

# CHEMMUNICATOR

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2006 Fall Semester

UMR  
Chemistry  
Department

## UMR students show legislators why research matters

Selected students from the University of Missouri-Rolla participated in Undergraduate Research Day an annual event, on April 4, 2006, in Jefferson City, Mo. at the Capitol.

The purpose of the event was to show state lawmakers how University of Missouri undergraduates are participating in meaningful research with faculty.

Students from all four UM campuses displayed research posters in the Capitol rotunda. Additionally, the participating students had opportunities to let legislators know how their research addresses the needs of society.

In addition to demonstrating the benefits of hands-on learning, Undergraduate Research Day organizers hoped the event would provide leadership development, improve collaborative problem solving and promote professional development.

The following research topic was presented by UMR Chemistry students participating as individuals or in groups at Undergraduate Research Day at the Capitol:

Turning plants into paint: Kyle Anderson, a senior in chemistry from California, Mo. and Travis McDowell, a senior in chemistry from Fredericktown, Mo.

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- Chemistry welcomes new faculty member Cynthia Bolon

## UPCOMING events

Rolla Night in St. Louis.....	October 5, 2006
Homecoming.....	October 20-21
Fall Commencement.....	December 16
Spring Semester Starts.....	January 8, 2007
Spring Open House.....	February 19
St. Pat's Celebration.....	March 13-18
Spring Open House.....	April 6
2007 Spring Banquet.....	April 27
Spring Commencement.....	May 12

## Homecoming 2006

The Chemistry Department will host a Departmental Open House on Friday, October 20, 2006 from 3-4 pm in the Webb Reading Room in Schrenk Hall.

# UMR dean received award from national sorority



Dr. Paula M. Lutz, dean of the College of Arts and Sciences at the University of Missouri-Rolla, was recently named a recipient of a 2005 Order of the Pearl award from Kappa Delta sorority.

The Order of the Pearl recognizes Kappa Delta alumnae for outstanding contributions to society at the national, state or local level outside of their service to Kappa Delta. Lutz was nominated for the award by the Epsilon Alpha chapter at UMR.

Lutz joined Kappa Delta as an undergraduate student at UMR and became involved as an alumna in 1976 while in graduate school at Duke University Medical School. "I was walking down a hall in the research building where I studied at Duke and encountered an undergraduate work-study student wearing a KD T-shirt," Lutz says. "I asked about the chapter there and discovered that they had few advisors and needed help."

"Over the last 30 years, I've enjoyed being an alumna advisor for KD," Lutz says. "I have been privileged to work with some fantastic young women here and at Duke, and some truly talented and dedicated alumni as well. They have taught me and inspired me. As an administrator, I don't have as much student contact as I used to have, or would like to have and the KDs help me keep my finger on the pulse."

Lutz, who was UMR's Woman of the Year in 1999, earned her bachelor's degree in life sciences from UMR in 1976, then went on to earn a Ph.D. in microbiology and immunology at Duke University Medical Center. She came back to UMR in 1987 as an assistant professor of life sciences. She was named chair of the biological sciences department in 2000 and dean of the College of Arts and Sciences in 2002.

Since returning to UMR, Lutz has served the Epsilon Alpha chapter of Kappa Delta sorority as faculty advisor, membership advisor, president and standards advisor. She is currently co-advisor for standards.

## *Faculty News Bites*

### *Dr. Prakash Reddy*

was promoted to associate professor of chemistry with tenure.

