



## Welcome from the Chair

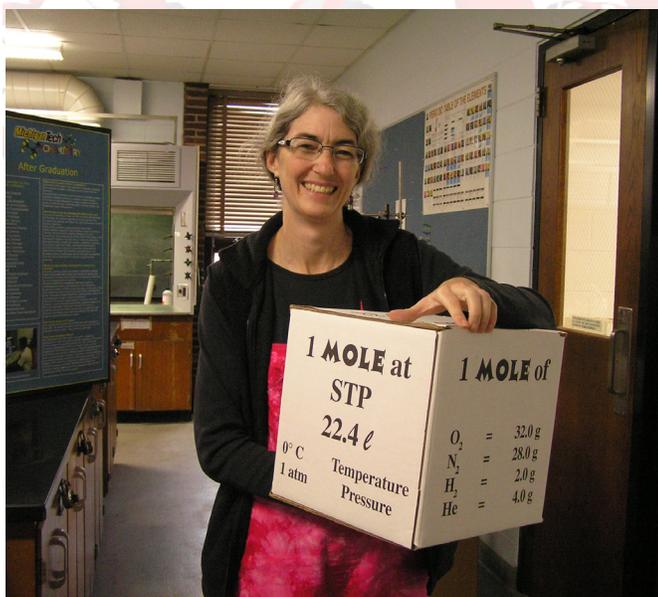
I can hardly believe I've been department chair for over three years. In that time we have gained a new University president and provost, three new faculty members in the department, and almost a whole generation of students. At the end of this school year, students who arrived on campus as I was moving into this office will be graduating!

The Michigan Tech chemistry department continues to evolve to meet the needs of our undergraduate and graduate students. In the last several years we have inaugurated three new degree programs—the first in the department since the establishment of the BS in Chemistry. Undergraduate enrollment in the department is increasing; we currently have more than 100 students in our degree programs!

There has been a large turnover of department faculty in the last ten years, with the most recent retirees being John Williams and Dick Brown, who have gone on to new projects. Les Leifer officially retired in 2001 but continues to pop in regularly for seminars. In exchange for these years of experience, we have a collection of new faces imparting their enthusiasm to the department and leading us in new directions.

Sadly we lost the much beloved Doc Berry this year; he was surely responsible for teaching chemistry to over 10,000 Michigan Tech students (and I think he still remembered all their names when he last visited the department in spring 2005). Another loss was Ray Cross (MS Chemistry, 1935), who held an unshakable belief in the ability of chemistry to benefit humankind. He left a very generous endowment for a research fellowship, which will allow graduate students to carry on his vision into the future.

Our BS graduates are being heavily recruited to prestigious graduate and professional programs, where they are valued as exceptionally well qualified for advanced studies and research. Recent graduates are conducting research at Indiana University, Northwestern University, University of Minnesota, University of Iowa, University of Idaho, and others. Our alumni (BS, MS, and PhD) are employed by Kimberly-Clark, Dow, Pfizer, Merck, Dow Corning, and numerous other companies, big and small. They are studying dentistry, practicing medicine, running marathons, programming computers, managing businesses, traveling the world, and researching and teaching chemistry. Please let us know where you are and what you're up to!



**Left:** Department Chair **Sarah Green** supports a mole of air for Michigan Tech Open House.

## Current Research

*Dr. Haiying Liu*

Dr. Liu's research is focused on the design, synthesis, and characterization of molecules for chemical and biological sensing. One current project uses fluorescent polymers for detection of bacteria.

In order for a bacterial cell to infect you, it first attaches itself to its favorite cell type in your lungs, guts, kidneys, or elsewhere. How does it recognize these cells? Most bacteria identify their host cells through the distinct array of carbohydrates present on the host cell's surface.

