



Michigan Tech

DEPARTMENT OF CHEMISTRY

2016 NEWSLETTER

mtu.edu/chemistry



Greetings from Department Chair Cary Chabalowski



Computer rendering of undergraduate teaching laboratory after modernization.

It's been a very good year, and I hope it has been a good year for you, too. Our people, including our terrific students, are our biggest asset. In these pages, you'll read about their outstanding work, but before you do, I want to tell you about upgrades to our facilities and how you can help.

President Mroz and the Board of Trustees have generously allocated up to \$3.6 million to the Department of Chemistry: \$3 million to build a modern, centralized chemical purchasing, storage, and distribution center, i.e., *Chemical Stores*, for the entire University, and \$600,000 to begin modernizing our undergraduate teaching laboratories.

Our use of chemicals in teaching and research at Michigan Tech has increased by almost 20-fold since our building was completed in 1968. We have clearly outgrown the existing facility and construction on *Chemical Stores* will begin summer 2017.

The \$600,000 will complete the first of *three renovation phases* to our nine undergraduate teaching laboratories.

Phase I: Overhaul the interior of one of our teaching labs, e.g., new hoods, lab benches, storage cabinets, wall, ceiling and floor coverings, etc.; a detailed architectural plan with cost estimates for completing five other teaching labs, and complete modernization of our equipment.

Phase I.a: The architectural plan for total renovation of the initial six laboratories is now complete. These labs serve the largest number

of undergraduate students. The total renovation of one of the six labs has begun and is scheduled to be completed by early August. In addition, all nine teaching labs will be equipped with high-speed wireless internet.

Phase I.b: Begun two years ago, this phase focuses on upgrading and modernizing equipment in all nine teaching labs. It will completely upgrade our science equipment ensuring our students have the current analytical and experimental chemistry tools. More than \$100,000 in upgrades has been completed. We will modernize our labs at a rapid pace and upgrades will continue as needed to ensure we remain at the forefront in chemistry lab education. The equipment costs over the first five years are expected to total at least \$310,000, which is not included in the \$600,000 from the University.

The good news is all funds for equipment upgrades have been raised or identified through other sources. This will happen!

Phase II: Completes interior renovations for the next five teaching labs at a cost of about \$600,000 per lab, or an additional \$3 million.

Phase III: Completes renovations of the final three teaching labs at a cost of about \$1.8 million, bringing the estimated total for all nine laboratory renovations to \$4.8 million.

Now we need YOUR help!

We need to raise the \$3 million to complete Phase II and we need the help of our alumni and friends. We ask that you consider contributing to this goal. All contributions, from \$10 to \$1 million, will help. A fund entitled Excellence in Undergraduate Education supporting this goal is available at mtu.edu/chemistry/department/giving. You can also mail donations using instructions at the end of this newsletter.

We appreciate your continued financial support of the excellent chemistry education for which Michigan Tech is so well known. On behalf of the entire department, I want to thank you in advance for your generosity!

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Cary Chabalowski, Chair

Go Huskies!
Cary

Tarun Dam earns Bhakta Rath and Exceptional Mentor Awards



Associate Professor of Chemistry **Tarun K. Dam** received the 2016 Bhakta Rath Award and the Exceptional Graduate Faculty Mentor Award, capping an outstanding year, which included his promotion to associate professor with tenure.

The Bhakta Rath Award is given to an exceptional doctoral student and advisor pair at Michigan Tech who are making a difference with their research.

Dam along with graduate student Melanie Talaga were this year's recipients for their work in glycobiology.

Talaga praised Dam for his approach to teaching and mentoring.

"He has a contagious passion for science that has rubbed off on me—the research doesn't feel like work when you enjoy what you are doing and look forward to coming to lab each day," she said.

Dam said the key to successful research is mentoring.

"We both are very much connected to our scientific projects; they are inseparable parts of our lives," he said, adding that collaboration and communication—as much as the actual chemistry—defines the Mechanistics Glycobiology Lab's effectiveness.

"It is easy to work with Melanie because she is always willing to work hard to be on the same page with me."

The pair's work specifically looks at the molecular behavior of glycoproteins, studying how the proteins act and respond to other molecules and affect cell-cell interactions.

The Exceptional Graduate Faculty Mentor Award from the Graduate Student Government is for excellence in mentoring exemplified through advocacy, availability, awareness, creativity, and modeling.

Bruce Seely, the dean of the College of Science and Arts points out that Dam also won Michigan Tech's Distinguished Teaching Award last year.

