

COLLEGE OF  
Science & Engineering

UNIVERSITY OF MINNESOTA

# CHEMnews

DEPARTMENT OF CHEMISTRY NEWSLETTER

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## Diverse, multi-disciplinary collaboratives key to successful research



Professor Erin Carlson explains her research during the departmental tours for the National Historic Chemical Landmark celebration in September.

Researchers in the Department of Chemistry have recently been extraordinarily successful in obtaining national funding for such collaborations through the establishment of major research centers.

"Some of the very best science is done when researchers with diverse backgrounds and perspectives work together to tackle the most challenging problems," said Professor William Tolman, chair of the Department of Chemistry.

*If today's researchers are going to successfully tackle some of society's most complex and important human health, energy and environmental problems, they need to draw on diverse expertise by collaborating with other university researchers and leading industrial partners.*

Critical to the success of the centers is the unique collegial and highly collaborative culture and climate fostered in the College of Science & Engineering (CSE), which supports and facilitates departments working and growing together.

Over the past two years, Department of Chemistry researchers have received more than \$63 million from the Department of Energy (DOE) and National Science Foundation (NSF) for major research centers that involve University of Minnesota

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## CHEMnews

DECEMBER 2014

DEPARTMENT OF CHEMISTRY CHAIR  
William Tolman

EDITOR  
Eileen Harvala

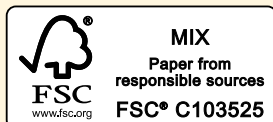
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*The Department of Chemistry is dedicated to providing a world-class education through its classroom and laboratory teaching; and creating new scientific knowledge through research aimed at solving some of society's most important human health, energy, and environmental problems.*

*This publication is available in alternative formats upon request. Direct requests to Eileen Harvala at 612-624-0831 or harva015@umn.edu.*

*The University of Minnesota is an equal opportunity educator and employer. The University's mission, carried out on multiple campuses and throughout the state, is threefold: research and discovery, teaching and learning, and outreach and public service.*

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# Building upon our history



Chair William Tolman

*We stand on the shoulders of others in our work, dreams, and aspirations, and sometimes it's important to recognize this in a way that is both fitting and inspirational.*

In an exciting special event this fall, the American Chemical Society and the University of Minnesota recognized the contributions of Izaak Maurits "Piet" Kolthoff to the field of analytical chemistry as a National Historic Chemical Landmark, and the centennial of Smith Hall, which was erected in 1913, and named after Lee Irvin Smith. Huge crowds enjoyed the festivities, which included tours of the department, a symposium by distinguished scientists from widely disparate backgrounds, and a memorable personal recollection of Piet by Professor Pete Carr. These events reinforced the notion that through recognition and understanding of our shared history, we best position ourselves to shape the future of our society through scientific research and educating the leaders of tomorrow.

As you will see in this issue of our annual newsletter, the future of the Department of Chemistry is looking ever brighter. A paradigm shift in the way that research is organized and funded is underway, in which multi-investigator teams funded through large center grants work to solve challenging, multi-faceted problems. The uniquely collaborative environment at the University of Minnesota has been key to the recent establishment of several such centers, which have secured an astounding amount of federal funding (more than \$60 million). In addition, improvements to our instrumentation infrastructure are critical for research success, and we are fortunate to have top-notch facilities led by outstanding scientists. The stories about our new centers and our facilities in this issue paint a picture of exciting growth and dynamic activity.

Student enrollments in our classes have reached new highs, attesting to the role of chemistry as

the central science as well as the outstanding performance of our instructors. Notably, last year, approximately 6,800 students in 138 undergraduate majors enrolled in 17 chemistry laboratory courses in 111 individual sections. These students came from across a wide swath of the University, including the College of Liberal Arts (35 percent), College of Science & Engineering (26 percent), College of Biological Sciences (18 percent), and College of Food, Agricultural and Natural Resource Sciences (10 percent), with the remaining distributed in smaller numbers from eight other colleges.

Recognizing the significance of the experiential learning that occurs in our laboratory courses and the need to improve the quality of our facilities, the Board of Regents approved the establishment of a Teaching Laboratory Building in the latest six-year capital plan. This will allow us to modernize and relocate the current teaching laboratories to the new building as well as provide much needed renovation and critical safety improvements to research laboratories and associated facilities in 100-year-old Smith Hall. In addition, we will be able to increase our number of faculty in order to teach the very large and growing number of undergraduate students enrolling in our courses and to lead our cutting-edge research efforts. We look forward with great excitement to these major changes. As we embark on future efforts, we cannot help but be inspired by those who came before us. The legacy of predecessors Kolthoff and Smith that we just celebrated is a superb foundation on which to grow.

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# LeClaire-Dow Instrumentation Facility critical to university researchers

*Nestled on the first floor of Kolthoff Hall is one of the most sophisticated, specialized instrumentation facilities on the University of Minnesota campus.*

The LeClaire-Dow Instrumentation Facility houses the Mass Spectrometry Laboratory (MSL), the Nuclear Magnetic Resonance (NMR) laboratory, and the X-Ray Crystallographic Laboratory (XCL). These laboratories annually support hundreds of researchers in the Department of Chemistry, across the university, and from other institutions and industries. Most of the equipment is state-of-the-art and some recent infrastructure grants will replace aging equipment.

Each of these facilities are directed by highly trained, doctorate-holding chemists who are specialists in their fields.

Each of these facilities are directed by highly trained, doctorate-holding chemists who are specialists in their fields. Joseph Dalluge is director of the MSL, Letitia Yao is director of the NMR lab, and Victor Young Jr. is director of the XCL.

## Mass Spectrometry Laboratory

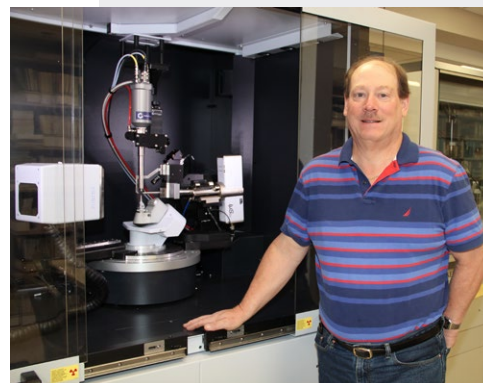
The Mass Spectrometry Laboratory is highly used by faculty and student researchers at the university and from other colleges and universities, and by industrial researchers. Forty Department of Chemistry faculty members and

their research groups use the facility, and 50 researchers from other departments such as Biochemistry, Molecular Biology and Biophysics, Food Science and Nutrition, Biomedical Engineering, Chemical Engineering & Materials Science, Medicinal Chemistry, Pharmaceuticals, and Veterinary Medicine, and the Medical School employ the facility for analysis or research collaboration.

Working with Dalluge, these research collaborations have resulted in eight peer-reviewed articles published the past year. In addition, more than 20 industrial clients use the instrumentation.

Since Dalluge started with the department in 2009, he has expanded the breadth of equipment and services provided by the MSL, making it one of the premier facilities of its kind in the country. Its capabilities range from classical chemical characterization techniques to leading edge MS and 2D imaging and advanced metabolite profiling.

The recent acquisition of two mass spectrometers was made possible through grants awarded in 2013. The first is an Applied Biosystems-Sciex 5800 MALDI-TOF/TOF mass spectrometer funded by a National Science Foundation Major Research Instrumentation grant awarded to Professor Michael Bowser, principal investigator, and Dalluge, co-principal investigator. MALDI-MS is a powerful tool for analyzing a variety of different analytes including small molecules (metabolites), lipids, nucleic acids, peptides, proteins, and polymers. The second is a Fluidigm CyTOF2



Victor Young Jr., Ph.D.

## Victor Young Jr., Ph.D.

**Education:** Doctorate from Arizona State University, bachelor's degree from Spring Arbor College in Michigan

**Post-Doctoral Research:** Arizona State University

**Employment:** Development and Testing Engineer II for Chrysler Corporation; Visiting Scientist at the Los Alamos National Laboratory; Staff Crystallographer in the Department of Chemistry at Iowa State University; and Research Associate, Senior Research Associate and, since 1995, Director of the X-Ray Crystallographic Laboratory since 1995

**Professional affiliations:** American Crystallographic Association, and Neutron Scattering Society of America

**Publications/Presentations/Patents:** More than 40 presentations and 257 publications, workshops for local university and college faculty members and their students to introduce them to crystallographic theory and the modern instrumentation, and part of the International Year of Crystallography 2014 Task Force that is organizing numerous educational and outreach activities through this year of celebration.

continued on page 4



## LeClaire-Dow Instrumentation Facility *continued from page 3*



Joseph Dalluge, Ph.D.

### Joseph Dalluge, Ph.D.

**Education:** Doctorate in biochemistry from the University of Utah, bachelor's degree from Gustavus Adolphus College

**Post-Doctoral Research:** National Research Council Post-Doctoral Associate, National Institute of Standards and Technology, Gaithersburg, MD

**Employment:** Research Chemist at the National Institute of Standards and Technology; Senior Chemist with Cargill Incorporated; Director of Department of Chemistry Mass Spectrometry Laboratory since 2009

**Professional affiliations:** Editorial Board, *Current Protein and Peptide Science*, American Chemical Society, American Society for Mass Spectrometry, Past-President and Board Member of the Minnesota Mass Spectrometry Discussion Group

**Publications/Presentations/Patents:** 37 publications, four abstracts, one patent, and seven invited presentations



Letitia Johnson Yao, Ph.D.

