2007

The 38th Annual Presentation

Once Upon a Christmas Cheery In the Lab of Shakhashiri

Saturday, Dec 1, & Sunday, Dec 2
1:00 & 4:00 pm

38
Sr

Room 1351 Chemistry Building
1101 University Ave, UW-Madison

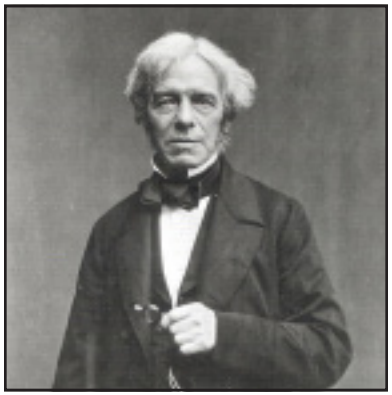
Wisconsin Public Television telecasts:
Friday, Dec 21, at 4:30 p.m.
Sunday, Dec 23, at 8:00 a.m.
Monday, Dec 24, at 12:30 p.m.
Tuesday, Dec 25, at noon
Friday, Dec 28, at 1:00 p.m.
and on Monday, Dec 31, at 9:00 a.m.

Check local listings for other PBS broadcasts.

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, and he began giving his Christmas Lectures for children 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 him as guide. 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 – to question nature directly – whenever anyone discovered something out of the ordinary.



38
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Strontium

This is the 38th annual presentation of the Holiday lecture, "Once Upon a Christmas Cheery in the Lab of Shakhashiri." It is fitting for a chemist to mark an anniversary with the element whose atomic number is 38, namely strontium.

Strontium is a soft, silvery-yellow metallic element that's used in fireworks to provide a beautiful red color. Its electrons give off a brilliant red glow after being excited by heat. Strontium was discovered by Irish scientist Adair Crawford in 1790 and named for the small mining town in Scotland where it was discovered, Strontian.

Strontium is best known for a radioactive isotope called strontium-90, which became infamous in the 1950's as a product of testing atomic bombs. Isotopes are different forms of the same element. All strontium nuclei have 38 protons, but they can have from 48 to 52 neutrons. Strontium-90 has 52 neutrons and is unstable–it gives off beta radiation as one of its neutrons becomes a proton, and that changes it into the next higher element, yttrium, which has 39 protons. The newly-formed yttrium is also radioactive. Radiation from both is damaging and can cause cancer.

Strontium-90 is a bigger threat to human health than some other products of nuclear reactions, because human and animal bodies easily absorb it. Strontium is chemically similar to calcium, its neighbor in column 2 of the periodic table. Strontium follows some of the same chemical pathways as calcium in the body. Our bodies can incorporate strontium in place of calcium in bones, which are over 50% calcium. Strontium is relatively rare, and incorporating a little non-radioactive strontium in bones is harmless. But once strontium-90 is incorporated in bones, it continues to give off harmful radiation for many years (its half life is 29 years–it takes that long for half of the strontium-90 nuclei to decay). Nuclear fallout created by atomic explosions landed on pastures, where it was eaten by cows and incorporated into their bones and milk (milk is rich in calcium). When people drank the milk, the strontium-90 got into their bones. A major alarm sounded when baby teeth were tested and found to contain dangerous levels of strontium-90. Public pressure resulted in a ban on testing nuclear weapons in the atmosphere, signed by the U.S., the Soviet Union, and Britain in 1963.

Strontium has only a few commercial uses. In addition to fireworks, it's used in the manufacture of some types of glass and color TV picture tubes. Despite its brilliance in fireworks, strontium's main claim to fame is the controversy over its radioactive version.

Bassam Z. Shakhashiri
William T. Evjue Distinguished Chair for the Wisconsin Idea

"Scientist by training, teacher and public servant by trade, advocate by conviction, optimist by nature" that is the way Bassam Z. Shakhashiri describes himself. As Professor of Chemistry at the University of Wisconsin-Madison, Dr. Shakhashiri finds outlet for all four attributes, to which he might add a fifth: entertainer by avocation.

Dr. Shakhashiri is probably best known to the public at large for his annual program, "Once Upon a Christmas Cheery/In the Lab of Shakhashiri,"; that attracts enthusiastic live and television audiences across the country. The one-hour show as well as two half-hour shows are featured year round on PBS and on other stations. The Christmas Lecture, which is in the tradition of the great British scientist Michael Faraday, is only one demonstration of Dr. Shakhashiri's attachment to hands-on science.

Dr. Shakhashiri is a guest on TV and radio talk shows across the country and is a regular guest on the Larry Meiller Show of Wisconsin Public Radio. He has been featured in newspaper, magazines, national and local radio and television including the *New York Times*, the *Washington Post*, *Newsweek*, *Time*, *NBC Nightly News*, CNN, and the *Larry King Show*.

A native of Lebanon, Dr. Shakhashiri came to the United States in 1957 with one year of college (at the American University of Beirut) behind him. He completed undergraduate work at Boston University (Class of '60) with an A.B. degree in chemistry, served as a teaching fellow at Bowdoin College for one academic year and then earned master's 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 chemistry faculty at the University of Illinois, Urbana, Dr. Shakhashiri joined the faculty of the University of Wisconsin in 1970, a position he has held since. In 1977 he was the founding chair of the UW System Undergraduate Teaching Improvement Council. In 1983 Dr. Shakhashiri founded the Institute for Chemical Education (ICE) and served as its first director.