"Every person we hire must be an effective teacher and scholar," Seely says, explaining that Dam has "demonstrated a deft touch in guiding students."

Our outstanding faculty and their accomplishments

Lynn Mazzoleni was awarded a Fulbright Scholar Award to study one of Europe's pollution hot spots. On sabbatical in Bologna, Italy, Mazzoleni collaborated with researchers in the Institute of Atmospheric Sciences and Climate at the Italian National Research Council. Their study focused on the chemistry of atmospheric nitrogen species to improve the understanding of aqueous-phase chemistry that contributes to the high concentrations of aerosol pollution.

Lynn Mazzoleni is the lead researcher on a team that has brought an Orbitrap Elite high-resolution mass spectrometer to campus through a Major Research Instrumentation grant from the National Science Foundation (NSF). The instrument is an analytical chemistry tool with a scan rate high enough to identify trace components in complex samples.

Andrew Galerneau, lecturer, was named a finalist in the Assistant Professor/Lecturer/Professor of Practice Category of the William G. Jackson Center for Teaching and Learning annual Distinguished Teaching Awards. The awards, which recognize outstanding contribution to the instructional mission of the University, are based on more than 50,000 student-rating-of-instruction responses.

Pushpa Murthy joined the Graduate School as associate

dean in August. Murthy had spent the previous three years as a program officer at the National Science Foundation (NSF) in the Division of Graduate Education. She was recently named dean of the graduate school and associate provost.

Murthy worked closely with the Graduate Research Fellowship Program while at NSF. She is active in the Midwestern Association of Graduate Schools (Michigan Tech's regional affiliate of the national Council of Graduate Schools) and serves as a member of the Innovation and Excellence in Graduate Education Award Committee.

"I am honored to be given the opportunity to work in the Graduate School. I am excited to work to enhance graduate education at Michigan Tech so that our students are well prepared to launch their careers and make significant contributions to the global research enterprise," Murthy says.

Provost Jackie Huntoon stated, "Dr. Murthy will bring a wealth of experience to Michigan Tech and its graduate programs; we are fortunate to have the opportunity to benefit from the experience she gained at NSF by involving her now in the day-to-day operations of the Graduate School."

From Associate Professor Lynn Mazzoleni



Hello alumni and friends! I'm writing to you from Bologna, Italy, where I've been on sabbatical this academic year as a Fulbright Scholar. Unfortunately, my time here is ending soon, but I'm looking forward to my return to campus this summer.

Why Bologna? Well, there are a few reasons (and yes, the food is definitely one of them). The primary reason though has been to learn more about aqueous-phase atmospheric chemistry.

Bologna is located in a large valley of Northern Italy that is susceptible to frequent fog events. In stagnant conditions, the valley accumulates gaseous and particulate pollution. This, combined with certain meteorological conditions, especially high humidity and clear skies, yield what is referred to as a radiation fog. The fog is a dense collection of suspended droplets, similar to a cloud, but is much more polluted. Like clouds though, it can drastically alter the chemistry of atmospheric aerosol. New molecules form and others are removed.

My colleagues at the Italian National Research Council have studied this natural laboratory for 20 years; however, they've never approached the chemistry from my perspective with an expertise in ultrahigh resolution mass spectrometry techniques.

So, we developed a plan to study aerosol and fog chemistry in greater molecular detail than has ever been done before. When I return in July, we plan to install the new, NSF-funded, ultrahigh resolution mass spectrometer on campus and apply its capabilities to a few dozen samples to extend the collaboration.

There are other rewards associated with an international sabbatical, including learning to speak a new language, full immersion in a new culture, personal growth, and travel opportunities. One of my favorite cultural experiences was learning to make Italian pasta. Anyone hungry for 'Tagliatelle al Ragù' (aka spaghetti Bolognese) or 'Tortelloni di Zucca' (pumpkin stuffed pasta)?

New faculty welcome



Kathryn A. Perrine joined the Department of Chemistry as an assistant professor in fall 2015. Perrine earned her PhD in Chemistry from the University of Delaware and her Bachelor of Science in Chemistry from the University of South Carolina.

Before joining Michigan Tech, she worked as a visiting scientist on renewable energy projects at the DOE's Joint Center for Artificial Photosynthesis at the California Institute of Technology and as a postdoctoral scholar at the University of California, Irvine on heterogeneous surfaces and liquid interfaces.