### Letitia Johnson Yao, Ph.D.

**Education:** Doctorate from the University of Minnesota, bachelor's degree from the College of Wooster in Ohio

**Post-Doctoral Research:** University of California in San Francisco

**Employment:** Temporary Department of Chemistry faculty, and NMR Research Associate since 1997, and now Laboratory Director

**Professional affiliations:** American Chemical Society, Minnesota Section of the American Chemical Society, Association of Managers

of Magnetic Resonance Laboratories, Sigma Xi, Phi Beta Kappa, Graduate Women in Science, Department of Chemistry Women in Science & Engineering (WISE) team, Minnesota NMR Users Group, National Academy of Sciences Committee on Science, Engineering and Public Policy

**Publications/Presentations/Patents:** 18 publications, six presentations

“Letitia Yao is the person that I absolutely admire for her outstanding NMR service and attentive help at all times”

—Son Nguyen

Mass Cytometer funded through a University of Minnesota Office of the Vice President for Research Infrastructure Grant awarded to Professor Edgar Arriaga, principal investigator. Mass cytometry combines the advantages of single cell high speed analysis common to conventional flow cytometry with the ability to resolve more than 100 metal probes with minimal signal overlap common to atomic mass spectroscopy. This provides researchers with an unparalleled ability to phenotypically and functionally profile cells from normal and disease states.

### Nuclear Magnetic Resonance Laboratory

For Yao, NMR spectroscopy is an invaluable tool for researchers who make or structurally characterize new organic, organometallic, medicinal, and polymeric compounds. Essential to the productivity of these researchers is modern, sophisticated instrumentation capable of providing high quality data in a user-friendly, walk-up or open-access environment, which is offered in her laboratory.

Approximately 300 researchers from 42 different research groups on campus, spanning 10 different departments, including Chemistry, Chemical Engineering and Materials Science, the Masonic Cancer Center, Medicinal Chemistry, and Bioproducts and

Biosystems Engineering, are trained operators of the spectrometers in the NMR laboratory. Together, they collect more than 40,000 spectra annually. These instruments also service the needs of about a dozen industrial clients, several local colleges and community colleges, and the Department of Chemistry's undergraduate teaching mission. A critical distinction of the Department of Chemistry's laboratory is the diversity of experiments required by its users. Thousands of new compounds are produced at the University of Minnesota each year.

"Letitia Yao is the person that I absolutely admire for her outstanding NMR service and attentive help at all times," wrote Son Nguyen in his student dissertation, *Synthesis of the ABCD and FGHI Domains of Azaspiracid*.

The NMR laboratory houses three vintage Varian spectrometers at 300 MHz and 500 MHz, which were acquired in the late 1980s, and two modern 500 MHz spectrometers, which were acquired in the 2010s. One of the Bruker 500 MHz instruments, which sits on a vibration isolation table, was purchased by the university so at least one spectrometer is protected from the vibrations and electromagnetic interference generated by the nearby light rail trains. The second Bruker 500 MHz instrument was purchased with a National Institutes of Health instrumentation grant with matched funding from the university and Department of Chemistry. Professor William Pomerantz contributed a portion of his start-up funds to equip one of the Brukers with a liquid-nitrogen cooled Prodigy cryoprobe with enhanced sensitivity for F19 nuclei (and H1 and C13).

The NMR laboratory was recently awarded a \$329,600 Research Infrastructure Reinvestment Program grant from the Office of the Vice President for Research, which will be matched with funds from the College of Science & Engineering and the Department of Chemistry. This will enable the laboratory to purchase two new 400 MHz spectrometers to replace the vintage ones, which require frequent repairs, once they reach the end of their useful lifetimes.

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## The X-Ray Crystallographic Facility is nationally recognized, providing its users with a variety of crystallographic instrumentation, expertise in crystallographic techniques, computers, and crystallographic software.

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The new machines also will lower the use of non-renewable consumables like liquid helium, and will be fully shielded from vibrations and electronic fields generated by the light rail line.

### X-Ray Crystallographic Laboratory

The X-Ray Crystallographic Facility is nationally recognized, providing its users with a variety of crystallographic instrumentation, expertise in crystallographic techniques, computers, and crystallographic software. The mission of this facility is to provide the best molecular structure elucidation services to University of Minnesota researchers and collaborators at other institutions and industries. While the laboratory primarily offers single crystal diffraction services, expertise in most areas of crystallography is available.

About 300 projects were studied in 2013, and most of those provided researchers with publication-ready crystallographic results.

Frequently, the research projects present obstacles that require expertise and innovation to overcome such as twinning, small crystal sizes, or solvent loss, said Young. "For instance, our laboratory is recognized as being expert in the solution and refinement of non-merohedrally twinned materials," he said.

In 2012, the XCL was awarded a National Science Foundation Major Research Instrumentation Grant to purchase a Bruker-AXS D8 Venture single crystal diffractometer with Cu-K  $\alpha$  microfocus source, PHOTON-100 CMOS detector, and an Oxford Cryostream 700-Plus Cryostat. This joined an existing Bruker-AXS APEX-II CCD diffractometer. Additional equipment includes two area-detector single-crystal instruments, plus access to the Cambridge Structural Database and the APEX-II software suite.

Since 1999, Young has taught the graduate course CHEM 5755, which blends a traditional theory curriculum with a laboratory experience where the students learn to operate modern single crystal diffractometers.

## Collaboratives key *continued from page 1*

researchers, researchers from universities and colleges across the country, and industrial partners. Those centers include the:

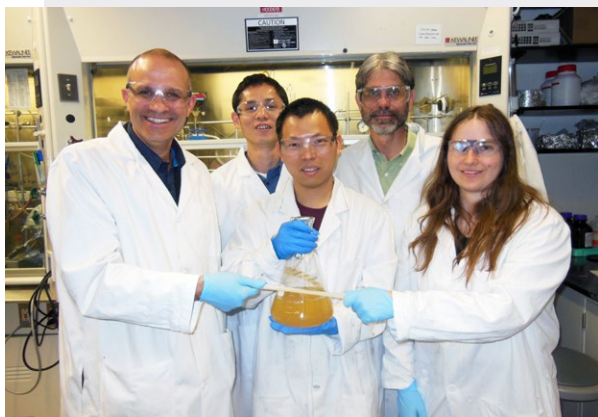
- Center for Sustainable Polymers (CSP), directed by Professor Marc Hillmyer—\$20 million over five years, funded in 2014;
- Inorganometallic Catalyst Design Center (ICDC), directed by Professor Laura Gagliardi—\$12 million over four years, funded in 2014;
- Nanoporous Materials Genome Center (NMGC), directed by Professor Ilja

Siepmann—\$8.1 million over five years, funded in 2012;

- Scientific Discovery through Advanced Computing (SciDAC) partnership, the Center for the Study of Charge Transfer and Charge Transport in Photoactivated Systems, directed by Professor Christopher Cramer—\$5 million over five years, funded in 2012; and

- Materials Research Science and Engineering Center (MRSEC), directed by Professor Timothy Lodge—\$16.8 million funding for the past six years, and funding for the next six years is pending official approval from the NSF.

### Center for Sustainable Polymers



The biosynthesis and polymer research team includes, from left, Chemistry Professor Marc Hillmyer, Chemical Engineering and Materials Science (CEMS) Professor Kechun Zhang, CEMS Post-Doctoral Associate Mingyong Xiong, CEMS Professor Frank Bates, and Chemistry Graduate Student Deborah Schneiderman.

Researchers in the Department of Chemistry and the Department of Chemical Engineering & Materials Science (CEMS) have laid the groundwork for producing polymers from sugar-derived building blocks. This break-through research could lead to the creation of biobased block polymers that mimic the performance of petroleum-based polyester plastics.

This collaborative research involved CEMS Professor Kechun Zhang and Post-Doctoral Associate Mingyong Xiong designing a biosynthetic route to make a six-membered ring  $\beta$ -methyl- $\delta$ -valerolactone (MVL) as a new biobased monomer.

Chemistry Professor Marc Hillmyer,

Chemistry Graduate Student Deborah K. Schneiderman, and CEMS Professor Frank Bates then controllably copolymerized MVL to make a soft, amorphous polyester. They demonstrated that additions of lactide, a biobased cyclic diester already used as a biodegradable polymer building block, could be used to prepare block polymers. By varying the size and ratio of each component block, it is possible to control the mechanical properties of the material. (*Proc. Natl. Acad. Sci. USA* 2014, DOI: 10.1073/pnas.1404596111).

### Center for Sustainable Polymers

A major NSF-funded research center is the Center for Sustainable Polymers, which draws together a remarkable group of scientists that includes researchers at the University of Minnesota, Cornell University, and the University of California, Berkeley, along with more than 32 companies from across the nation. The center integrates the research of experts in polymer, organic, biosynthetic, inorganic, computational, and materials chemistry. Their research is aimed at transforming how plastics are made and unmade. The CSP is focused on reducing the national reliance on finite feedstocks by developing technologically competitive, environmentally friendly, cost-effective plastics from natural, sustainable and renewable materials.

