant pollution or impending energy crises. Readers love chemistry stories. And yet, news coverage of chemistry is, in my opinion, surprisingly sparse and inconsistent. Why? As a reporter with experience covering many different areas of science, I have a few ideas. Let's look at some examples of how chemistry shows up in the news, both good and bad, and then I'll share some thoughts about how scientists and science writers can work together to transform elegant experiments into accurate, engaging news stories.



## **Strengthening research and educational partnerships with scientists in developing countries: It's good for everyone**

*Geraldine Richmond*

With the recognition that many of the important challenges that we face today are global, it is imperative that scientific innovations and advances permeate into all parts of the world, particularly in less developed countries. There is a tremendous amount of technical talent and creativity in these countries but limited resources for making research and discovery advances without collaborations with >

... continued on page 10

# Speakers & Abstracts ... continued

scientists in more developed countries. For the U.S. participants, these international collaborations provide a broader perspective on how their research capabilities can be applied to desperate challenges in these developing countries, challenges that often foreshadow what lies ahead for many developed countries as natural resources become more limited. This talk will provide an overview of some of our recent COACH scientific research and capacity building activities conducted in parts of Africa, Asia and Latin America and the importance of engaging researchers, faculty and our students in such global activities.



## **Growing up Shakhashiri: What I've learned (and am still learning) from my Dad**

*Elizabeth Reynolds*

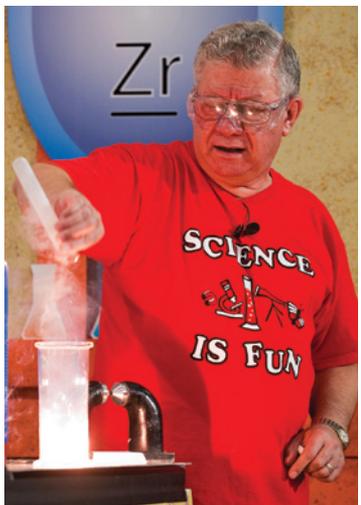
Bassam Z. Shakhashiri is a celebrated author, respected professor and leader in national science education policy. But what's it like to live with him for nearly two decades? Set in Maryland, Egypt and other exotic locales (Madison, Wisconsin), this story begins in the 1980's, continues through my time as an undergraduate at the University of Wisconsin and rounds out in present-day Costa Rica. He is a noted and beloved science educator, but I will reflect on the life lessons I have learned in my years with my father. In so doing, I will present a lighter perspective on Shakhashiri's past 30 years, including some anecdotes from life in the Shakhashiri domicile. From the early years of home science experiments - dry ice, soap bubbles and even, once, an exploding light bulb - through the first time I attended a full lecture in his Chemistry 103 class, and beyond, growing up Shakhashiri was never dull and invariably educational.



## **Concluding Remarks**

*Bassam Z. Shakhashiri*



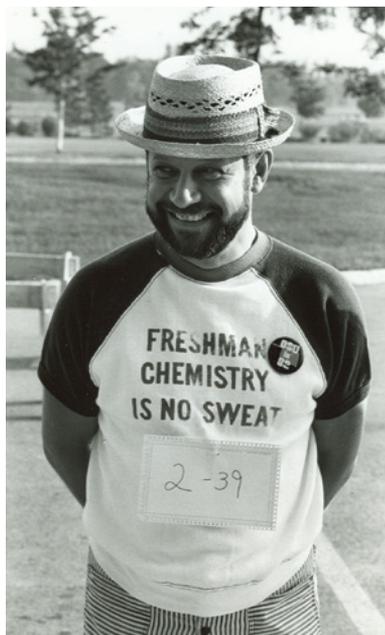
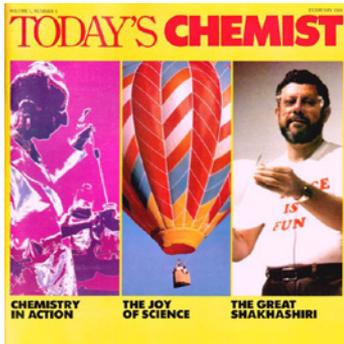


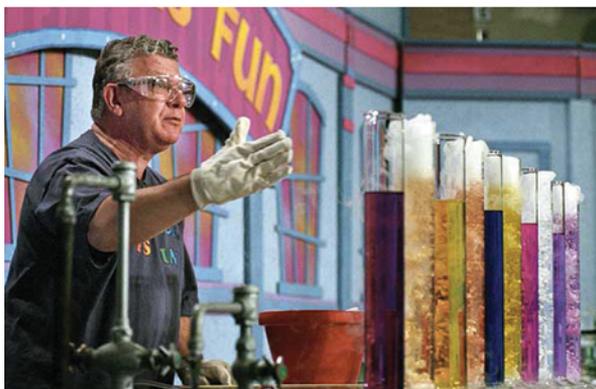
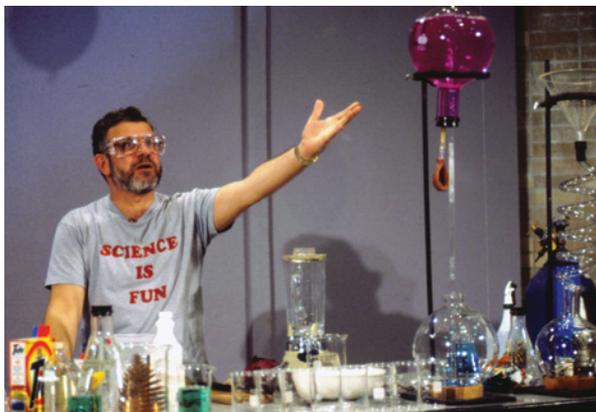
*"Scientists must purposefully address the global challenges that face science and society."*

*- Bassam Z. Shakhshiri*



1970 - 2014





**ADVANCING GRADUATE EDUCATION IN THE CHEMICAL SCIENCES**

Summary Report of an ACS Presidential Commission

**ACS**  
Chemistry for Life  
American Chemical Society



ACS Global  
**WATER**  
Initiative



**PUBLIC ENGAGEMENT**  
**ONE OF THE HALLMARKS OF THE**

WISCONSIN INITIATIVE FOR  
**WISL**  
SCIENCE LITERACY

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