***Congratulations Dr. Reddy!!***

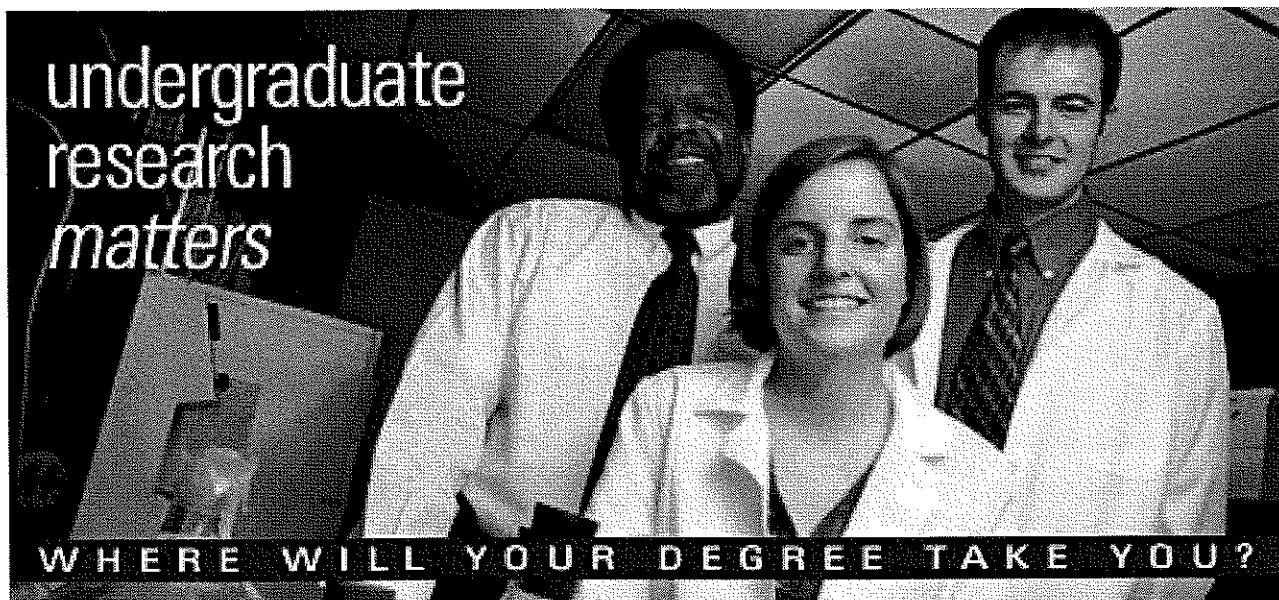
### *Dr. Charles Chusuei*

latest work is a first-time publication of his in the area of x-ray absorption spectroscopy that appears in Chemistry of Materials. This article has been featured as an unsolicited Science Highlight by the National Synchrotron Light Source, which recognizes the top 50 publications in the field annually.

### *Dr. Jay Switzer*

will be the recipient of the 2006 ACS Midwest Award. This award will be presented on October 26, 2006, at the Midwest Regional Meeting (MWRM) in Quincy, IL. The award is conferred annually on a scientist who has made meritorious contributions to the advancement of pure and applied chemistry, chemical education and the profession of chemistry.

***Congratulations Dr. Switzer!!***



Kylee Hyzer, center, and Kyle Anderson, right, enjoy the experience of conducting research at UMR with professors like Harvest Collier, left, professor of chemistry.

## Turning Plants into Paint



Paving the road for less U.S. dependence on foreign oil are Kylee Hyzer and Kyle Anderson, Chem. '05, whose research at UMR could lead to a soybean-based replacement for the petroleum used in roadway paint.

Their project, called "Plants into Paint," involves the use of a certain oil found in soybeans. Hyzer, a senior chemistry major with minors in math and biology, and Anderson, a chemistry major who has completed his B.S. degree and joined the UMR PhD program to study polymer and coating chemistry, are working to refine the oil found in the soybean and to chemically modify it for use in the acrylics normally used in road coating.

The students also hope to keep the process efficient and economical enough for industrial use. They want the process to be inexpensive and environmentally friendly. "If it is expensive, no one will use it," Hyzer said. In addition, current methods of producing the paint with petroleum produce a great deal of waste. Hyzer and Anderson want to reduce this waste by creating a one-step process that won't be affected by temperature.

Soybeans are one of the most renewable resources in Missouri and are "recognized as one of the strongest agricultural products in the state," said Harvest Collier, professor in chemistry and the project advisor. Increasing the need for soybeans will help the Missouri agricultural industry, Collier adds.

While this OURE project ultimately might help one industry become less dependent on petroleum, it's also teaching Anderson and Hyzer to be more independent. "OURE prepares you for the world outside academia," said Anderson, adding that both he and Hyzer were surprised by how much independence UMR gave them. Collier expects them to come up with methods and processes on their own. Hyzer is most impressed by "how much trust and resources UMR allows the student to have to conduct research."

The students are also encouraged to learn from graduate students and to seek help from other professors. Anderson notes, "It seems that people are always willing to help out."

Collier adds that "the research offers students the opportunity to learn about problem-solving from a fundamental chemical research perspective and also from a practical industrial application perspective."



## Greetings from the Chair

to a total of 59.

