A man with grey hair and safety glasses, wearing a red shirt, is working in a laboratory. He is looking down at a large, billowing white cloud of smoke or vapor that is rising from a test tube. To his left, there are other test tubes, one containing a purple liquid and another containing a yellow liquid. The background is a dark tunnel-like structure. The entire scene is set against a vibrant red background with a radial pattern of white squares and lines, creating a festive, holiday atmosphere.

Once Upon a
Christmas Cheery,
In the Lab
of Shakhashiri

December 1 & 2, 2012
Chemistry Building, UW-Madison

www.scifun.org

Origin of the Christmas Lecture



Michael Faraday, the noted English physicist and chemist, lived from 1791 to 1867. He was a gifted lecturer who began giving his Christmas Lectures for children and their families at the Royal Institution of Great Britain in the 1840s. Faraday loved simplicity, and he had a strong sense of the dramatic. His audience entered wholeheartedly into the world of science with his guidance. His ideas were still considered very unorthodox at that time, and children, who had not yet adopted conventional ideas, would react enthusiastically to the ones he presented. Eventually, the lectures became very popular, and even the Prince of Wales attended and learned about the mysteries of electricity. Faraday sought to awaken the sense of wonder in his listeners. He knew that once a person could be made to wonder about the world, it was only a short step to studying it. He strove to point out that if you looked closely at the most ordinary thing, such as the force of gravity, it ceased to be ordinary and became somehow miraculous. Throughout the 19 annual Christmas Lectures that he presented, Faraday did all he could to urge his listeners to see and judge for themselves, to experiment, and to question nature directly whenever anyone discovered something out of the ordinary.

Tc

Technetium

43

This is the 43rd annual presentation of the holiday lecture, "Once Upon a Christmas Cheery, In the Lab of Shakhshiri." It is fitting for a chemist to mark this anniversary with the element whose atomic number is 43, namely **technetium**.

Technetium (tech-NEE-she-um) is a silvery-gray metal that looks like many other metals, such as nickel, zinc, and platinum. What is unusual about technetium is that none of its atoms are stable—they are all radioactive. Because of this, almost no technetium is found in nature.

The creator of the periodic table, Dmitri Mendeleev, predicted in the mid 1800s that an element would exist to fill a gap in the table between molybdenum (42) and ruthenium (44). Although many claimed to have found it in nature, all of these claims turned out to be false. Finally, in 1936, the team of Carlo Perrier and Emilio Segre of the University of Palermo, Sicily, found technetium in a sample of molybdenum that had been used as a deflector plate in an early atomic particle accelerator.

Nearly all technetium is synthetic, made through technology, which is why it's called technetium. Most technetium is formed in fission nuclear reactors, similar to those used to generate electric power. In these reactors, larger atoms of uranium (92) break apart into various smaller atoms, including technetium. All atoms of technetium give off high-energy radiation. In this process, the atoms of technetium are transformed into atoms of other elements, eventually becoming a stable atom.

The major use of technetium is in medicine. Technetium 99 is used as a tracer for imaging and functional studies of many organs. It emits easily detectable gamma rays, and since its half-life is only 6.1 hours (the time taken for half of the atoms to decay), the radioactivity does not linger in the body.



Bassam Z. Shkhashiri is professor of chemistry at the University of Wisconsin-Madison and the first holder of the William T. Evjue Distinguished Chair for the Wisconsin Idea. The *Encyclopedia Britannica* cites him as the “dean of lecture demonstrators in America.”

- He has given over 1300 invited lectures and presentations around the world. He has been featured widely in the media including the *New York Times*, *Washington Post*, *Newsweek*, *Time*, the German language *Business Week*, NBC Nightly News, National Public Radio, CNN, and the Larry King show. He appears as a regular guest of Larry Meiller on the Ideas Network of Wisconsin Public Radio.

- He is the recipient of seven honorary doctoral degrees and over 35 awards, including the 2003 American Association for the Advancement of Science Award for Public Understanding of Science and Technology, “for his tireless efforts to communicate science to the general public, and especially children.”

- Inducted in 2004 into the Hall of Fame of the national chemistry fraternity Alpha Chi Sigma.

- In 2005, received the Madison Metropolitan School District Distinguished Service Award for a Citizen, the CHEMICAL PIONEER Award from the American Institute of Chemists, the American Chemical Society Helen M. Free Award for Public Outreach for “lifelong accomplishments and for explaining and demonstrating science with charisma and passion,” was elected Fellow of the Wisconsin Academy of Sciences, Arts and Letters and cited in the Answer Book of Capital Newspapers as “the coolest UW professor.”

- National Science Board 2007 Public Service Award for “extraordinary contributions to promote science literacy and cultivate the intellectual and emotional links between science and the arts for the public.”

- 2012 President of the **American Chemical Society**. He will serve a one-year term as immediate past president in 2013.