CSP researchers from the CSE's departments of Chemistry and Chemical Engineering & Materials Science include Professors Frank Bates, Christopher Cramer, Marc Hillmyer, Thomas Hoye, Chris Macosko, Theresa Reineke, William Tolman, Jane Wissinger, and Kechun Zhang. Professors Geoff Coates and Will Dichtel, and Anne LaPointe, Ph.D., are leading the research at Cornell University. At the University of California, Berkeley, research collaborators are Professors Michelle Chang, John Hartwig and Dean Toste. Professor Mark Matsen from the University of Waterloo in Toronto, Canada, adds important research expertise in self-consistent field theory.

**Developing bio-based plastics that will compete with or outperform those made from fossil resources is a complex scientific puzzle, the solution for which requires the diversity of expertise embodied by the center's researchers.**

“Our research could lead to new opportunities for energy efficiency and resource conservation.”

—Laura Gagliardi

Developing bio-based plastics that will compete with or outperform those made from fossil resources is a complex scientific puzzle, the solution for which requires the diversity of expertise embodied by the center’s researchers. For example, CSP researchers at the University of Minnesota recently used biosynthesis, chemical engineering, metabolic pathway engineering, materials science, and polymer chemistry to build new biobased block copolymers, a class of high-performance materials, from purely sugar-derived building blocks. This patented, breakthrough technology is being marketed to industries that can translate this discovery into innovative products.

## Department of Energy Research Centers



Professor Laura Gagliardi is director of the Inorganometallic Catalyst Design Center.

The Department of Chemistry has three national research centers funded by the Department of Energy, which bring together experts from throughout the country to accelerate discoveries related to solving important energy issues.

The **Inorganometallic Catalyst Design Center** is a DOE Energy Frontier Research Center (EFRC), focusing on the discovery of

a new class of energy-science-relevant catalytic materials for energy- and atom-efficient conversion of shale-gas components.

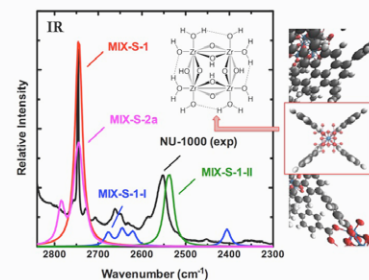
“Our research could lead to new opportunities for energy efficiency and resource conservation,” Gagliardi said. “Our ultimate goal is to design and produce catalysts for reactions that will yield significant energy savings and environmental benefits compared to existing alternatives. A more immediate outcome of the research will be what we learn about structure-function relationships for new catalysts in a size range spanning the nano- and meso-scales.”

Gagliardi is developing theories to model chemical processes relevant to the energy needs of modern society. For example, she guides research aimed at designing new materials to remove carbon dioxide from the atmosphere and, through her participation in a second EFRC headquartered at the University of Notre Dame, new processes to recycle spent nuclear fuel from nuclear power reactors.

In addition to Gagliardi, five other professors from the Department of Chemistry are involved in the center, including Christopher Cramer, Connie Lu, Lee Penn, Andreas Stein, and Donald Truhlar. These researchers are all leaders in theoretical chemistry and inorganic chemistry—two fields in which the University of Minnesota excels. Other partners include Northwestern University, University of Washington, University of California-Davis, Clemson University, Argonne National Laboratory, Northwest National Laboratory, and Dow Chemical Company.

Before becoming director of the ICDC, Gagliardi was leading the **Nanoporous**

## Inorganometallic Catalyst Design Center



Researchers are defining the proton topology of the  $Zr_6$ -based metal-organic frameworks, which will have wide ranging implications in defining their chemical reactivity, acid/base characteristics, conductivity, and chemical catalysis. These  $Zr_6$ -based metal-organic frameworks have exceptional thermal, chemical and mechanical stability. However, their structural diversity makes it difficult to assign where protons, which are needed for charge balance, reside on some  $Zr_6$ -based nodes. A combined quantum mechanical and experimental approach is indicating that a mixed node topology,  $[Zr_6(\mu_3-O)_4(\mu_3-OH)_4(OH)_4(OH_2)_4]^{8+}$ , is preferred.

This collaborative research involved Professors Joseph T. Hupp, and Omar K. Farha from the Department of Chemistry Northwestern University who synthesized the  $Zr_6$ -based MOFs. Then, Department of Chemistry Professors Laura Gagliardi and Christopher Cramer with chemistry Graduate Student Joshua Borycz, and Post-Doctoral Associates Nora Planas and Samat Tussupbayev constructed some models of these materials and determined their structures and proton topology by means of quantum chemical calculations. (*J. Phys. Chem. Lett.*, 5, 2014 pp 3716–3723 DOI: 10.1021/jz501899).

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Timothy Lodge, a Regents Professor in both the Department of Chemistry and Department of Chemical Engineering & Materials Science, is director of the Materials Research Science and Engineering Center.

**Materials Genome Center**, which is now being led by Professor Ilja Siepmann. This center is developing and using high-end computational tools to characterize and predict the performance of millions of advanced materials at the nano scale. These new materials have many potential applications related to energy, including the capture of greenhouse gases such as carbon dioxide, and the storage of hydrogen. In addition, the group aims to improve catalysis and advanced chemical separations used in environmental research as well as those used in petroleum and biofuels processes to make them more efficient and environment-friendly.

The NMGC includes researchers from six other institutions including the University of California, Berkeley, Lawrence Berkeley National Laboratory, Washington State University, Rice University, Georgia Tech, and Northwestern University. Co-investigators from the University of Minnesota include Cramer, Gagliardi and Truhlar from the Department of Chemistry, and Michael Tsapatsis from the Department of Chemical Engineering & Materials Science.

The **Center for the Study of Charge Transfer and Charge Transport in Photoactivated Systems** is funded through the DOE's Scientific Discovery through Advanced Computing (SciDAC) initiative. Researchers are developing methods and algorithms, and improving software tools needed for the reliable modeling of charge transfer and charge transport in photoactivated systems. Such processes are fundamental for solar energy capture, solar energy conversion, and photoactivated catalysis, both industrial and biological. Cramer is the center's director, and co-investigators include Gagliardi (the founding director), Siepmann and Truhlar. Research partners include the Pacific Northwest National Laboratory and the Lawrence Berkeley National Laboratory.

### **Materials Research Science and Engineering Center**

The Materials Research Science and Engineering Center, one of the university's oldest and largest multi-disciplinary research centers, is an exemplar for collaborative centers. It was originally funded in 1998, with grants renewed in 2002 and 2008.

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**“Together, the array of major Department of Chemistry enabling major, highly imp broad scope to be address**

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Possible renewed funding is currently pending from the NSF.

NSF MRSECs are structured to support interdisciplinary and multidisciplinary materials research that addresses complex and important science and engineering problems, which could not be addressed under traditional funding of individual research projects.

The university's MRSEC has distinct research foci, clustered in what are called Interdisciplinary Research Groups. Each involves a number of faculty researchers from five different CSE departments, including Chemistry, Chemical Engineering and Materials Science, Electrical and Computer Engineering, Mechanical Engineering, and Physics. Recent IRGs have focused on engineering multiblock polymers, organic optoelectronic interfaces, magnetic heterostructures, and nanoparticle-based materials.

The university's MRSEC also helps researchers through its seed program, providing grants of \$50,000 for new and innovative research projects. It is not unusual for seed-funded research to ultimately blossom into major research initiatives. For example, two of MRSEC's new IRGs originated with seed funding.

“Our researchers are engaged in cutting-edge materials science research,” said Lodge. They are aided by the strong collaborations in the departments, among the different disciplines that their research represents, and by the shared facilities that are available at the University of Minnesota such as the



research centers involving faculty and students is important scientific problems of ed.”

—William Tolman

Minnesota Supercomputing Institute, the CSE Characterization Facility, and the Minnesota Nano Center. The majority of MRSEC’s researchers are also engaged with the university’s Industrial Partnership for Research in Interfacial and Materials Engineering (IPrime), which fosters relationships with industrial scientists. More than 40 industrial partners are involved with IPrime.

### Other collaboratives

In addition to his participation in the DOE-funded center, Professor Truhlar is co-principal investigator in two large grants, the specific aims of which are to understand and design heat shields for hypersonic vehicles. These grants include a \$1.5 million Multidisciplinary University Research Initiative Grant, and a \$1.7 million Air Force Office of Scientific Research grant.

While not based at the University of Minnesota, Professor Christy Haynes, an expert in nanotechnology, is involved in the multi-disciplinary Center for Sustainable Nanotechnology (CSN), which was created with a \$1.75 million NSF Centers for Chemical Innovation grant. Researchers are investigating how nanoparticles interact with living ecological systems. In addition to the University of Minnesota, the CSN brings together the expertise of researchers from five different institutions, including the University of Wisconsin-Madison, University of Wisconsin-Milwaukee, Northwestern University, University of Illinois, and the Pacific Northwest National Laboratory.

“Together, the array of major research centers involving Department of Chemistry faculty and students is enabling major, highly important scientific problems of broad scope to be addressed,” said Tolman. “The extraordinarily high level of research funding supports the efforts of a myriad students and post-doctoral associates who push the research forward and gain fundamental knowledge necessary to address society’s most critical needs.”

### Education/ Outreach

In addition to research, many of the centers are heavily engaged in outreach and education initiatives focused on training the next generation of scientists, which includes strong outreach to K-12 schools, and creating opportunities for undergraduate and graduate students to participate in research.

