



**2008**  
**The 39th Annual Presentation**

**ONCE UPON  
A CHRISTMAS CHEERY  
IN THE LAB OF  
SHAKHASHIRI**

**December 6 & 7**  
**Chemistry Building**  
**UW-Madison**

**[www.scifun.org](http://www.scifun.org)**

**Wisconsin Public Television telecasts:**

**Sunday, Dec 21, at 7:00 am**

**Wednesday, Dec 24, at 10:30 am**

**Thursday, Dec 25, at 1:30 pm**

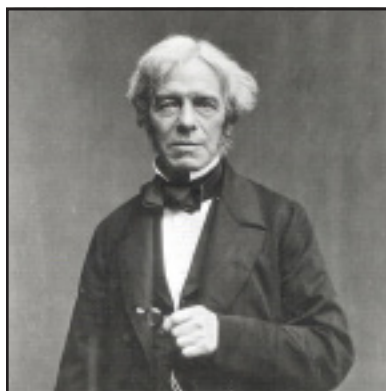
**Sunday, Dec 28, at 8:00 am**

**Check local listings for other PBS broadcasts**

## 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 electric-



ity. 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.



39

Y

Yttrium

This is the 39th annual presentation of the Christmas 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 39, namely yttrium.

Yttrium is a silvery grey metal. It’s stable in air and mildly toxic if ingested. Yttrium has no known biological function, and we could all live without it. But yttrium has several uses in high-tech products. In TV picture tubes, yttrium helps europium provide the red color. Yttrium collects energy from the TV tube electron gun while the europium provides the red glow. In radar sets, garnets (like the gemstone) made of yttrium and iron are extremely effective microwave filters, eliminating noise and allowing for lower power radar units with smaller collectors. Yttrium aluminum garnets are used to make YAG lasers that are employed in laser surgery. Also in medicine, a radioactive isotope, yttrium-90, is used in needles to kill pain-transmitting nerves. Isotopes are different forms of an element. All yttrium atoms have 39 protons in their nuclei, but they can have different numbers of neutrons. Yttrium 90 has 51 neutrons ( $39+51=90$ ), which is more than it needs, so it decays, giving off nuclear radiation.

Yttrium has also played a role in the search for high temperature superconductors. Superconductors conduct electricity with no resistance and no loss of energy, but so far they have to be extremely cold to do it. A compound of yttrium, barium, copper and oxygen is one of the highest-temperature superconductors yet discovered. It is superconductive at temperatures higher than that of liquid nitrogen ( $-196^{\circ}\text{C}$ ). Because liquid nitrogen is a common coolant used in many laboratories and factories, this yttrium compound makes the use of superconductors much more practical.

Yttrium was discovered by Finnish chemist Johann Gadolin in 1789. It is named for Ytterby, a small town in Sweden, where a mine yielded many unusual minerals which lead to the discovery of several elements. Three other elements, discovered much later, are also named for Ytterby, terbium (element 65), erbium (68), and ytterbium (70). Gadolin also discovered element number 64 and named it for himself, gadolinium. The ruins of the mine where the minerals were found is now an International Historic Landmark.

**BASSAM Z. SHAKHASHIRI**  
**William T. Eujue 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. Shakhshiri describes himself. As Professor of Chemistry at the University of Wisconsin-Madison, Dr. Shakhshiri finds outlet for all four attributes, to which he might add a fifth: entertainer by avocation.

Dr. Shakhshiri is probably best known to the public at large for his annual program, “Once Upon a Christmas Cheery/In the Lab of Shakhshiri,”; 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. Shakhshiri’s attachment to hands-on science.

Dr. Shakhshiri 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. Shakhshiri 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. Shakhshiri 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. Shakhshiri founded the Institute for Chemical Education (ICE) and served as its first director.

Dr. Shakhshiri has given over 1100 invited lectures and presentations in the US and other countries. He has coauthored 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 *Encyclopaedia Britannica Year Book* 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. In 2007 he was selected by the National Science Board, which oversees the National Science Foundation, as recipient of its 2007 Public Service Award. He is featured in the December 2008 issue of *Brava* magazine.

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, Religion, and Ethics; and Conversations in Science. For more information about WISL, please visit his web site at [www.scifun.org](http://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.

**Clare Arena Haden** is a third year graduate student of acting here at UW-Madison, and she is also the TA of beginning and intermediate voice for the actor classes for theatre undergraduates.

**Leah Latorraca**, a sophomore at La Follette High School, is a member of the Music Institute of Chicago's Academy program where she studies violin privately with Desiree Ruhstrat. In 2008 she won the Madison Symphony Orchestra Bolz Young Artists competition.

**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. Shkhashiri on 38 Christmas Lectures.

**Bucky Badger** has participated in all 39 of Prof. Shkhashiri's Christmas Lectures, and he always obeys the safety rules!

## **Wisconsin Initiative for Science Literacy**

WISL sponsors many programs in addition to the Christmas 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](http://www.scifun.org).

## **Support the Christmas Lecture**

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

**Shkhashiri 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

Many plants contain acid-base indicators. Red cabbage contains a universal indicator, one that gradually changes color as its acidity changes. You can use red cabbage to make a solution that can have all the colors of the rainbow.

Put about a cup of red cabbage chunks into a blender with a cup of water. Blend the mixture until the cabbage has been chopped into tiny pieces. With a sieve, strain the liquid from the solid, and put the liquid into a tall glass. Add enough water to fill the glass  $\frac{3}{4}$  full.

Add about a tablespoon (15 mL) of milk of magnesia to the glass and stir. The mixture will be cloudy blue. Add about a tablespoon of vinegar to the glass and stir. The mixture will turn red. Continue to stir, and the mixture will gradually cycle through the colors of the rainbow, until it has returned to blue. You can repeat this several times by adding more vinegar, until the mixture is no longer cloudy.

For more experiments you can do at home, check the Science Is Fun web site: [www.scifun.org](http://www.scifun.org).

## ORDER YOUR CHRISTMAS LECTURE VIDEO

You can have your very own copy of this year's Christmas Lecture on DVD (as well as DVDs from past years' shows)! Also available are **SCIENCE IS FUN** buttons, shirts, hats, mugs, Chem Time Clocks, periodic-table cups, and the 4-volume set of *Chemical Demonstrations: A Handbook for Teachers of Chemistry*. All of these and many more great science fun items are available from

**Educational Innovations, Inc.**  
362 Maine Avenue  
Norwalk, CT 06851

1-888-912-7474 (toll free)  
[info@teachersource.com](mailto:info@teachersource.com)  
[www.teachersource.com](http://www.teachersource.com)





## Acknowledgements

The 2008 Christmas Lecture  
is made possible through the  
cooperation and support of:

University of Wisconsin-Madison  
Department of Chemistry

Bucky Badger

Wisconsin Public Television  
Public Broadcasting System

Friends of the UW  
Christmas Lecture