

*25th Annual*

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

*December 1994*



**SPECIAL SILVER ANNIVERSARY CELEBRATION**

*December 10 (1:00 & 3:30 pm)*

*December 11 (1:30 & 4:00 pm)*

*Farrington Daniels Chemistry Building  
University of Wisconsin-Madison*

## *Michael Faraday's 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. 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.





## **Bassam Z. Shakhashiri**

"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, as a matter of fact, is probably best known to the public at large for his annual entertainment, "Once Upon a Christmas Cheery! In the Lab of Shakhashiri." The science-oriented "magic" show has played to packed houses at such varied places as the University of Wisconsin-Madison, the National Academy of Sciences and the Smithsonian's National Air and Space Museum in Washington, and Boston's Museum of Science. This show and other science-oriented programs also have been featured on local and national broadcasts including Wisconsin Public Television, the NBC Nightly News with Tom Brokaw, the Cable News Network, and the Larry King Show.

The show is Dr. Shakhashiri's way of proving that "science is fun" (the legend on a T-shirt he dons for the show). By demonstrating how much fun it can be, Dr. Shakhashiri, in his role as advocate for science, seeks to impart the joy of discovery that has aroused young minds throughout history. This excitement, he believes in his role as optimist, will lure future generations to careers as researchers, entrepreneurs and teachers on whom the nation's continuing economic health and national security will depend. More importantly, he advocates the achievement of literacy in science, mathematics, and technology among those who choose other pursuits. He believes it is essential for the well being of our society that all citizens develop an understanding and an appreciation of science, the benefits of technology, and the potential risks associated with advances in both.

A native of Lebanon, Dr. Shakhashiri is the son of a physician who recently retired from the U.S. National Institutes of Health

in Bethesda, MD. The Shakhshiris, father, mother, son and two daughters, came to the United States in 1957 when Bassam was 18 years old 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 as post-doctoral research and two years as a junior member of the 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 1983 he founded the Institute for Chemical Education and served as its first director.

On June 26, 1984 he was sworn-in as Assistant Director of the National Science Foundation for Science and Engineering Education by the President's Science Adviser. In this position he was the principal education officer of the government agency chiefly concerned with research in the natural sciences and engineering. As such, he was responsible for the design and administration of a wide variety of programs to improve all levels of education in mathematics, engineering and the sciences.

He presided over the rebuilding of the NSF efforts in science and engineering education after they had been essentially eliminated in the early 1980's. His vision and effectiveness in developing and implementing national programs in science and engineering education became legend and have set the NSF education effort on its strongest programmatic direction and biggest budget ever.

In September of 1990 he returned to Madison and resumed teaching introductory level chemistry to over 700 students annually. In addition, he continues his advocacy for both increasing the flow of talent to careers in science and achieving science literacy by the public at large.

The Christmas show is only one demonstration of Dr. Shakhshiri's attachment to hands-on science. He is well known nationally for his development and use of demonstrations in the teaching of chemistry in lecture rooms and laboratories as well as in such less formal settings as convention centers, shopping malls and retirement homes. He is a guest on radio talk shows across the country and is featured regularly on the Larry Meiller Show on the Wisconsin Educational Radio Network. One of his best known efforts is an interactive chemistry exhibit on permanent display since 1983 at the Chicago Museum of Science and Industry. He has co-authored several publications including: Manual for Laboratory Investigations in General Chemistry; Workbook for General Chemistry Audio-Tape Lessons; Chemical Demonstrations: A Handbook for Teachers of Chemistry, Volumes 1, 2, 3 and 4; and semi-programmed booklets on equilibrium, kinetics, and organic chemistry. The Shakhshiri Chemical Demonstrations Videotapes were published in 1991 by Holt, Rinehart and Winston, Inc. and Saunders College Publishing Company.

Dr. Shakhshiri is a member of many scientific and educational organizations including the American Chemical Society, in which he has held numerous leadership positions at the local and national levels. In 1986, he was elected a fellow of the American Association for the Advancement of Science in recognition of his scientific and educational achievements.