For example, each of the CSP’s senior investigators will have the opportunity to mentor an undergraduate student in a 10-week summer research program that helps teach excited younger researchers about opportunities in science and engineering.

One of those CSP senior investigators, Professor Jane Wissinger, brings extensive experience working on diverse aspects of green chemistry. In addition to coursework development and integration of new green laboratory practices, she has developed experiments for undergraduate students focused on creating new polymers from biobased feedstocks. She shares her expertise with university professors and K-12 educators across the country.

Both the CSP and MRSEC are major supporters of the university’s Energy and U program, which brings more than 10,000 elementary-aged students to the University of Minnesota campus every year to teach them about energy and to show them that science is fun and something that they, too, can do. A

focus for Energy and U is engaging students from underrepresented groups in the sciences.

MRSEC researchers offer a variety of weeklong summer camps for high school students, including a possible new Materials



Professor Marc Hillmyer, director of the Center for Sustainable Polymers, demonstrates the durability of a next-generation polymer made from sugar-derived building blocks.

Week for Native American students. Many of the researchers also provide undergraduate research experiences for promising students from a national network of four-year colleges, minority-serving institutions, tribal colleges, and research universities.

Recently, the National Institutes of Health renewed the Chemical Biology Interface Training Grant (CBITG) for the next five years, which provides \$1.2 million to fund graduate students working at the interface of chemistry and biology. Overseen by Professor Mark Distefano, this grant will support five to six students per year over the next five years. The students take courses in chemistry and biology, attend a seminar series devoted to the chemistry-biology interface, are provided with funds to attend outside scientific meetings and career-related activities, and are responsible for organizing and running a symposium involving speakers from academia and industry. The training grant involves faculty from the departments of Chemistry, Biochemistry, Molecular Biology and Biophysics, and Medicinal Chemistry.

# National Historic Chemical Landmark celebration draws hundreds

*More than 400 people attended the National Historic Chemical Landmark dedication ceremony and research symposium, Sept. 12-13, 2014, honoring the legacy of Professor Izaak M. Kolthoff.*

A public ceremony celebrating the landmark designation and Smith Hall centennial, which included the unveiling of a plaque in Kolthoff's honor, was conducted, Friday, Sept. 12, on the steps of Smith Hall, Kolthoff's long-time academic home. The dedication ceremony featured remarks by representatives from the University of Minnesota and the American Chemical Society. Speakers included Professor William Tolman, chair of the Department of Chemistry; Steven Crouch, dean of the College of Science & Engineering (CSE); Karen Hanson, provost and senior vice president for the University's Office of Academic Affairs; Clyde Allen, a member of the University's Board of Regents; Rebecca Guza, chair of the Minnesota Local Section of the American Chemical Society (ACS); Susan King, senior vice president of the ACS Journals Publishing Group; and Marinda Li Wu, immediate past president of the ACS.

A research symposium on Kolthoff's scientific legacy was held on Saturday, Sept. 13. The symposium featured some of the most renowned scientists in their field who are living out Kolthoff's commitments to education and research at their universities and in their work. Some can trace their scientific lineage back to Professor Kolthoff. Speakers included Allen Bard from the University of Texas at Austin, Harry Gray from the California



Celebrating the legacy of Izaak M. Kolthoff at the National Historic Chemical Landmark dedication ceremony and research symposium were, from left, Susan King, senior vice president of the American Chemical Society, Journals Publishing Group; Professor Peter Carr from the Department of Chemistry at the University of Minnesota who shared reflections on his personal friendship with Izaak Maurits Kolthoff; Professor Judith Klinman from the University of California, Berkeley; Professor Laura Kiessling from the University of Wisconsin-Madison; Professor Richard Zare from Stanford University; Marinda Li Wu, Ph.D., immediate past president of the American Chemical Society; Professor Harry Gray from the California Institute of Technology; Professor Allen Bard from the University of Texas at Austin; Steven Crouch, dean of the College of Science & Engineering; Karen Hanson, provost and senior vice president for the University's Office of Academic Affairs; Professor William Tolman, chair of the UMN Department of Chemistry; Clyde Allen, regent from the University's Board of Regents; and Rebecca Guza, chair of the Minnesota Local Section of the American Chemical Society.

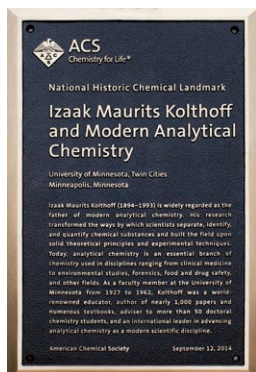
Institute of Technology, Laura Kiessling from the University of Wisconsin-Madison, Judith Klinman from the University of California, Berkeley, and Richard Zare from Stanford University. In addition, UMN Chemistry Professor Peter Carr shared his story of friendship with Kolthoff.

A reception and tours followed the dedication ceremony and Saturday's research symposium. The tours focused on the Department of Chemistry's research excellence, its cutting-edge technology and equipment, and its education of more than 18,000 students annually. The tours were opportunities to visit the department's teaching, laser, chemical biology, and organic synthetic laboratories as

well as learn about two of its research centers (the Center for Sustainable Polymers and the Chemical Theory Center), and the LeClaire-Dow Instrumentation Facility.

The University of Minnesota College of Science and Engineering, the University's Department of Chemistry, and the Minnesota Section of the American Chemical Society sponsored these events.

The American Chemical Society established the National Historic Chemical Landmark program in 1992 to recognize important achievements in the history of the chemical sciences. This is only the second landmark designation in the five-state region. In 2007, 3M was recognized for the invention of Scotch tape.



The American Chemical Society prepared a plaque outlining Izaak Maurits Kolthoff's contributions to modern analytical chemistry and the honoring of his legacy as a National Historic Chemical Landmark.





Symposium speaker Professor Harry Gray (second, from left) caught up with former student Professor Kent Mann (left), and California Institute of Technology alumni Assistant Professors Ian Tonks and Connie Lu. (Photo by Eileen Harvala)



Hundreds of Department of Chemistry alumni, friends, students, faculty, and university officials and colleagues attended the dedication ceremony for the American Chemical Society's National Historic Chemical Landmark dedication.

Department of Chemistry Professor Peter Carr shared his special reflections of his friend Izaak M. Kolthoff in a presentation titled, Pete and Piet.

*Photos by Richard Anderson Photography*

## Madolyn Youse Babcock

A special visitor to the dedication ceremony and symposium was Madolyn Youse Babcock, one of Professor Izaak Kolthoff's graduate students and close personal friend. While looking at the historical display prepared for the National Historic Chemical Landmark celebration, Madolyn discovered that a scrapbook was open to some pictures of her and Kolthoff and their special times together at the University. Madolyn, who will be 90 years old in December, earned her master's degree in analytical chemistry in 1952 under Kolthoff's tutelage. After graduation, Madolyn worked as a chemist for General Mills until the arrival of the first of her six children in 1954. She remained involved in academic pursuits

by serving on the Board of Trustees at her alma mater Stephens College in Columbia, MO. Throughout her life, Madolyn has supported and inspired women to pursue careers in the sciences through scholarships and mentoring. Two of her daughters currently work for the National Marine Fisheries Service in the fields of fisheries and environmental policy. So far, 4 of her 13 grandchildren are pursuing careers in the sciences, and the artist in the family is following a career in scientific illustration. Upon hearing of the events surrounding the Kolthoff celebration, one of her granddaughters, a second-year medical student at Rush Medical School



Pictured, from left, are Madolyn's daughter, Anne Babcock Hollowed, Madolyn Youse Babcock, Madolyn's grandson Edmund Babcock, and Madolyn's son James Babcock.

in Chicago, wrote, "I am so proud to have grandmother as my role model in every aspect of my life, not just in science, but in family, faith, and fun!"



*We are grateful to the generosity of these donors who are supporting talented and deserving chemistry students through scholarships, fellowships, and awards.*

## Fellowships

**Newman & Lillian Bortnick Fellowship**—  
Chad Hoyer

**Robert C. Brasted Memorial Fellowship**—  
Nathan Klein

**Robert & Jill DeMaster Fellowship**—Yi Zhang

**Monsanto Franz Excellence in Graduate  
Studies Fellowship**—Jacob Brutman

**Graham N. Gleysteen Fellowship in Chemistry**—  
Laura Clouston

**Lester C. & Joan M. Krogh Endowed Fellowship  
Fund II**—Samuel Egger and Jinbo Hu

**Wayland E. Noland Fellowship in Chemistry**  
—Yi Zhang

**Wayland E. Noland Fellowship in Organic  
Chemistry**—Mohammadreza Nasiri

**Kenneth E. & Marion S. Owens Endowed  
Fellowship in Chemistry**—Evgenii Fetisov

**Phillips 66 Excellence in Graduate Studies  
Fellowship**—Ryan Cammarota

**Dr. Venkateswarlu Pothapragada and  
Family Graduate Fellowship**—Shaohong Li

**Torske Klubben Fellowship**—Ian Gunsolus

**Doctoral Dissertation Fellowships (2014-15)**—  
Christopher Huber, Katherine Hurley, William  
Isley III, Maral Mousavi, Mayank Puri, Pragma  
Verma, and Tao Wang