- Bassam and his wife June live in Madison. Their daughter Elizabeth, a 2007 alumnus of UW-Madison, graduated in May 2010 from the University of Michigan Law School and practices law in Chicago.

The American Chemical Society is the world's largest scientific society with more than 164,000 members. This includes 187 local sections throughout the United States and 33 scientific specialty divisions, ranging from food and agriculture to industrial and engineering chemistry. The society publishes 41 scientific journals and is one of the world's leading sources of authoritative scientific information. ACS is a non-profit organization chartered by Congress.



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- C. water vapor
- D. carbon dioxide

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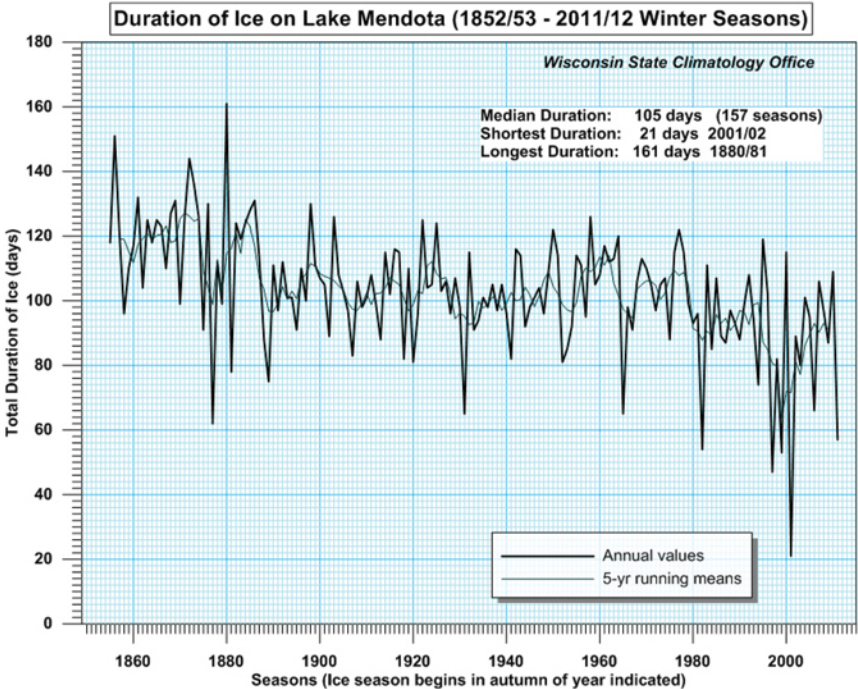
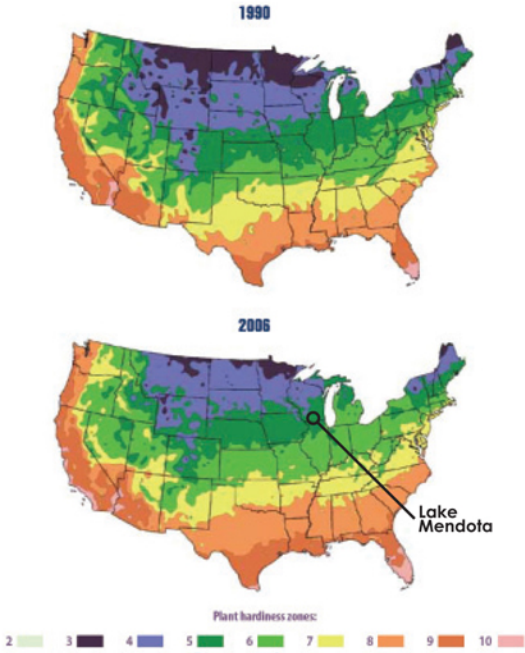
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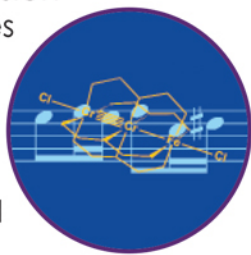


Wisconsin Initiative for Science Literacy

The dual mission of WISL is to promote literacy in science, mathematics and technology among the general public and to attract future generations to careers in research, teaching and public service. Science literacy is important because it allows all of us to make informed decisions in a world that relies daily on science and technology. It is essential for the well-being of our society that all citizens develop an appreciation of science, the benefits of technology, and the potential risks associated with advances in both.

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Chemical of the Week



The more we learn about chemicals the more we can appreciate their properties and uses. Every week you can learn fascinating facts and useful information by selecting one or more of these topics, available on the scifun.org website.

Communicating Chemistry Research to the General Public

The WISL encourages all PhD students to include a chapter in their thesis communicating their research to non-specialists. The goal is to explain the candidate's scholarly research and its significance to a wider audience that includes family members, friends, civic groups, newspaper reporters, and politicians.



Homemade Xylophone

You can make a xylophone at home. You need a set of glasses or glass bottles that are all the same. Pour a different amount of water into each bottle and place them all in a row. You can also add different colors of food coloring into the water to make them each look unique.