With respect to scholarly activity the faculty have published 88 articles in the open literature yielding an average of 4-5 publications per full-time faculty member, and the department's grant and contract expenditures totaled \$2.94M. The research underwritten by these externally sponsored funds addresses a diverse range of topics as evidenced by the following examples: particulate matter characterization, novel hydrogen storage materials, corrosion finishing and coating materials, mine detection and epitaxial electrodeposition of chiral metal oxides. These examples represent just a few of the research topics currently being pursued by our faculty and staff.

The search for the Vitek Chair is close to completion. We are currently negotiating with an excellent candidate and I hope to share good news about an appointment in the near future.

With best wishes to all,

Phil Whitefield

## Alumni Updates

### **Audrey (Linville) Fox**

(B.S. 1993) and Jon Fox, Phys '93, had a baby boy, Calvin on Aug. 4, 2005. He joins brothers Louis, 3, and Maxwell, 7.

### **Donald T. Robertson**

(B.S. 1970) was a member of the independents while attending MSM-UMR. He worked for Rohm and Haas Co. as a chemist and at Miami University-Middletown in the Center for Chemistry Education. Mr. Robertson was a life long amateur astronomer and a Civil War enthusiast. Deceased Nov. 3, 2005.

### **Joseph T. Bohanon**

(Ph.D. 1970) My son Jason will graduate from Evangel University and will

begin Graduate Studies at UMR fall 2006.

### **Richard Rowton**

(B.S. 1950 & M.S. 1952) After a 30 year stint as a research chemist with Texaco Chemical Co., we continue to hold forth in Austin, TX, surrounded by family & friends.

### **George A. Chappell**

(B.S. 1960 & M.S. 1962) was a member of Sigma Phi Epsilon, Alpha Chi Sigma, Alpha Phi Omega, the Scholastic Honors Association, AIChE and Army ROTC while attending MSM-UMR. He worked for the Institute of Gas Tech-

nology and was deputy chief information officer for Textron Lycoming, after which he taught high school chemistry and science, retiring in 2002. Deceased Dec. 18, 2005.

### **Donna Kay (Parks) Rathowski**

(B.S. 1982) works for Afton Chemical Corp. in Sauget, IL.

### **Gene Addison**

(B.S. 1974) has been at Rutland Products for almost 2 years. He is a chemist and does research and development, quality control, environmental, safety and technical customer service. He would love to hear from fellow chemists of the class of '74.

# New antioxidant may help prevent AIDS dementia, says UMR chemist



A newly redesigned antioxidant may play a critical role in preventing HIV-1-associated dementia, says a University of Missouri-Rolla chemist. Her research will be published in an upcoming issue of the journal *Experimental Neurology*.

"A third of the adults and half of the children with AIDS develop HIV-1-associated dementia," explains Dr. Nuran Ercal, professor of chemistry at UMR and adjunct associate professor of internal medicine at Saint Louis University. "Cognitive impairment, postural disorders and tremors are among the most common symptoms encountered in patients suffering from AIDS dementia complex."

Ercal collaborated with Dr. William Banks, professor of geriatric medicine at Saint Louis University, to determine whether the antioxidant N-acetylcysteine amide (NACA) could prevent cell death and reverse oxidative stress, a condition associated with many different irreversible

neurological degeneration diseases, including Parkinson's and Alzheimer's.

"There's a beautiful balance in our bodies," Ercal says. "We have these free radicals -- atoms and molecules with an unpaired electron that attack other molecules. Our bodies have developed a natural antioxidant defense system that includes enzymes and small molecules to overcome harmful effects of these attacks. If the balance is tipped over, then we have oxidative stress."

The researchers narrowed their study to the blood-brain barrier, a selective barrier that controls the entry of substances from the blood into the brain. They believed two toxic HIV proteins -- the envelope glycoprotein (gp120) and transregulatory protein (Tat) -- could be disrupting the protective barrier and allowing toxic materials to pass through to the brain. If true, the proteins could be inducing oxidative stress in the cells and causing dementia in patients.

Using an artificial model of a rat's blood-brain barrier, the researchers incubated cells with the viral proteins for 24 hours. Every parameter the researchers then employed to measure oxidative stress described the same scenario: both gp120 and Tat were inducing oxidative stress in the rat brain capillaries.