**National Science Foundation Research  
Fellowship**—Rebecca Carlson (fellowship), and  
Samuel Egger, Emily Keller, and Marie Vanderlaan  
(honorable mentions)

**Interdisciplinary Doctoral Fellowship**—  
Mohammad Mohsen Mahmoodi

**Heisig/Gleysteen Chemistry Summer Research  
Program Fellowships**—Katharine Anton, Xiang  
Ao, Stephanie Breunig, Maya Cutkosky, Erin  
Duffy, Moriana Haj, Matthew Henley, Kadir  
Hussein, Jacob Kautzky, Mitchell Lancaster,  
Joseph Manulik, Samantha Meyer, Abbie Mozzetti,  
Molly Newbold, Vignesh Palani, Matthew Styles,  
Anthony Tabet, Matthew Turcotte, Elena Werst,  
Tedd Wiessner, Ming Yu, Haini Zhang, and  
Katherine Ziebarth

## Scholarships

**Peteris Auzins Memorial Scholarship**—  
Clay Batton

**Thomas DuBrui Memorial Award**—  
Jacob Kautzky and Thang Phan

**Lloyd W. Goerke Scholarship**—Vignesh Palani

**Dr. Paul F. and Patricia Guehler Chemistry  
Scholarship**—Stephanie Breunig and Joseph  
Manulik

**ACS/Hach Foundation Chemistry Teacher  
Scholarship**—Daniel Ries

**Sally Herz Memorial Scholarship**—Emily Walsh

**David A. and Merece H. Johnson Scholarship**—  
Moriana Haj, Curtis Peterson, Matthew Styles,  
and Katherine Ziebarth

**Betty A. Lewis Scholarship**—Tenley Brown and  
Megan Magee

**Kenneth E. & Marion S. Owens Scholarship**—  
Justine Chu

**M. Cannon Sneed Scholarship**—Sammy Shaker

**Jane B. Spence Scholarship**—Eric Kalkman  
and Vignesh Palani

**George T. Walker Scholarship**—Xiang Ao,  
Nicholas Johnson, and Zhenshu Wang

## Individual Awards

**Beaker and Bunsen Third Year Graduate  
Student Research Symposium honors**—  
Rebecca Mackenzie, Jennifer Strehlau,  
Sarah Wegwerth, and Xiaojie Wu

**Robert C. Brasted Outstanding  
Undergraduate Teaching Assistant  
Award**—Jeanette Tensfeldt

**Department of Chemistry Award for  
Doctoral Thesis Excellence**—Alireza  
Shokri, Ph.D.

**Eastern Analytical Symposium  
Graduate Student Research Award**—  
Seyedeh Mousavi

**Excellence in Science Award from the  
Minnesota Academy of Science**—  
Sammy Shaker

**Robert L. Ferm Outstanding Graduate  
Teaching Assistant Award**—Grant Frost,  
Victoria Szlag, and Megan Weisenberger

**Goldwater Scholarship Program  
Honorable Mention**—Moriana Haj

**International Genetically Engineered  
Machine Best Environment Project  
Award**—Valeriu Bortnov, Niko LeMieux,  
and Srijay Rajan (part of a 24-member  
team from the University of Minnesota)

**L'Oreal USA For Women in Science  
Fellowship**—Jennifer "Jenny" Laaser, Ph.D.

**J. Lewis Maynard Memorial Prize in  
Advanced Inorganic Chemistry Award**—  
Sammy Shaker

**Wayland E. Noland Award for Academic  
Excellence in**—Quang Luu Nguyen

**President's Student Leadership & Service  
Award and Sue W. Hancock SEEDS of  
Change Award**—Kadir Hussein

**2014 Reaxys PhD Prize**—Dawen Niu, Ph.D.

**4.0 Grade Point Averages**—Siyao He and  
Junyi Wang

# Graduate students are at the forefront of important chemical research

*Research advances in the Department of Chemistry are led by outstanding graduate students, including Ian Gunsolus, a fourth-year graduate student working with Professor Christy Haynes, and Maral Mousavi, a fourth-year graduate student working with Professor Philippe Buhlmann.*

## Ian Gunsolus



Ian Gunsolus

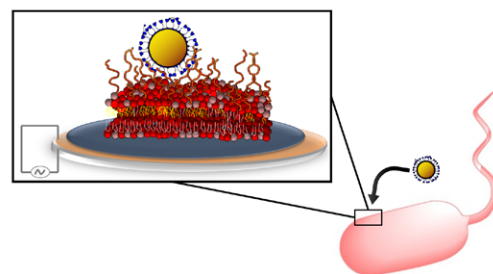
Ian graduated with a bachelor's degree in chemistry and mathematics from St. Olaf College. While at the University of Minnesota, he has earned a number of scholarships and fellowships, including the Robert L. Ferm Outstanding Graduate Teaching Assistant Award, a National Institutes of Health Biotechnology Training Grant, and the Minneapolis Torske Klubben Graduate Student Fellowship (twice).

He is broadly interested in analytical chemistry and in applying chemical principles to address environmental problems. His current research encompasses engineered nanomaterial interactions with biological systems, and their

transformations in the environment. In collaboration with Professor Philippe Buhlmann's research group, he has concurrently studied silver nanoparticle stability, dissolution, and toxicity to a bacterial cell model under aquatic environmental conditions. Bacteria are used throughout his research to understand the potential consequences of engineered nanomaterial release into natural environments, given their ubiquitous and fundamental role in natural ecosystems. In collabora-

tion with other researchers within the Center for Sustainable Nanotechnology, an National Science Foundation-funded Center for Chemical Innovation, Ian studies the fundamental mechanisms of interaction between bacterial cell membranes and engineered nanomaterials, with the goal of informing the design of sustainable nanomaterials. In this context, he has also characterized the toxicity of emergent, industrially relevant classes of nanomaterials, such as those used in next-generation lithium-ion batteries.

For the future, Ian would like to pursue a career in an industrial research setting.



*Bacteria serve as model organisms for investigating the implications of nanoparticle release into the environment. In some of these studies, the primary goal is to understand the interactions between bacterial cell membranes and nanoparticles (e.g., where nanoparticles bind to the membrane). Researchers have characterized nanoparticle interactions with live bacterial cells (lower right) and simulated bacterial cell membranes (upper left) in parallel, effectively zooming-in on nanoparticle-bacteria interactions while retaining biological relevance. This approach has yielded new insights into the mechanism of this interaction.*

continued on page 14

## Graduate students *continued from page 13*

### Seyedeh "Maral" Mousavi

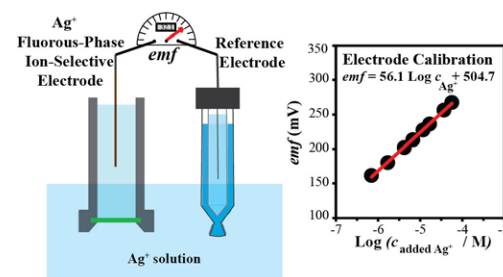


Seyedeh "Maral" Mousavi

Maral Mousavi earned her bachelor's degree from Sharif University of Technology, one of the top universities in Tehran, Iran. She then came to the University of Minnesota in January 2011 to pursue graduate studies and joined the research group of Professor Philippe Buhlmann. She has received several prestigious awards and fellowships, including the 2014-15 Doctoral Dissertation Fellowship for outstanding research, the 2013-2014 Graham N. Gleysteen Fellowship for Academic Excellence in Chemistry, the 2014 Eastern Analytical Symposium Graduate Student Research Award for outstanding research achievements in the field of analytical chemistry, and the Graduate Student Travel Award from the Society for Electro-Analytical Chemistry to present research at the 2014 Pittsburgh Conference of Analytical Chemistry.

Maral works with electro-analytical sensors, specifically fluorous-phase, ion-selective electrodes (ISE), and is expanding the application of these sensors to environmental and biological samples. In collaboration with Professor Christy Haynes' group, she utilized the  $\text{Ag}^+$  selective fluorous-phase ISEs to look at the challenging environmental issue of the toxicity of silver nanoparticles. She was able to quantify the extent and kinetics of  $\text{Ag}^+$  release from silver nanoparticles and also

fully characterized  $\text{Ag}^+$  speciation in complex biological and environmental samples. Her work showed several advantages of detection with fluorous-phase  $\text{Ag}^+$  ISEs over the conventional methods used for studying silver nanoparticle toxicity. To make detection with fluorous-phase ISEs more applicable, Maral is determined to reduce the sample volume needed for detection with these sensors. For this purpose, she has been working on the design and synthesis of highly fluorophilic electrolytes that can be added to the fluorous membrane to reduce the membrane resistivity and allow fabrication of fluorous-phase micro-ISEs. In addition to fluorous-phase ISEs, she also investigated applications of nanoporous polymeric materials for the development of miniaturized and more robust reference electrodes, and worked on tuning the structure of



This figure shows a typical experimental set up and electrode calibration for  $\text{Ag}^+$  detection with fluorous-phase  $\text{Ag}^+$  ion-selective electrodes.

electrolytes and ionic liquids to improve their electrochemical stability, increasing the energy density of electrochemical supercapacitors.

Maral enjoys how collaborative research can result in creative solutions for real life problems, and the opportunities available in the Department of Chemistry to work on exciting and challenging problems in collaboration with Professor Haynes, Professor Andreas Stein, and Professor Marc Hillmyer's research groups. In the future, Maral wants to continue research in an industrial setting. Her goal and dream is to pursue scientific research and service that contributes to promoting health, education, and peace across the world.