Tap the sides of the glasses with a metal spoon to hear the different sounds they make. You can tune your xylophone by adding or removing water from the bottles. Then, create your own music. And most importantly ...

Have Fun!



This Year's Guests

Rodney Schreiner, Senior Scientist at UW-Madison, has presented science shows in a wide variety of locations including the Epcot Center and has collaborated on 42 Christmas Lectures.

C. Marvin Lang, Emeritus Professor of Chemistry at UW-Stevens Point, has presented hundreds of demonstration shows around the world.

Lauren Buchanan is a PhD graduate student working in Prof. Martin Zanni's group, studying biophysics using 2D IR spectroscopy.

Acknowledgements

The 43rd Annual Christmas Lecture is made possible through the cooperation and support of:

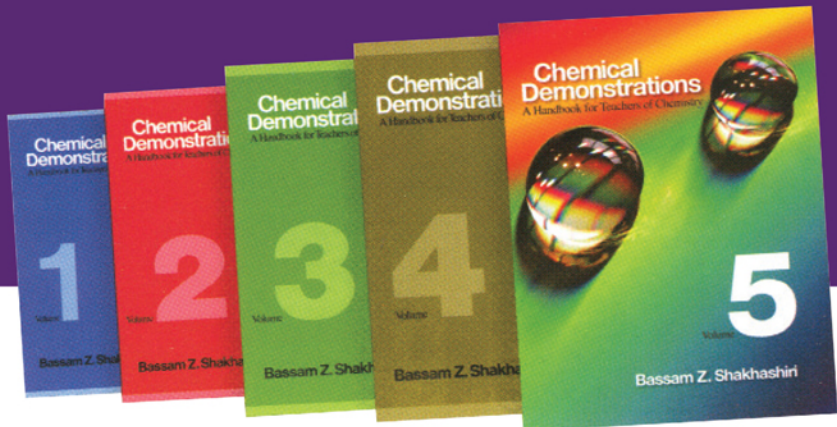
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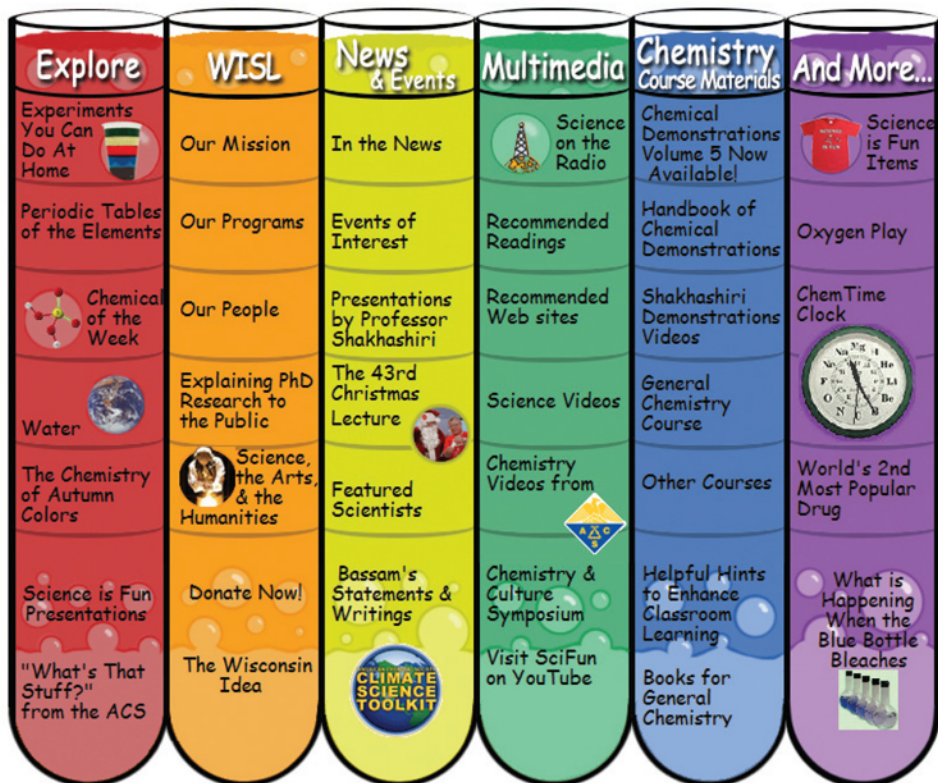
SCIENCE IS FUN

in the Lab of Shakhashiri

The master of chemical demonstrations and science policy advocate, University of Wisconsin-Madison Chemistry Professor **Bassam Z. Shakhashiri**, shares the fun of science through home science activities, public presentations, scholarship, and other programs of the Wisconsin Initiative for Science Literacy.

Bassam Z. Shakhashiri is the 2012 ACS President

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Wisconsin Public Television Telecasts

Friday, December 21 • 4:30 p.m.

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Wednesday, December 26 • 9:30 a.m.

Sunday, December 16 • 1:00 p.m. (on The Wisconsin Channel)

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