In previous studies involving lead poisoning and radiation exposure, Ercal had successfully used the originally

formulated N-acetylcysteine (NAC), the drug of choice in treating acetaminophen overdoses, to combat the resulting oxidative stress. Unlike NAC, the newly synthesized NACA passes easily through cell membranes, leading researchers to believe NACA could reverse the oxidative stress levels in the blood-brain barrier.

**"A third of the adults and half of the children with AIDS develop HIV-1-associated dementia." -- Dr. Nuran Ercal, professor of chemistry at UMR**

"We found NACA, this new compound, prevented cell death," Ercal adds. "NACA returned all parameters to their control levels, and it's not harmful except in extremely high concentrations. Therefore, we determined that while treating AIDS patients, perhaps we should include antioxidants to prevent oxidative stress or prevent possible dementia."

The researchers are now studying the brain and liver samples from transgenic rats. The animals have been genetically modified to contain gp120, allowing the researchers to further study the effects of this protein.

"If gp120 is causing these free radicals, then we should have lots of free radicals in these animals because they are continuously making this protein," Ercal adds.

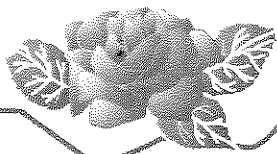
Ercal and the others involved in this study have had their results published in the following Journals.

1. T. Otamis-Price, N. Ercal, R. Nakoke, W. A. Banks, "HIV-1 Proteins gp120 and Tat Induce Oxidative Stress in Brain Endothelial Cells", *Brain Research*, 1045(1-2):57-63, 2005.
2. T. Otamis-Price, F. Uras, W. A. Banks, and N. Ercal, "A novel Antioxidant, N-acetylcysteine amide prevents gp120 and tat-induced Oxidative Stress in Brain Endothelial Cells", *Experimental Neurology*, in press, 2006.
3. W. A. Banks, N. Ercal, and T. Otamis-Price "The Blood-Brain Barrier in NeuroAIDS", invited review article, *Current HIV Research*, in press, 2006.

The Spring Awards Banquet was held on April 28, 2006 at Zeno's. Many of the faculty and students in our department received awards. Christina Taylor was the speaker at the awards banquet that night. Dr. Nicholas Leventis and Dr. Chariklia Sotiriou-Leventis received the Outstanding Teaching Award for 400-level Chemistry. Dr. Nuran Ercal and Dr. Thomas Schuman received the Outstanding Teaching Award for 300-level Chemistry. The Wilbur Tappmeyer Excellence in Teaching Undergraduate Award was presented to Dr. Terry Bone.

The recipient of the Outstanding Senior Award was: Marc Armbruster. The recipients of the Outstanding

# Spring Awards Banquet April 28, 2006



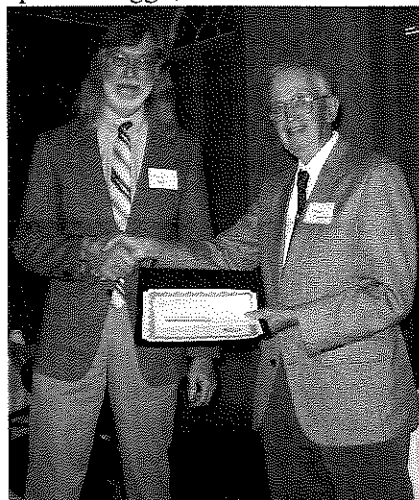
Benjamin Murrell . Miranda Ceballos received the American Institute of Chemists Foundation Student Award. Receiving the Pietsch Distinguished Scholar Award was James Buerger. On behalf of CRC Press, the winner of the 2005 Freshman Chemistry Achievement Award was Sherea Stricklin. The Distinguished Alumnus Award was presented to Dr. Christina Taylor, PostDoc, Center for Computational Biology, Marshall Lab, Washington University School of Medicine.

Junior Awards were: Tara Banaszek, Kylee Hyzer and Tracie Kost . The recipient of the Outstanding Sophomore was: Yi-Jen Su. The recipients of the Outstanding Freshman Student Awards were: Brandi Clark, Taylor Hahn, Joseph Kellogg , Martin McPhail and

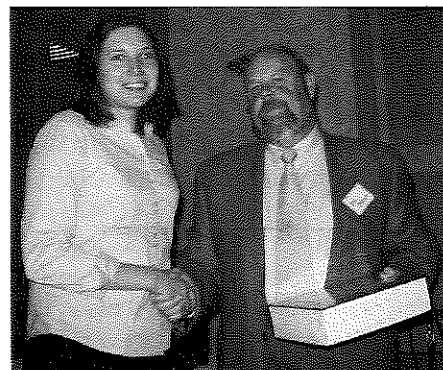
The Outstanding Graduate Teaching Assistant Awards were presented to Peris Carr, Lea Dankers, Johnathan Harper and Emma Schmitzhe.