# Recognizing long-time employees critical to department activities

*Long-time employees Christine “Chris” Lundby and Bruce Moe in the Department of Chemistry have encountered many interesting people over the years, experienced some strange and unusual events, adapted to change, and made and said goodbye to some good friends.*

Chris, assistant to the Department of Chemistry chair, has 40 years of service with the University of Minnesota, all but six months in the Department of Chemistry. Bruce, information technology manager, has worked for the University of Minnesota and in the Department of Chemistry for 33 years.

## Chris Lundby



Chris Lundby

Throughout the years, Chris’ roles have fallen loosely under the category of “office support,” but, in reality, have encompassed a variety of front-line support. She started out working in the front office with her time spent among graduate recruiting, research stockroom, electronics shop, building maintenance, management of keys, sorting mail and, of course, answering the phone. Gone are the days of typewriters, phones that wouldn’t allow you to re-dial, first-generation computers and software programs, and hand-drawn research graphics.

She chuckles over some of the memorable phone calls from people seeking chemistry solutions to such problems as dissolving twigs that a child put in a gas tank, or fixing bad dye jobs that resulted in orange hair. One of her favorite memories is being able to pet a baby lion that a veterinarian student brought for a visit. “Who gets to do that?” she said.

Chris has worked with a number of administrators, starting with Department Vice Chair Archie Wilson, Department Administrator Stanley Bonnema, Director of Operations Chuck Tomlinson, and now Chair William Tolman. Throughout the years, she has also worked with many professors, including Jan Almlöf, Christopher Douglas, John Ellis, Craig Forsyth, Gary Gray, Paul Gassman, Wayne Gladfelter, John Ellis, Kent Mann, George O’Doherty, and Ilja Siepmann.

She moved to the front office again in 2009, working closely with Tolman, and handling

the complicated visa processes for international post-doctoral associates and visitors, industrial recruiting for graduate students and post-doctorate researchers, and faculty honors and awards.

“Chris is an incredibly savvy and dependable coworker,” said Tolman. “She’s a central person in the department because of her extensive knowledge of how the University works and her refreshing ‘can-do’ attitude.” This can-do attitude and commitment to customer service has resulted in Chris receiving three outstanding service awards.

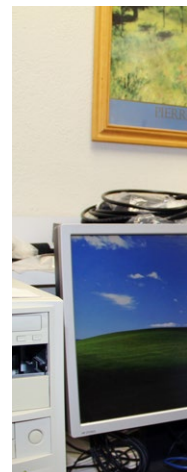
Forty years of service come with many highlights and enjoyments, and interactions with special people. “Working with Paul Gassman was like keeping up with a whirlwind,” she said. “The year that he was president of the American Chemical Society (ACS) was beyond busy. Before he took office as ACS president, a celebration was held in his honor, which was attended by Governor Rudy Perpich who declared it Paul Gassman Day. I accompanied Doc and his wife Gerda to two national meetings. There’s nothing like staying in the penthouses of the Back Bay Westin in Boston and the Washington Hilton. I learned a lot from him. Being in such close proximity with his research group was great, and the friendships with his group members have stood the test of time.”

“With her years of experience comes influence,” said Tomlinson. “Many of the dedicated, helpful staff in our department can point to the example Chris has set for others. I turned to her for help 21 years ago, and still do today.”

Chris has lots of memories and seen many changes. “It has been a great ride,” she said.

## Bruce Moe

Bruce Moe started working for the Department of Chemistry in 1981 as a senior electronics technician, was promoted to electro mechanical systems specialist in 1985, and to electronics shop manager in 1992. His title was later changed to information technology manager. His responsibilities include supervising three employees, including Mike Casey,





end user support, Dan MacEwan, academic technologist, and Eric Schulz, systems/database design/administrator and webmaster.

One of Bruce's important responsibilities has been to design and make changes to the software used to track internal sales in the department. In addition, he repairs, designs and builds electronic instruments that are used throughout the department. He consults with faculty, staff and students about their computer and electronic issues and how to resolve them. He helps with the direct purchasing of computers, projectors and printers, and instruments used in chemistry courses. In addition, he serves and provides much-needed leadership and advice to the department's Web Committee. Because of his commitment to service, Bruce is also an outstanding customer service award recipient.

"The breadth of Bruce's skills and responsibilities over his career is impressive, and I value his honest advice on ever-changing technology matters," said Tomlinson. "I also enjoy watching him work with university electricians, plumbers and telecommunications staff because there isn't an inch of our buildings that he doesn't know."

Technology is constantly changing and evolving. When Bruce started working for the department in 1981, there were only a few computers (VAX 11/780 and 2 Cromemco machines). He built several Heath Kit H89 machines over the next couple of years, replacing typewriters with word processors. Today, there are more than 900 computers in the chemistry department.



Bruce Moe



Chris Lundby and Bruce Moe

He also had to fix many chart recorders, as restringing the pen mechanism was a common problem. Now only a few of these devices are still in use. "I do not miss working on those devices," said Bruce.

"Bruce's insights and wide skill set have been invaluable for the running of the department," said Tolman. "He has always provided superb leadership and calm advice as we continually try to keep up with technological advances in communications, computations, and instrumentation."

Bruce enjoys working in the Department of Chemistry: "I have always had an interest in science," he said. "I like to know how things work. The work I do here changes every day, so I am never working on the same problem very long. This variety has made my job very enjoyable. Working with people from all over the world and sharing experiences has also been a real treat."

## After 41+ years, Ted Tolaas, stockroom services director, retires

For years, his routine encompassed an early-morning rise at 4:30 a.m., followed by an hour plus drive to the University of Minnesota, an hour workout at the university's Recreation Center, and then off to a full day of work for the Department of Chemistry. This left little time for anything else at the end of the day.

But at the end of May 2014, Theodore "Ted" Tolaas retired, saying goodbye to more than 41 years of service to the Department of Chemistry, most of those spent as stockroom services director. Ted actually started with the Department of Chemistry in April 1970, working in the teaching laboratory stock room for about a year and a half, before leaving to finish his bachelor's degree in plant and soil science and a brief stint working as a junior scientist. He returned in 1973 and, shortly thereafter, became the supervisor of what became a melded research and teaching laboratory stockroom.

For close to 39 years, Ted worked with Stanley "Stan" Bonnema, the department's Director of Operations who retired in 2009. "Ted was a good supervisor to his employees, encouraging them to be their best and to do their best," said Bonnema. "He was a very dependable employee, even though he lived 60 miles away in Wisconsin. Even in the worst winter weather, Ted managed to be at work on time."

Ted's main responsibility was attaining all of the equipment and chemicals necessary for the department's research and teaching laboratories, which encompassed preparing bids, working and developing relationships with vendors, and securing the best prices possible. He developed a purchasing system unmatched at the university. The system was built on high-volume bulk purchasing, which yielded some of the most competitive pricing at the university.

For Ted, it was 41 years of toil and trouble, challenges and changes, good times and deep friendships, and the ups and downs of the job itself; but, he looked forward to all that awaited him in a busy retirement.



Ted Tolaas



## Five chemistry professors promoted

*Five Department of Chemistry professors were promoted in 2013, including David Blank, Michael Bowser and Christy Haynes from associate professors to professors, and Christopher Douglas and Valerie Pierre from assistant professors to associate professors with tenure.*

### David Blank



David Blank

**David Blank** joined the Department of Chemistry in 2000 as an assistant professor and was promoted to associate professor in 2006. He came to the university after earning his doctorate in chemistry and conducting post-doctoral research under Professor Graham Fleming at the University of California at Berkeley. His research group investigates a variety of dynamic events in condensed media.

### Michael Bowser



Michael Bowser

**Michael Bowser** joined the Department of Chemistry in 2000 as an assistant professor and was promoted to associate professor in 2006. He came to the university after earning

his doctorate at the University of British Columbia, and conducting post-doctoral research at the University of Florida, working with Professor Robert Kennedy. His research is focused on bioanalytical chemistry, including identifying areas of science limited by technological development.

### Christy Haynes



Christy Haynes

**Christy Haynes** joined the Department of Chemistry in 2005 and was promoted to associate professor in 2010. She earned her doctorate in chemistry from Northwestern University, and

was a post-doctoral fellow at the University of North Carolina at Chapel Hill, working with Professor R. Mark Wightman. Her research group focuses on applications of analytical chemistry in the fields of immunology and toxicology, with much expertise in the area of single cell analysis.

### Christopher Douglas



Christopher Douglas

**Christopher Douglas** joined the Department of Chemistry in 2007. He earned his doctorate in chemistry at the University of California, Irvine, and was a National

Institutes of Health post-doctoral fellow at the California Institute of Technology, working with Professor Robert Grubbs. Research in his group focuses on the development of new synthetic methods and on finding solutions to a variety of synthesis problems.

### Valerie Pierre



Valerie Pierre

**Valerie Pierre** joined the Department of Chemistry in 2007. She earned her doctorate at the University of California, Berkeley, and was a post-doctoral scholar at the California

Institute of Technology, working with Professor Jacqueline Barton. Her group works at the intersection of synthetic and analytical chemistry, using organic and inorganic chemistry, material science and chemical biology to design, develop and promulgate new probes for cell biology and for medicine.

