



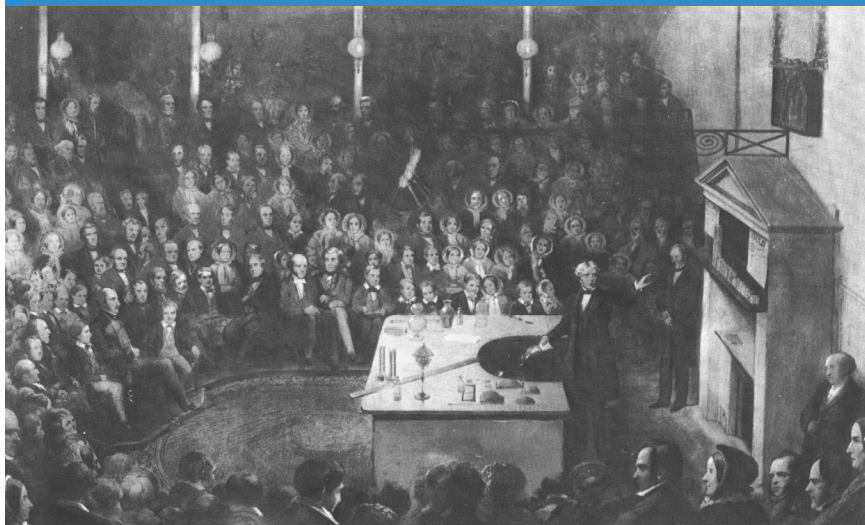
*The 42<sup>nd</sup> Annual*

**Once Upon a  
Christmas  
Cheery  
In the Lab  
of Shakhshiri**

December 10 & 11, 2011  
Chemistry Building, UW-Madison

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

# Origin of the Christmas Lecture



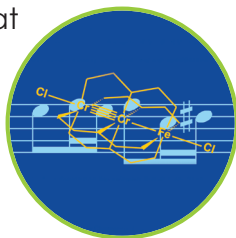
**M**ichael Faraday, the noted English physicist and chemist, lived from 1791 to 1867. He was a gifted lecturer who began giving his Christmas Lectures for children and their families at the Royal Institution of Great Britain in the 1840s. Faraday loved simplicity, and he had a strong sense of the dramatic. 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 – to question nature directly – whenever anyone discovered something out of the ordinary.

# 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.

## Science, the Arts and the Humanities

Creativity, passion and the urge for expression and exploration are essential human qualities that inspire science, the arts, and the humanities, and thus constitute a common bond among them. WISL helps people explore, discuss, and cultivate the intellectual and emotional links between science, the arts, and the humanities.



## 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](http://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.



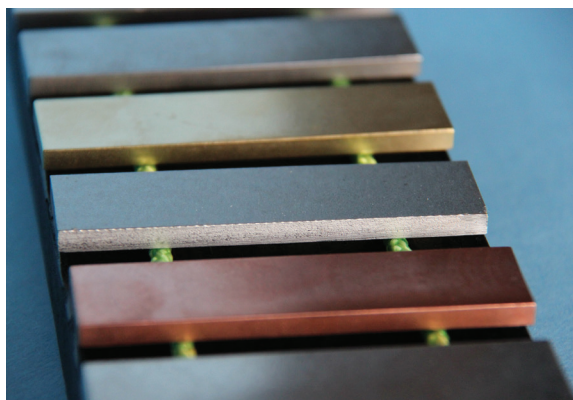


**m**olybdenum (*moe-LIB-di-num*) is probably the most useful element that you have never heard of. It's commonly alloyed with iron to make different kinds of steel and is also a necessary nutrient for the human body.

An alloy is a mixture of two or more metals. Bronze is a mixture of copper and tin. Brass is a mixture of copper and zinc. Steel is a mixture of iron with any of several other metals that include nickel, chromium, vanadium, magnesium, tungsten and molybdenum. Because molybdenum has a very high melting point, 2623 C (4,753 F), it makes steel more heat resistant. Iron melts at only 1535 C. Molybdenum's atoms are bigger than iron's and have 60 percent more electrons, so they get excited more slowly, absorb more heat and bind together tightly. This prevents the iron atoms from rearranging themselves in response to heat, a process which makes iron more brittle. Molybdenum also makes steel harder and more corrosion resistant. A popular form of steel is called "chrome-moly" steel. Chromium by itself makes iron corrosion resistant. Adding molybdenum makes it even more corrosion resistant and also makes it harder and more heat resistant. Molybdenum is also used in applications that do not involve iron. For example, molybdenum disulfide is used as a solid lubricant in situations requiring high heat and pressure resistance.

Molybdenum is also necessary for the functioning of the human body. It's found in many enzymes, bio-chemical catalysts that promote chemical reactions in cells. A catalyst is a substance that modifies the rate of a chemical reaction, usually speeding it up, without being consumed in the process. Humans need only very small amounts of molybdenum, which are easily supplied by a normal diet. It's possible to ingest too much molybdenum, but that's unlikely given its scarcity in the environment. Molybdenum is also present in human tooth enamel, and may help prevent decay.