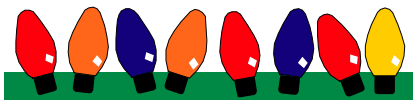
Dr. Shakhashiri has given over 1100 invited lectures and presentations in the US and other countries. He has co-authored several publications including *Workbook for General Chemistry*; *Chemical Demonstrations: A Handbook for Teachers of Chemistry, Volumes 1, 2, 3 and 4*; and semi-programmed booklets on equilibrium, kinetics, and organic chemistry.

Another of his pioneering efforts is an interactive chemistry exhibit on permanent display since 1983 at the Chicago Museum of Science and Industry.

From 1984 to 1990 Professor Shakhashiri served as Assistant Director of the National Science Foundation for Science and Engineering Education. As the NSF chief education officer he presided over the rebuilding of all the NSF efforts in science and engineering education after they had been essentially eliminated in the early 1980s. His leadership and effectiveness helped set the annual NSF education budget at its current level of about $800 million. His NSF strategic plan launched most of the NSF education programs of the last decades.

Among his over 35 awards are the 1977 Kiekhofer Distinguished Teaching Award from UW-Madison, the 1979 Manufacturing Chemists Association Catalyst Award, the American Chemical Society James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry (1983) and the ACS Award in Chemical Education (1986), and the 2003 "Public Understanding of Science and Technology" of the American Association for the Advancement of Science. In 1995 he was cited in the Year Book of Encyclopaedia Britannica as the "dean" of lecture demonstrators in America. In 2004 he was inducted into the Hall of Fame of Alpha Chi Sigma. In 2005 he received Madison Metropolitan School District "Distinguished Service Award for Citizen," the ACS Public Outreach Award 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 was cited in the *Answer Book* of Capital Newspapers as "the coolest UW professor." In 2006 he received the Rotary Club Senior Service Award. He is the recipient of five honorary doctoral degrees. This year he was selected by the National Science Board, which oversees the National Science Foundation, as recipient of its 2007 Public Service Award.

Dr. Shakhashiri directs the Wisconsin Initiative for Science Literacy (WISL) and its various programs including Science in the City; Science, the Arts, and the Humanities; Women in Science; Science on the Road; and Conversations in Science. For more information about WISL, please visit his web site at *www.scifun.org*.



This year's guests

C. Marvin Lang, Emeritus Professor of Chemistry, UW-Stevens Point, has presented hundreds of demonstration shows around the world to a wide variety of audiences.
Allan Naplan, General Director of the Madison Opera, is an award-winning composer and former professional opera singer.
Rucha Trivedi is a first-year student at the University of Wisconsin-Madison and holds a 4-year scholarship from the School of Music.
Nora Hickey, a senior at McFarland High School, is a member of the Wisconsin Youth Symphony Orchestra and a prize winner in the Wisconsin Science Olympiad.
Elise Larson is a first-year undergraduate student at the University of Wisconsin-Madison, majoring in astrophysics.
Rodney Schreiner, Senior Scientist at UW-Madison, has presented science shows in a wide variety of locations including the Epcot Center and has collaborated with Prof. Shakhashiri on 36 Christmas Lectures.
Bucky Badger has participated in all 37 of Prof. Shakhashiri's Christmas Lectures, and he always obeys the safety rules!

Wisconsin Initiative for Science Literacy

WISL sponsors many programs in addition to the Holiday Lecture. Among its offerings are Science Is Fun! presentations by a group of UW students and staff who travel to various locations to demonstrate the joy of science. We also offer hands-on workshops where students and parents work together on experiments on topics, such as energy, sound, polymers, light, or ecology. More information is at *www.scifun.org*.

Support the Holiday Lecture

For 38 years, audiences have enjoyed Professor Shakhashiri's Holiday Lecture in person and through television broadcasts across the country. You can join Professor Shakhashiri and his friends in supporting the Holiday Lecture by sending a gift to the University of Wisconsin Foundation. You may send your tax-deductible contribution to:

Shakhashiri Science Education Fund (attn Wendy Richards)
University of Wisconsin Foundation
P.O. Box 8860
Madison, WI 53708-8860

Your gift, no matter the amount, is greatly appreciated.

A Home Science Experiment

An old adage has it that "a watched pot never boils." It means, of course, that something you are eagerly anticipating seems to take forever to happen, such as the arrival of Santa. This saying expresses its meaning because it does take a lot of heat to raise the temperature of water. Here's a dramatic way to demonstrate this.

What you need are two similar uninflated balloons and a candle. First, inflate one of the balloons, and tie it shut. Second, put about 100 mL (¼ cup) of water into the second balloon, inflate it, and tie it shut. Now, light the candle. Hold the first balloon by its knot and lower it above the candle until the flame touches the rubber. The balloon will pop almost immediately. Now, lower the second balloon over the candle flame, making sure that the water inside is directly over the flame. You will be able to hold the balloon in the flame for at least several seconds.

The first balloon breaks because heat from the flame weakens the rubber. The second balloon doesn't break because the water inside absorbs most of the heat. For more experiments you can do at home, check the Science Is Fun web site: *www.scifun.org*.

Acknowledgements

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University of Wisconsin-Madison
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School of Music

Bucky Badger

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