Nick Leventis & Philip Whitefield



Terry Bone & Wilbur Tappmeyer



Sherea Stricklin & Philip Whitefield



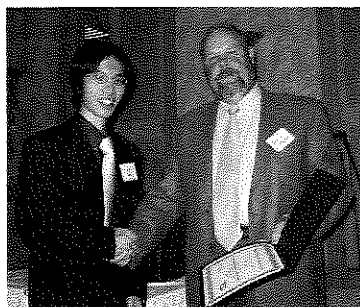
Tara Banaszek & Philip Whitefield



Thomas Schuman & Philip Whitefield



Marc Armbruster & Philip Whitefield



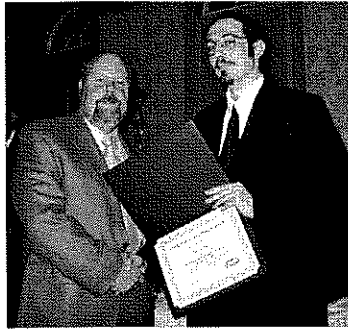
Yi-Jen Su & Philip Whitefield

Tracie Kost & Kylee Hyzer





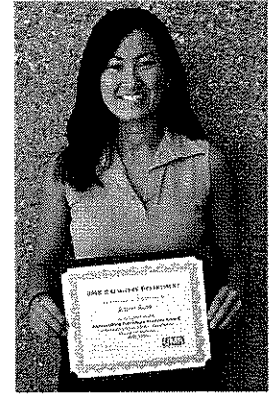
Brandi Clark & Philip Whitefield



Philip Whitefield & Peris Carr



Christina Taylor & Chariklia Sotiriou-Leventis



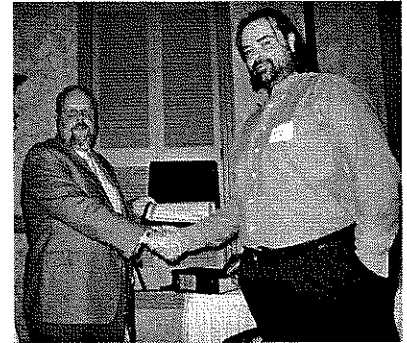
Taylor Hahn



Nuran Ercal & Philip Whitefield



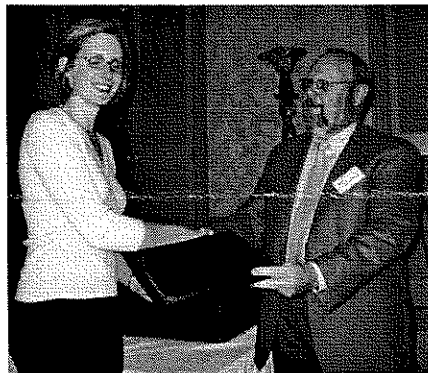
James Buergler & Philip Whitefield



Philip Whitefield & Johnathan Harper



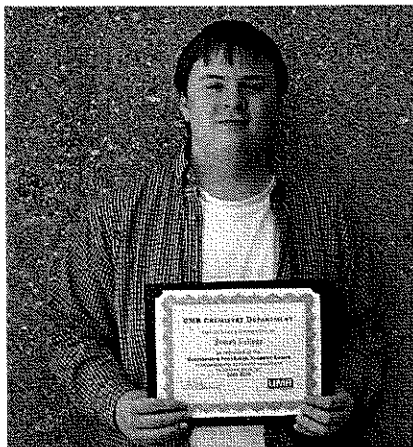
Emma Schmitzche



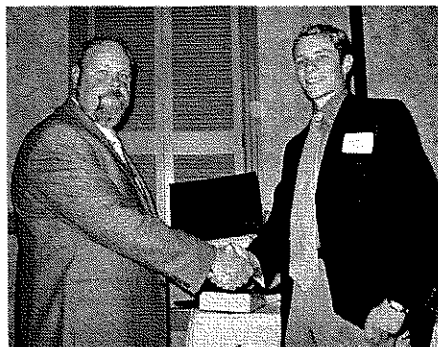
Lea Dankers & Philip Whitefield



Chariklia Sotiriou-Leventis & Philip Whitefield



Joseph Kellogg



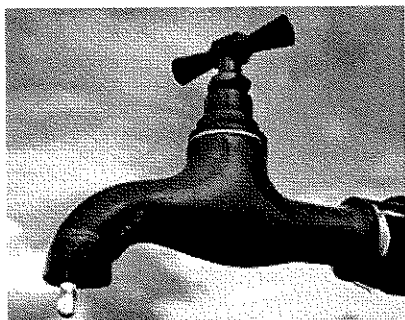
Philip Whitefield & Martin McPhail



Miranda Ceballos & Philip Whitefield

*Congratulations to all of our award winners!!!!*

# Drinking water: make mine unleaded, says UMR chemist



The use of monochloramine to disinfect drinking water can cause harmful levels of lead in the water, says a University of Missouri-Rolla chemist. His research was published in the May 15 issue of the journal *Environmental Science and Technology*.

With \$150,000 in funding from the National Science Foundation, Dr. Jay A. Switzer, the Donald L. Castleman/ Foundation for Chemical Research Missouri Professor of Discovery in Chemistry at UMR, studied what happens when water districts switch from using free chlorine to disinfect drinking water to using monochloramine.

In early 2004, officials in Washington, D.C., a city whose water district had recently switched to monochloramine as a disinfectant, discovered abnormally high levels of lead in several homes across the city – some as high as 48,000 parts per billion (ppb). The Environmental Protection Agency stipulates an action limit of 15 ppb of lead for drinking water to be safe.

The rise in lead levels appeared to coincide with the water district's switch from the use of free chlorine to the use monochloramine to treat the city's water. This coincidence led researchers to explore its affect on lead in drinking water.

"You have to disinfect drinking water to kill pathogens or to inactivate them and what has traditionally been used is chlorine," explains Switzer. "In the field they call this free chlorine. Basically they just bubble chlorine through the water and the practice has been very effective."

Effective, but not necessarily safe. Chlorine reacts with natural organic