So, bacteria display carbohydrate-binding proteins called lectins on their surfaces, which are specific for their hosts. These lectins make ideal "handles" to detect specific bacteria; to take advantage of these handles, all we need is a sensor molecule that mimics the host's surface carbohydrates and can produce a signal when it binds to the lectins. Postdoctoral researcher Dr. Cuihua Xue, under the direction of Dr. Liu, has synthesized fluorescent polymers with linked carbohydrates that are designed to bind to bacteria. These new sensors were successfully tested on *E. coli*, in collaboration with biochemist Dr. Pushpa Murthy and her PhD student, Sonali Jog (now a postdoc at USC).

*See Research inside*



## New Degree Programs

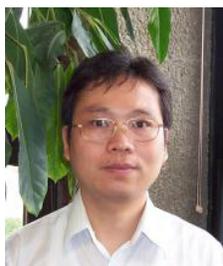
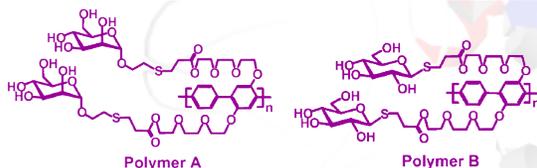
BS degrees in Pharmaceutical Chemistry, Biochemistry and Molecular Biology, and Cheminformatics are new options for those with special interest in these areas.

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*Pharmaceutical Chemistry* is the study of the molecular and mechanistic aspects of pharmaceuticals. The discipline emphasizes the chemistry of drug design and development, drug action, drug transport, drug delivery, and targeting. The development of new pharmaceuticals is critically dependent on a molecular-level understanding of biological processes and mechanisms of drug action. The pharmaceutical industry is a major employer of chemists; in recent years more than twenty percent of graduates with BS and PhD degrees in chemistry work in the pharmaceutical industry.

*Cheminformatics* integrates a comprehensive knowledge of chemistry with an extensive understanding of information technology. The intersection of chemistry and information technology embraces an expanding territory; it includes computational modeling of individual molecules, thermodynamic methods of estimating chemical properties, methods of predicting biological activity of hypothetical compounds, and organization and classification of chemical information. Chemistry is no longer exclusively a laboratory science. With over twenty-four million chemical substances known (CAS registry), computer methods are increasingly essential to anyone who works with chemistry at any level, from students to specialized researchers.

The *Biochemistry and Molecular Biology* BS degree is offered through a collaboration of the departments of Chemistry and Biological Sciences. The program meets the guidelines set by the BIO2010 report (National Research Council of the National Academies, 2003) and the American Society for Biochemistry and Molecular Biology (ASBMB) in having a strong basis in quantitative and physical sciences. The subject can be studied from the perspective of molecular concepts that are applied to biological systems, or from a cellular biochemical process perspective progressing down to the molecular scale.



The Liu Group has developed facile and versatile prepolymerization and postpolymerization functionalization approaches to prepare well-defined fluorescent conjugated glycopolymers bearing a variety of carbohydrates for potential biosensing applications.

## New Faculty



Dr. Marta Wloch is developing new computational methods in quantum chemistry with a focus on approaches based on the coupled-cluster theory, and the application of these methods to problems in organic and bioinorganic chemistry. She is currently recruiting graduate and undergraduate students with a strong physical chemistry background and excellent mathematical skills to join her group. Dr. Wloch comes to us from Michigan State University, where she conducted research as a research assistant professor. She received her doctorate from the Department of Theoretical Chemistry at the University of Silesia in Poland.



Dr. Lanrong Bi's research areas include the development of novel molecular probes for DNA sequencing analysis and disease gene discovery, new imaging and therapeutic agents towards cancer and cardiovascular disease, and the design and synthesis of novel prodrugs of peptides and peptide mimetics with enhanced bioavailability and selectivity. Dr. Bi's group has openings for graduate and undergraduate students with an interest in medicinal chemistry and skills in organic synthesis. She comes to us from her most recent position as an associate research scientist at the Columbia Genome Center at Columbia University in New York.