## in MEMORIUM

### Professor Emeritus Warren L. Reynolds

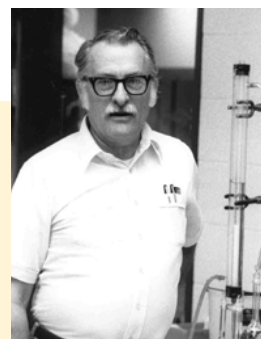
**Professor Emeritus Warren L. Reynolds**, 93, died on Monday, Nov. 3, 2014. He began his teaching career at the University of Minnesota in 1954, working for two years as an instructor before becoming an assistant professor in 1956. Warren served as professor of inorganic chemistry, committed to teaching and research for 37 years, until his retirement in 1991.

Warren was born on Nov. 29, 1920, in Gull Lake, Saskatchewan. He contributed more than four years to his country by serving in the Royal Canadian Air Force. He earned his bachelor's and master's degrees from the University of British Columbia in 1949 and 1950, respectively. He earned his doctorate at the University of Minnesota in 1955, under the tutelage of Professor Izaak M. Kolthoff.

Warren's research was in many areas of transition metal chemistry with a particular interest

in the mechanisms of electron transfer. He contributed substantially to the understanding of ligand substitution reactions on octahedral complexes. He was author or co-author of more than 100 research publications, and was an adviser to a number of undergraduates, graduate researchers, and post-doctoral fellows. He wrote a book with the late-Professor Emeritus Rufus Lumry on electron transfer reactions, *Mechanisms of Electron Transfer*, which was published in 1966. It included information on electron-transfer reactions, metal ion-solvent bond energies, electron-transfer reactions in homogeneous solutions, energy surfaces, non-adiabatic electron transfer, adiabatic electron transfer, heterogeneous electron-transfer reactions, and nuclear tunneling.

He was known as an excellent teacher of inorganic chemistry at both the undergraduate



Professor Emeritus  
Warren L. Reynolds

and graduate levels, and he regularly taught introductory courses in general and analytical chemistry. The quality of his teaching was recognized in 1984, when he was chosen to be one of the developers of what was then the Institute of Technology's honors chemistry program for top freshmen.

After his retirement, he continued his research, and kept busy with family, travel, bridge and gardening, and filled his available time with research into the solvation of alkali ions.

## student RESEARCHERS *continued*

### Mohamed Ahmed *continued from page 15*

"Mohamed is a great undergraduate researcher, said Vervacke. "He is organized in his preparation, and shows a refined skill in both lab awareness and execution. Above all, Mohamed is respectful; always doing what he can to help better the lab even if sacrificing his own free time is required."

After graduating from the University this spring, Mohamed plans to take a year off to perhaps work in industry before returning to graduate school with a focus on chemistry or on medical school.

"I like working in a lab, but I also like interacting with people while serving my community, which is why I may pursue the medical field," said Mohamed. "There are so many people in the African community in need, and they need someone who can speak directly to them in their native language."

Mohamed is not the only one from his family interested in chemistry and medicine. His brother Abdimalik graduated last May, and conducted research under the tutelage of Edgar Arriaga.

Professor Distefano has long served as an adviser to student researchers from diverse backgrounds. "The State of Minnesota is home to a diverse population originating from a range of cultures," he said. "As part of our mission to promote education and create new knowledge, members of the Chemistry Department are committed to engaging a diverse group of students in research activities. An inclusive environment is key for maintaining the scientifically literate populace required for our technologically advanced society. Working with students from different backgrounds and watching them develop into productive scientists and achieve their dreams is



Mohamed Ahmed is pictured with his faculty adviser Professor Mark Distefano, and his mentor Graduate Student Jeffrey Vervacke.

one of the great joys of being a faculty member at Minnesota."

In addition to his studies and research, Mohamed also has a strong commitment to helping others. He tutors MCTC students in chemistry and math, and tutoring young students in math and science at the Franklyn library on Saturdays.

"When you receive help, you have to give it back," he said.

## Christopher Douglas

Associate Professor **Christopher Douglas** was honored with the College of Science & Engineering's *George Taylor Career Development Award*. This award honors professors seeking tenure for their exceptional contributions to teaching. Faculty members are considered for this award at the time they are being evaluated for the granting of permanent tenure and promotion to the rank of associate professor.

## Joseph Franek

Lecture Demonstration Director **Joseph "Joe" Franek** received the *President's Award for Outstanding Service*. This prestigious award honors current and retired employees who have gone well beyond their regular duties and who have demonstrated unusual commitment to the university community. Franek is important to the department's teaching and outreach missions. He works with professors to design and create safe and exciting live demonstrations that illustrate fundamental and advanced chemical principles and that make chemistry accessible to students. He is a key Energy and U team member, creating and managing demonstrations for the shows, which bring 10,000 elementary-aged school students to campus every year.

## Laura Gagliardi

Professor **Laura Gagliardi** received the University of Minnesota's 2014 *Distinguished McKnight University Professorship*. This professorship recognizes and rewards the university's most outstanding mid-career faculty members. Recipients are honored with the title, *Distinguished McKnight University Professor*, which they hold for as long as they remain at the University of Minnesota. Gagliardi, who has

been a professor in the Department of Chemistry since 2009, was chosen based on the level of distinction and prestige that her scholarly work brings to the university; the merit of her achievements and the potential for greater attainment in the field; the dimension of her national or international reputation, including leadership efforts in interdisciplinary or collaborative initiatives; the extent to which her work and reputation are identified with the University of Minnesota; the quality of her teaching and advising; and her contributions to the wider community.

## Christy Haynes

Professor **Christy Haynes** was honored with the 2014 College of Science & Engineering's *George W. Taylor Award for Distinguished Research*. This award honors younger faculty members, within 15 years of earning their doctorates, who have shown outstanding research ability. Haynes joined the University of Minnesota in 2005, and she has built a research program that addresses questions at the interface of immunology, toxicology, materials science, and chemistry.

**Haynes** is also on the *Analytical Scientist's* 2014 Top 40 Under 40 list of researchers. The list represents the most influential analytical scientists under the age of 40 who "prove what can be achieved with determination, passion, and inspiration." Gustavus Adolphus College Associate Professor **Dwight Stoll**, a former student of Professor Peter Carr, is also on the list.

## Marc Hillmyer

Professor **Marc Hillmyer** received a 2014 award for *Outstanding Contributions to Graduate and Professional Education*. This award recognizes contributions to postbaccalaureate, graduate, and professional education. Recipients are

chosen for excellence in instruction; involvement in students' research, scholarship, and professional development; development of instructional programs; and advising and mentoring of students. Hillmyer is now a member of the Academy of Distinguished Teachers and holds the title *Distinguished University Teaching Professor*.

## Thomas Hoye

Professor **Thomas Hoye** received the 2014 *Minnesota Award from the Minnesota Section of the American Chemical Society* (MN-ACS). The Minnesota Award was established in 1958 to honor section members who have made outstanding contributions to chemical research or in service to the profession. Recently, members of Hoye's research group demonstrated that benzynes can generally and practically be formed merely by heating appropriate triyne precursors, which has been termed the hexadehydro-Diels-Alder (HDDA) reaction. Hoye has co-authored more than 190 scientific papers, and is co-inventor of 11 patent applications. Since joining the chemistry faculty in 1976, he has led a highly productive and well-funded research program. Hoye is also an outstanding teacher and mentor, and holds both of the University of Minnesota's two highest teaching awards—the Award for Outstanding Contributions to Post-Baccalaureate, Graduate, and Professional Education, and the Morse-Alumni Award for Excellence in Undergraduate Teaching.

## Aaron Massari

Associate Professor **Aaron Massari** received the 2014 *George W. Taylor/College of Science & Engineering Alumni Award for Distinguished Teaching*, which recognizes outstanding contri-

## Mark Distefano

Professor **Mark Distefano** was named a 2014 *American Chemical Society (ACS) Fellow*. Fellows are honored for their outstanding contributions and service to chemistry, science, the profession, and the ACS. Distefano has been a professor in the Department of Chemistry since 1992. He teaches chemical biology and organic chemistry, and has

earned top university teaching honors. He also has an exemplary service record both within and outside the ACS. He is currently regional editor for *Bio-organic Chemistry* and a member of the Advisory Board for *Organic Chemistry Insights*. At the University of Minnesota, he is the principal investigator of a National Institutes of Health-funded

training grant that focuses on the chemistry-biology interface. Distefano's research is at the interface of chemistry and biology, focusing on understanding how proteins accelerate chemical reactions and how proteins recognize other molecules with high specificity, which is useful for drug design and biotechnology applications.



butions to undergraduate and/or graduate teaching. Since joining the faculty in the Department of Chemistry in 2006, Massari has established a reputation for innovative and enthusiastic teaching. He has taught more than 1,600 undergraduate students and more than 110 graduate students, served as a mentor to aspiring teachers, and contributed to educational literature. He is a member of the Energy and U outreach program and directs the chemistry track of the University of Minnesota Southwest Regional Outreach Center's University on the Prairie program.