matter in the water and makes what are called disinfection byproducts. Of these byproducts, chloroform and other trihalomethanes are suspected to be carcinogenic.

In an effort to reduce the carcinogens in drinking water, the EPA began exploring other disinfection options and found several advantages to monochloramine. While it isn't quite as good a disinfectant as free chlorine, it doesn't react with the natural organic molecules, so no trihalomethanes are formed. Plus, Switzer says, it lasts longer. "It's kind of a time-release disinfectant."

When chlorine is added to water, it produces hypochlorite and hypochlorous acid, which act as disinfectants. Free chlorine is still used in the water treatment plants as a primary disinfectant, but as a secondary or residual disinfectant, many plants bubble ammonia through the water to react with chlorine, which produces monochloramine.

To see if the switch to monochloramine in Washington, D.C., caused the elevated lead levels, Switzer and his research team deposited lead onto an electrochemical quartz crystal microbalance, a sensitive device capable of measuring masses to nanograms in a solution.

"You can deposit lead onto this device and put it into a beaker of simulated drinking water, then add a shot of monochloramine or chlorine and see what happens, then record the mass," Switzer says.

The researchers found that when monochloramine was added to the water, the lead almost completely dissolved into the water.

Switzer's team also tested lead deposits with chlorine. "We found that with chlorine, the lead gets coated with a lead dioxide, which passivates the lead and keeps it from dissolving."

While homes are rarely constructed with lead pipes today, there are still several sources of lead along the path from the water district to a kitchen tap.

The water mains are usually made of plastic or cast iron with a service line running from the main to each home. In a lot of older houses, that service line is lead. Another source is brass alloys in water meters that contain lead. In houses, flow regulators, check valves, water meters and faucets – even lead-free brass faucets – can contain up to 8 percent lead. Even copper pipes in many modern houses are soldered with lead solder.

When water treated with monochloramine passes this lead, the monochloramine dissolves the lead into the water. This could explain the lead increase in Washington, D.C.'s drinking water.

Now, Switzer is studying ways to disinfect water without producing harmful byproducts or leaching lead. One thing they're experimenting with is the occasional switch back to solely using free chlorine.