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## Research, *continued from front page*

The fluorescent polymers containing mannose bound to *E. coli* cells causing the colonies to become fluorescent. Cells that lacked the mannose-binding sites did not react.

An important design problem to overcome is the need for these large molecules to be water-soluble, because bacteria are found in aqueous environments. Normally molecules can be made water-soluble by adding charged groups, but charges could interfere with sensing because biological environments are swimming with charged species that could attract or repel any charged sensor molecules. Dr. Liu attaches oligo-ethylene glycol units to the fluorescent glycopolymers to make highly soluble, but uncharged, compounds. By varying the fluorophores, the carbohydrates, and the length of the oligo-ethylene glycol units, these polymer sensors can be tuned for many applications. Dr. Liu's advances in synthetic techniques will make it possible to easily design and make a sensor tuned for a specific purpose.

See Dr. Liu's web page for a list of publications on this and other projects: [chemistry.mtu.edu](http://chemistry.mtu.edu).

## Department Briefs



Dr. Umme Salma joined the staff of the Department of Chemistry in fall 2006 as a postdoctoral research associate. Salma received her PhD at the University of Bath, UK, and the Quaid-I-Azam University, Islamabad. She was previously a senior scientific officer at the Pakistan Council for Scientific and Industrial Research Laboratories Complex. She has been actively involved in postdoctoral research under the kind supervision of Dr. Pat Heiden. Besides research, Dr. Salma taught CH1120 this fall semester.

Professor of Chemistry Dallas Bates was on sabbatical leave during fall 2006. Part of the sabbatical was spent researching background material utilizing library facilities at the University of Michigan in Ann Arbor. He also met with several former students employed at the Pfizer Global Research Center to discuss important career topics in pharmaceutical chemistry.

Dr. Bates also sought academic information related to medicinal chemistry in order to build on the newly introduced degree program in pharmaceutical chemistry at Michigan Tech. Having met with several faculty at other institutions, he learned there was much interest in the program as a potential source of graduate students for chemical biology and medicinal chemistry.

Bahne C. Cornilsen was recognized for thirty years of service to the University at an awards dinner on May 23, 2007.



## Locks of Love

Chemistry graduate student Steve Johnson grew his hair for Locks of Love. The nonprofit organization provides hairpieces to children suffering from medical hair loss. "I had just gotten out of the national guard and after having short hair for six years I figured I would grow it out and that would be a good goal. Took about eighteen months or so. The beard was just a test of my wife's patience." -sj

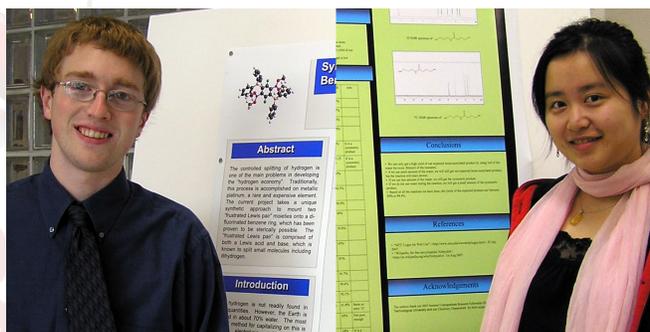
## SURF Recipients

Three chemistry undergraduates were awarded 2007 Summer Undergraduate Research Fellowships (SURF):

Garrett Gibbons, "Silver Catalyzed Enyne Cycloisomerization," with Assistant Professor Shiyue Fang

Andrew Spaeth, "Novel Synthetic Approach to Bi-Zwitterionic Phosphoniumboranes in Organic Hydrogen Activation," with Assistant Professor Eugenijus Urnezisus

Wei Tang, "Mono-Acetylation of Symmetric Diamines," with Assistant Professor Shiyue Fang



Andrew Spaeth (left) and Wei Tang (right).