Among his many awards are the 1977 Keikhofer Distinguished Teaching Award from the University of Wisconsin-Madison, and the 1979 Manufacturing Chemists Association Catalyst Award. He is the youngest recipient of two of the American Chemical Society's most coveted recognitions--the James Flack Norris Award for Outstanding Achievement in the Teaching of Chemistry (1983) and the ACS Award in Chemical Education (1986). In 1987, he was cited for distinguished public service by the District of Columbia Science Education Association, the National Science Teachers Association, the South Carolina Academy of Science, and the Boston University General Alumni Association.

In 1988 the George Washington University conferred upon him the degree of Doctor of Public Service, and Illinois State University awarded the degree of Doctor of Humane Letters for distinguished service to the science of chemistry and to the nation. In 1991 he was awarded an honorary doctoral degree by Ripon College in recognition of his outstanding national contributions to science education. In 1992 he was awarded an honorary doctoral degree from the University of Colorado. In 1993 he was awarded an honorary doctoral degree from Grand Valley State University. In 1994 he was elected to the Teaching Academy of the University of Wisconsin-Madison.

Detailed information about this year's experiments and many others may be found in *CHEMICAL DEMONSTRATIONS: A HANDBOOK FOR TEACHERS OF CHEMISTRY*, Volumes 1-4, Bassam Z. Shakhshiri, (1983, 1985, 1989, and 1992), University of Wisconsin Press, 114 North Murray Street, Madison, WI 53715; 608-262-8782.



## SILVER

Twenty-fifth anniversaries are usually associated with the precious metal silver. Silver is chemical element number 47, and its symbol is Ag (from its Latin name *argentum*).

Silver is one of the metals known since ancient times, along with gold, copper, iron, and lead. Like gold and copper, silver can sometimes be found pure in nature. However, most silver is extracted from sulfide ores that also contain lead or copper.

Pure silver is a soft and malleable metal. It can easily be bent or hammered into various shapes. To make silver objects harder and more durable, silver is alloyed with small amounts of other metals. The most common silver alloy for household items is sterling silver, which contains 92.5% by weight silver and 7.5% copper. Silver coins contain 90% silver and 10% copper.

Pure silver metal is a very white metal; it reflects nearly all colors equally. This property makes silver useful for mirrors. Other metals, such as aluminum and chromium are also used to make mirrors, but these metals appear somewhat blue, which is less desirable for cosmetic mirrors. Early mirrors were simply highly polished pieces of silver. However, a mirror of silver is easily damaged, not to mention quite expensive. Modern mirrors are made by depositing a very thin film of silver metal on a sheet of glass.

Silver is an enduring metal. It does not corrode like iron. However, silver can become tarnished. When silver tarnishes, a thin coating of silver sulfide forms on the surface of the silver, darkening it. Silver sulfide forms in a chemical reaction between silver and sulfides. Sulfides are sulfur-containing substances, which exist in the air or in foods, especially eggs.

Compounds of silver are used in a variety of products. One of these is photographic film. Many silver compounds are light-sensitive, darkening when exposed to light. Silver chloride and silver bromide are particularly sensitive. Photographic film has a coating that contains tiny crystals of one of these silver compounds. When the film is exposed, the crystals that light shines onto are changed. The changed crystals form a latent image that is enhanced in the process of development.

Silver compounds are also used in batteries. Many watches and calculators use zinc-silver oxide batteries. Unlike standard zinc-carbon batteries, these batteries can be made with electrodes that are very close together, so the batteries can be very small.



## **Acknowledgements**

The 1994 Christmas Lecture is made possible through the cooperation and support of:

*University of Wisconsin-Madison*

*Department of Chemistry*

*Institute for Chemical Education*

*Student Affiliates of the American Chemical Society*

*Bucky Badger*

*Wisconsin Public Television*

*Public Broadcasting System*

*Dow Chemical Company*

*Merck Institute for Science Education*

*University Bookstore for Kids*

*Anonymous Donors*

*Santa Claus*

*Santa's Elves*