## Lee Penn

Associate Professor **Lee Penn** received a *Breaking the Silence Award* from the University of Minnesota's Gay, Lesbian, Bisexual, Transgender, and Ally Programs Office. Penn was honored for her groundbreaking work in coordinating professional development opportunities for the Department of Chemistry, which includes serving as chair of the department's Diversity Committee, and engaging faculty, graduate students, and staff members in Ally training; her advocacy for all-gender restroom spaces; her presence, involvement, and passion for social justice; her advocacy on behalf of students; and her continuous efforts to raise awareness about issues of discrimination.

## Will Pomerantz

Assistant Professor **William "Will" Pomerantz** received a prestigious CAREER grant from the National Science Foundation (NSF). His grant is called the *Chemistry of Life Process Program* grant and is from the NSF Chemistry Division. The Faculty Early Career Development (CAREER) Program is one of the NSF's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations. Pomerantz' grant will aid in the development of fluorine nuclear magnetic resonance spectroscopy methods for detecting, quantifying, and defining novel modes of interactions at transcription factor-protein interfaces, including epigenetic regulatory proteins.

## J. Ilja Siepmann

Professor **J. Ilja Siepmann** was named a *Fellow of the American Physical Society* (APS). Election to APS Fellowship is limited to no more than one

half of one percent of the entire membership of the society. It represents Siepmann's recognition by his peers of his outstanding contributions to physics. Fellowship is a distinct honor signifying recognition by one's professional peers. The citation honoring Siepmann reads, "For the development of efficient Monte Carlo algorithms and accurate force fields and for applications to predictive modeling of complex chemical systems." Siepmann is a Merck Professor of Chemistry, vice chair of the Department of Chemistry, and director of the Nanoporous Materials Genome Center. He has been a professor with the Department of Chemistry since 1994.

## Andreas Stein & Donald Truhlar

Professor **Andreas Stein** and Regents Professor **Donald Truhlar** and are included on Thomson Reuters' list of the "*best and brightest scientific minds of our time*." Truhlar and Stein were two of 3,200 individuals who published the greatest number of highly cited papers between 2002 and 2012.

## Ian Tonks

Assistant Professor **Ian Tonks** received a \$110,000 grant from the American Chemical Society *Petroleum Research Fund Doctoral New Investigator Program*. This program aims to promote the careers of young faculty by supporting fundamental, high scientific caliber research in the petroleum field. Tonks' group will be using the award to explore the fundamental chemistry behind a new type of copolymerization reaction between carbon dioxide and ethylene to make biodegradable polyesters. Developing such a polymerization would represent a significant advance toward making new, inexpensive and biodegradable alternatives to traditional petrochemically derived plastics like polyethylene, while also providing a new use for greenhouse emissions. Tonks joined the Department of Chemistry in July 2013.

## Jane Wissinger

Associate Professor **Jane Wissinger** received the 2014 *Horace T. Morse-University of Minnesota Alumni Association Award for Outstanding Contributions to Undergraduate Education*. This honor is awarded to exceptional candidates nominated by colleges in their quest to identify excellence in undergraduate education. In addition to

## Joint Safety Team

The **Joint Safety Team**—the innovative safety program developed by the Department of Chemistry and Department of Chemical Engineering and Materials Science—received the inaugural *Council of Chemical Research Safety Award*. This award is presented to academic departments that are engaged in chemical research and that have demonstrated significant progress in creating a culture of safety. The Joint Safety Team, which is composed of laboratory safety officers from each research group in the departments, has created and implemented a number of successful initiatives, including:

- Regular safety visits by JST teams to all laboratories to provide input and advice on safety issues;
- Safety Moments, which are short presentations on safety topics that are given prior to every departmental seminar and most research group meetings;
- Safety posters throughout all three buildings housing the two departments;
- Safety notes in every electronic newsletter (posted weekly) in the Department of Chemistry;
- Safety video contest;
- Cleanup weeks to eliminate potentially hazardous waste and clutter;
- Website with extensive resources; and
- Incentive program with awards to specific laboratories for best safety practices.

honoring individual faculty members, the award contributes to the improvement of undergraduate education at the university by publicizing the honorees' work to serve as resources for the whole faculty. She is now a member of the Academy of Distinguished teachers, and holds the title *Distinguished University Professor*.

# 2014 Donors

*The Department of Chemistry thanks the many generous alumni, faculty, corporations, foundations, and friends listed below for their donations and commitments to support the Department of Chemistry, our faculty and students. We are so grateful for your support.*

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*This list includes gifts made year-to-date in calendar year 2014 (Jan. 1, through Oct. 24, 2014). Gifts received after Oct. 24, will be included in subsequent donor lists.*

For more information on giving or alumni involvement opportunities, please visit our web page at [www.chem.umn.edu](http://www.chem.umn.edu), or contact Kathy Peters-Martell at [kpeters@umn.edu](mailto:kpeters@umn.edu) or 612-626-8282 in the College of Science & Engineering Dean's Office.

## Susanna & Tim Lodge endow fellowship to honor their fathers

The University of Minnesota is announcing the creation of the Richard D. Amelar and Arthur S. Lodge Fellowship for Outstanding Collaborative Research in Materials. With this fellowship, Susanna and Timothy "Tim" Lodge hope to encourage and recognize exceptional graduate students in the Department of Chemistry and the Department of

Chemical Engineering & Materials Science who have demonstrated a strong collaborative spirit and initiative to improve the academic community.

In achieving their own personal and professional success, the Lodges drew inspiration from their fathers, both accomplished scientists of high intellectual and moral standards. Tim is currently a Regents Professor in the departments of Chemistry and Chemical Engineering & Materials Science. Susanna completed her doctorate in chemistry at the University in 1990.

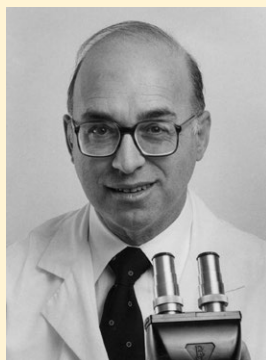
Arthur Lodge, Tim's father, was born in England in 1922, and earned his bachelor's and doctorate degrees from Oxford University in mathematics and physics, respectively. He joined the faculty of the University of Manchester Institute of Science and Technology in 1961 and, seven years later, emigrated to the United States. There, he became a professor at the University of Wisconsin, Madison, where he taught for 23 years. As a world-renowned expert in the field of rheology, the study of the flow and deformation of matter, he received many accolades and, in 1992, was elected to the National Academy of Engineering. He died on June 24, 2005.

"In his career," said Tim, "I'm sure he was proudest of two things: his students and his colleagues, with whom he built up the University of Wisconsin's Rheology Research Center."

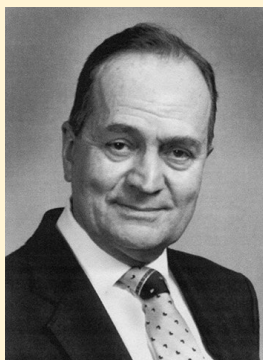
Susanna's father, Dr. Amelar, now retired, was a professor of clinical urology at the New York University (NYU) School of Medicine and a pioneer in the field of male infertility. Born in 1927 in New York City, he entered medical school at NYU at age 19 and graduated in 1950.

"My father always wanted to be a doctor and the best doctor he could be," said Susanna. "His patients' needs were paramount. He was an extremely able and compassionate physician, with a broad and deep understanding of medicine."

His many publications include *Male Infertility*, a book he co-authored that has been widely cited in the field. In 1969, he was invited to Geneva, Switzerland, to serve as a consultant to the World Health Organization on public health aspects of sub-fertility and sterility. The following year, he was awarded grants to establish the first free vasectomy clinic in the United States. He later served on scientific and advisory committees for the National Institutes of Health and was director of the American Fertility Society. Dr. Amelar received the 50 Year Faculty Service Award from the NYU School of Medicine in 2006.



Richard D. Amelar, father of Susanna Lodge



Arthur S. Lodge, father of Timothy Lodge

continued on back cover

## Gifts from alumni and friends invaluable to the Department of Chemistry

By Kathy Peters-Martell

I am overwhelmed when I look at the donor list for calendar year 2014, and the generosity of our alumni and friends. These gifts are invaluable to the department as they support faculty, research, the academic program and, of course, our students.

The undergraduate student body continues to grow in size (1,050 in the College of Science & Engineering (CSE) freshman class this fall) and in capability (our CSE freshmen have the highest average ACT scores on campus). The number of students taking chemistry classes is more than 13,000 per year. That means that the financial support we receive from our alums, faculty, staff and friends is making a huge difference.

Your gifts are helping the department attract and retain our world-renowned faculty members, supporting research that has global impacts, enhancing our academic program, and ensuring that deserving and talented students receive scholarships and fellowships to allow them to pursue their educational dreams.

Thank you.

*If you have questions or need assistance in making a gift to the department, please contact Kathy Peters-Martell, external relations office for the Department of Chemistry, at [kpeters@umn.edu](mailto:kpeters@umn.edu), or 612-626-8282.*



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## Lodge Fellowship

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In addition to honoring their father's legacies, the Lodges' award celebrates both community and technical skill.

"Growing up, I remember my father always helping people and doing more than what was asked of him," said Susanna.

"So often, people focused on the greater good are under appreciated."

For Tim, creating this award is a way to honor the powerfully understated role his father played in molding his life and career.

"He never complained about having to work," said Tim. "He did not dispense advice, but he did dispense example. I felt this most of all when it came to my own career choice. He never pushed on us the joys of academic science, but he demonstrated daily that he had a job he loved."