Molybdenum is a silvery-grey metal which is not found by itself in nature. It is sometimes found in the same ores as lead and was confused with lead and lead ore (known as galena). The name is a Latin adaptation of an ancient Greek word for lead. Molybdenum was first identified as a separate element in 1778 by Swedish chemist Carl Wilhelm Scheele (*SHAY-lä*), who was also a codiscoverer of oxygen. It was first isolated in 1781 by Swedish chemist Peter Jacob Hjelm. Because molybdenum is relatively scarce and isolating the pure metal is difficult, no commercial uses were discovered until the 20<sup>th</sup> century. The first widespread use occurred during World War I, when German manufacturers discovered that it made steel cannon barrels much more heat resistant, so the guns could fire many more rounds before wearing out. Since then, molybdenum has found many uses as an alloy to make different kinds of steel.



### **Molybdenum Gets Musical!**

The gray metal bar in the center of this metallophone is made of molybdenum, and produces a tone that is different from the other metal bars around it.





# 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!



**Bassam Z. Shakhshiri** 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.”

- 2011 President-Elect of the **American Chemical Society**. He will serve one-year terms as president in 2012 and 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 163,000 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.



ACS  
Chemistry for Life®

- The society's international membership exceeds 24,000 and represents more than 100 countries.
- The vision of ACS is to improve people's lives through the transforming power of chemistry.
- The mission of ACS is to advance the broader chemistry enterprise and its practitioners for the benefit of Earth and its people.
- ACS plays a leadership role in communicating with public policy makers and the general public about the importance of chemistry in our lives.
- ACS provides educational, science policy and career programs like the ACS Green Chemistry Institute, the ACS Scholars Program and Teacher Training.

[www.acs.org](http://www.acs.org)

### 2012 ACS Presidential Initiatives:

- To celebrate the sesquicentennial of the Morrill Land Grant Act
- To create a blue-ribbon panel to examine the purposes of graduate education in the chemical sciences
- To help the public understand the science of climate change
- To create an ACS high school teacher fellowship program

## **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 with Prof. Shakhshiri on 41 Christmas Lectures.

**Bucky Badger** has participated in all 42 of Prof. Shakhshiri's Christmas Lectures, and he always obeys the safety rules!

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

**Todd Hammes**, percussionist, resides in Madison and composes and performs with an ever-widening network of friends and musicians.

## **Acknowledgements**

**The 42<sup>nd</sup> Annual Christmas Lecture is made possible through the cooperation and support of:**

University of Wisconsin-Madison

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## **Become a Donor to WISL**

You can join Professor Shakhshiri and his friends in supporting the Christmas Lecture and other WISL programs by sending a gift to the University of Wisconsin Foundation. You may send your tax-deductible contribution to:

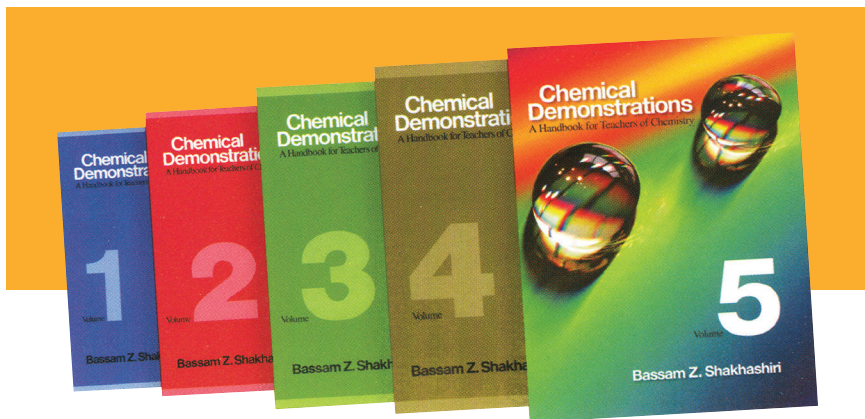
**Shakhshiri Science Education Fund**

**(Attn. Wendy Richards)**

**University of Wisconsin Foundation, P.O. Box 8860**

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# SCIENCE IS FUN

## in the Lab of Shakhshiri

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

40 Years of Once Upon a Christmas Cheery, In the Lab of Shakhshiri ... And Beyond!

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 Chemical of the Week	Our People	Presentations by Professor Shakhshiri	Recommended Web sites	Shakhshiri Demonstrations Videos	ChemTime Clock 
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Science is Fun Presentations	 Science, the Arts, & the Humanities	Featured Scientists		Other Courses	2009 Nobel Prize in Chemistry 
What's That Stuff? from the ACS	Support WISL	Bassam's Call to Action First appearing in Wisconsin People & Ideas, Vol. 55, No. 2 (Spring 2009).		Helpful Hints to Enhance Classroom Learning	 IYC 2011 International Year of Chemistry

## Wisconsin Public Television Telecasts

Friday, December 23 • 4:30 p.m.

Sunday, December 25 • 8:00 a.m.

Check local listings for telecast times elsewhere around the country.

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