"What if you, periodically, just use chlorine to passivate the pipes," Switzer poses. "We'll be studying how long that passivity lasts, once the chlorine is introduced to the water supply."

Switzer will also explore the affects of monochloramine on copper pipes. Many cities whose water districts use the disinfectant are finding pin-hole perforations in their copper piping. Switzer hopes to determine if there is a correlation.

Switzer's article is co-authored by Vishnu Rajasekharan, postdoctoral associate in the UMR Materials Research Center; Sansanee Boonsalee, Graduate Student; Elizabeth Kulp, Graduate Student; and Eric Bohannon, research assistant professor, in the UMR Materials Research Center.



# UMR Awarded Honorary Professional Degrees

The University of Missouri-Rolla awarded 11 honorary professional degrees during its spring commencement that was held on Saturday, May 13, 2006.

The professional degree recipients for Chemistry were:

## **Michael Roy Beckmann**

Mike Beckmann earned a bachelor's degree in chemistry from UMR in 1982. Beckmann's wife, Karen, earned a bachelor's degree in chemistry from UMR in 1981 and a master's degree in chemistry from UMR in 1983. Beckmann's first position was with Westin Engineering. Both Beckmanns then joined Riechhold Chemical in Pensacola, Fla. Later, they were both hired by PPG Industries, where Karen has risen to become an award-winning development chemist. Mike benefited from a range of experiences at PPG in various technologies and departments, including serving as a technical liaison to manufacturing processes. In 1992, Beckmann purchased Bonstone Materials, a producer of high performance epoxy adhesives. While at UMR, Mike was a member of Tau Kappa Epsilon. The Beckmanns live in Muskego, Wisc.

## **Gary L. Underwood**

Gary Underwood earned a bachelor's degree in chemistry from UMR in 1975. Underwood joined Red Arrow Products Co. as a senior food chemist in 1977. He is now vice president and chief technology officer of Red Arrow. Underwood received his first patent in 1980 for an injectable smoke flavoring. He has authored a total of 15 U.S. patents. In recent years, Underwood has worked with industry peers and European regulatory scientists to develop guidelines for the evaluation and approval of smoke flavorings in the European Union. He is a member of the American Chemical Society and the Institute of Food Technology. He lives in Manitowoc, Wisc.

## *Chemistry Department Welcomes*



Dr. Cynthia P. Bolon joined the faculty of the UMR Chemistry Department in August 2006 as a lecturer. She received her Ph.D. in nuclear chemistry in 2006 from the University of Missouri – Rolla. Her dissertation work focused on the interactions of nucleons and the repulsion of nucleons as a source for stellar energy.

Dr. Bolon is a Rolla native and daughter of Dr. Albert E. and Sherrell R. Bolon. She is a 1996 graduate of Columbia College where she received a Bachelor of Fine Arts in Fashion Design and a Bachelor of Arts - Independent Studies with an emphasis in Chemistry. Her undergraduate research concentrated on the chemistry and utility of natural dyes. During that time, she apprenticed for a natural dye artist Carol-Leigh Brack-Kaiser of Columbia, Missouri. She hopes to work in the future with Rolla resident and native Missouri plant authority Ella Roberson.

Dr. Bolon returned to Rolla in 1996. From 1996-1998, she worked as a grader and from 2001-2002, as a graduate teaching assistant for the organic labs. From 1998-2002, she worked for UMR's Environmental Health & Safety department as an Environmental Health Technician. She has also obtained her Missouri teaching certificates in Chemistry, Biology, Family & Consumer Sciences, and Latin. From 2000-2005, she taught Latin at Rolla High School.

Since 1996, Dr. Bolon has been involved with various organizations on campus, including: the W.T. Schrenk Society, and their program for the Girl Scouts (2 + 2 and Bridging The Gap) and the annual National Chemistry Week's Magic Show; RPDC's AHEC-PRIMO chemistry camp; Expanding Your Horizons; Minority Engineering's MITE and Gear-Up Missouri; and the UMR Science Olympiad. In 2001-2002 she was the ACS secretary for the south central Missouri region and ACS local coordinator for the Magic Show.

# We would love to hear from you.

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or <chem@umr.edu>

Name \_\_\_\_\_, Year attending UMR \_\_\_\_\_

Current activities/interests \_\_\_\_\_

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Family \_\_\_\_\_

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News/Plans \_\_\_\_\_

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