## Outreach in Chemistry

Department of Chemistry Chair Sarah Green was quoted about the effect of wind on the Keweenaw Current in the November 2007 issue of *Lake Superior Magazine*. The article is entitled "Seasonal Changes in Currents" within the *Kitchi-Gami Almanac* feature.

Green also made a presentation about the effects of climate change on Lake Superior for the "Paradise Lost? Climate Change in the North Woods" traveling art and science exhibit featured at the Omphale Gallery in Calumet.

The department cosponsored a Van Evera Distinguished Lecture by Nathan Lewis entitled "Powering the Planet in an Age of Global Warming" and a visit by David G. Gallo, director of special projects at Woods Hole Oceanographic Institution in Massachusetts, to speak about "Extreme Deep: Exploring the Ends of the Earth-Neptune's Basement" and "In Global Water Crisis".

Free rides on the research vessel *Agassiz* were offered during the Strawberry Festival last summer. The scientific excursions were cosponsored by the Department of Chemistry.

**Breaking News: Lois Blau, CLC Coordinator, has just received the Unsung Hero Award from the Michigan Tech Staff Council!**



# Dow Corning Internship Experience

by Kristen Semlow

**M** As a summer intern at Dow Corning, I was blessed in many ways. I was given a challenging project, an amazing supervisor, and outstanding opportunities to learn about the company and the future career paths available to me. I began working the week of the Tech Conference. This is the venue in which all Dow Corning employees from across the globe are encouraged to present the work they have been doing for the past two years. This conference alone exposed me to more technical information in eight hours than I would have thought possible, and I was very impressed at how diverse the company I had just started working for was.

**I** Throughout the rest of my thirteen weeks at the company, I continued to learn more than I would have thought imaginable. I was placed in the analytical sciences division and assigned to a method development project utilizing ion chromatography. My project required intense attention to detail and refined laboratory skills as I was measuring levels of ions down to ppb. There were many hurdles that managed to present themselves throughout the course of the project, but by working closely with my supervisor, those hurdles were overcome. I was able to explore many different aspects of the method that were not initially considered, and in turn, I was able to document information that will be of use to the company in the future. Furthermore, by the end of the summer I had a much more in-depth understanding of the principles of ion chromatography as well as the instrument itself.

**T** In addition to work inside of the lab, Dow Corning's internship program provides active forums for interns to talk to executives and learn about their career paths as well as their advice for new graduates. Toward the end of the semester, the company provided all of the interns from three different states the chance to spend an entire weekend together learning about the different businesses within the corporation, working on a volunteer activity, and even sending us on a free trip to Cedar Point.

**H** My internship experience at Dow Corning taught me more about industry, writing technical reports, and presenting technical information than I could have learned in ten years of attending classes. I was able to talk to and network with many of the industry's professionals and this helped me solidify my goals for the future.



Dow Corning interns at one of the Great Lakes Loons baseball games (with the mascot Lou E. Loon).

## About the Interns

Chemistry major **Renee Kulling** and pharmaceutical chemistry major **Kristen Semlow** were Dow Corning interns this past summer. Their supervisor Erin Zimmer, an economic evaluator in the Rubber Product Line and Michigan Tech chemistry alumna, had this to say about Michigan Tech's preparation of these students:

"Renee and Kristen were both outstanding interns for Dow Corning this past summer. Tech prepared them to work in laboratory situations with fellow chemists and engineers and to solve complex technical issues for our customers. Both of them produced high-quality, time-driven results that will help Dow Corning achieve its goals and objectives as a corporation. Michigan Tech is highly regarded at Dow Corning and having them join our company as summer interns was a win-win for everyone!"

## About Michigan Tech Chemistry

by Erin Zimmer

As far as my experience goes as an alumna of Michigan Tech, I feel my Chemistry degree helped me not only with the fundamentals of the discipline, but also taught me how to solve problems and become an active member of any team that I was put on due to the outstanding education I received at Tech. The skills I learned (laboratory, problem solving, analytical techniques, etc.) at Tech have helped me work in the professional world and become a better overall employee and contributor to Dow Corning.

**Both Renee Kulling and Kristen Semlow received and accepted full-time job offers at Dow Corning after graduation this coming May!**

## Kimberly-Clark Co-ops

Irene Holl: Fall 2005  
Lawrence Mailloux: Fall 2005  
Eric Winder: Fall 2004, Spring 2005, Summer 2005  
Terri Yerke: Summer Spring 2005, Summer 2005

The students were recruited by PhD graduate Tom Flicker, a chemistry alumnus and research scientist with the Kimberly-Clark Corporation. The Department of Chemistry is grateful to Kimberly-Clark for their long-standing commitment to student success and professional development.

## Students Employed in Research

Katrina Bugielski: Fall 2007  
Bingxin Fan: Summer 2007  
Irene Holl: Summer 2007  
Christopher Kupitz: Spring 2007, Summer 2007, Fall 2007  
Annie Putman: Summer 2007



Chemistry majors participate in the Tech open house by performing experiments for visitors.

## In Memorium

Tech benefactor **Ray Cross** earned a Bachelor of Science in Chemical Engineering and a Master of Science in Chemistry, graduating with both in 1935. Cross endowed a scholarship fund and a loan fund at Tech, as well as a postgraduate fellowship in chemistry. He was inducted into the Outstanding Chemistry Alumni Academy in 1996. Cross died in his home in Ann Arbor in August 2006.

Legendary professor **Myron "Doc" Berry** of Hubbell passed away that same month. Berry received the Clair Donovan Award for Outstanding Service and the University's Distinguished Teaching Award. Doc Berry was one of the most memorable influences on students and colleagues in the history of Michigan Tech.

"The chemists are a strange class of mortals, impelled by an almost insane impulse to seek their pleasure among smoke and vapor, soot and flame, poisons and poverty, yet among all these evils I seem to live so sweetly, that may I die if I would change places with the Persian King." —Johann Becher

## Alumni News

**Marek Urban** (1984 alumnus) has led the development of a method to coat medical devices with antibiotics to cut infections. Urban is a chaired professor at the University of Southern Mississippi in Hattiesburg. He is also director of the NSF Materials Research Science and Engineering Center for polymers there and a distinguished alumnus in the Academy of Sciences and Arts at Michigan Tech.

Recent alumnus **Matt Reuter** has received a DOE Computational Science Graduate Fellowship. The fellowship supports Reuter's graduate work at Northwestern University. Reuter obtained numerous degrees from Michigan Tech, including double degrees in bioinformatics and mathematics and double degrees in chemistry and cheminformatics.

Graduate student **Leigh Winowiecki** was awarded the University of Idaho Doctoral Research Fellowship Award for the fall 2007 semester. Winowiecki is a 1998 Chemistry graduate.

## Research Funding

Chemistry department research funding received well over one half million dollars in support over the last year. Sponsors include the National Institutes of Health, General Motors, National Science Foundation, 21st Century Jobs Fund of Michigan, US Department of Agriculture, Environmental Protection Agency, Michigan Space Grant Consortium, Michigan Tech, and friends and alumni.

## Giving

The Department of Chemistry is grateful for all donations from friends and alumni. Your gifts help support many professional activities, including:

**Chemistry Learning Center**—The CLC provides coaching services to all students enrolled in first year and organic and physical chemistry lecture courses. This initiative has a substantial impact on student success and retention. Coordinator Lois Blau advises the coaches, who are undergraduate students that have recently completed first year chemistry courses at Michigan Tech. The emphasis of the CLC is to cultivate mastery of chemistry concepts and confidence in learning skills.

**Undergraduate research** gives undergraduates the opportunity to develop their professional skills early in their career.

**Graduate research**—Each spring the Outstanding Graduate Student Award supports the recipient's summer research.



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