Perrine and Loredana Valenzano, assistant professor in the chemistry department, are updating current courses and designing new ones to take advantage of the latest developments in physical chemistry. Last fall, Perrine opened a new course on Surface Science and Spectroscopy that teaches students about modern vacuum and surface science and is applicable to various disciplines on campus.

Perrine's research is focused on designing metal oxide structures using bottom-up surface chemical approaches to grow tailored metal oxide heterostructures. Her group will determine their effects on surface reaction mechanisms and focus on the fundamental surface chemistry of fuels and pollutants on metal oxide surfaces under controlled conditions.

These investigations will help determine the physical and chemical properties underlying catalytic and environmental processes and will show how new bottom-up approaches to material design help to create new architectures that model heterogeneous catalysts and minerals in the environment.

Remembering Fred Williams



The department lost a cherished member of our family this year. Professor Emeritus Fred Williams passed away February 27 at the age of 79.

A native of Winnipeg, Williams completed his PhD in Chemistry after serving in the Canadian Army. He arrived at Michigan Tech in 1965 to teach chemistry and served as director of Tech's Center for Teaching Excellence.

As an instructor, Williams was known for innovation and creativity in the classroom, especially in the large-enrollment, first-year chemistry sections. His teaching and relationship with his fellow faculty are how his colleagues in the department remember him.

Professor Sarah Green calls Williams unfailingly kind and generous to faculty, students, and staff. "I was amazed at his ability to keep the attention of a full classroom in Fisher 135 for first-year chemistry," she says. "Several Nobel Prize

winning chemists visited campus and he invited them to his first-year chemistry class. Both students and visitors found those interactions inspiring."

Associate Professor Rudy Luck recalls Williams to be "a very positive and cheerful person, and someone with whom you were happier after speaking" he says. Luck remembers Williams teaching chemistry through limericks, "in an early attempt to bring hip hop to chemistry."

Such a fan of the five-line poem was Williams that he would award extra credit to first-year students for writing limericks as long as they related to chemistry. During the (then) 10-week term, more than 500 limericks would be turned in and about three would be read in class. The authors of those would receive the extra credit. The avalanche of limericks were saved and enjoyed by Williams and his family for years.

One of Williams' favorites expressed many freshmen's feelings about first-year chemistry:

*I think that most students agree.
We really don't like chemistry.
Homework . . . there's tons
And these seats hurt my buns
And we'd rather be watching TV.*

Williams retired in 2003 after nearly 40 years at Tech and was named professor emeritus of chemistry. Not only did his innovative teaching win him teaching awards during his career, the Jackson Center for Teaching and Learning established the Fredrick D. Williams Instructional Innovation Award in his honor.

Undergraduates achieve degrees in Spring Commencement 2016

One of the happiest and most satisfying experiences for faculty, staff, and students alike is the crescendo experience of commencement. A lively reception was held in the Huskies Suite prior to and during commencement for the graduates and their families.



Congratulations to our newest alumni!

Amid the pomp and circumstance of Spring 2016 Commencement, the following undergraduate students received their bachelor of science degrees:

Biochemistry and Molecular Biology with a chemistry focus

Kaley Annis, Sean Flattery, Andrew LeSage

Cheminformatics

Brandon Barkle, Alexandra Carpenter

Chemistry

Brian Fisk, Jacquelyn Hood, Jana Parkila, Ashley Schuman

Chemistry with a concentration in Polymers

Wade Korf

Chemistry with a concentration in Environmental Chemistry

Michael Kuhn

Pharmaceutical Chemistry

Erin Mathews, Tyler Sawall

Mazzoleni and team bring mass spectrometer to Tech



Air is not just air. It's not just a sterile, preset mix of oxygen, hydrogen, carbon dioxide, and other molecules. As an atmospheric chemist, **Lynn Mazzoleni** knows air is dynamic and full of soot, sulfates, dust, and other particles. Now, with a new piece of equipment, she can analyze complex aerosol samples and how their chemistry affects cloud formation.

Mazzoleni, an associate professor of chemistry at Michigan Tech and a recent Fulbright Scholar awardee, is also the lead researcher on a team that brought a high-resolution mass spectrometer to campus through a Major Research Instrumentation grant from the National Science Foundation (NSF).

The instrument is an analytical chemistry tool that identifies the type and amount of chemicals in a mixture.

"This will support various environmental and health studies involving very complex mixtures," Mazzoleni says, adding that her team plans to study everything from atmospheric aerosols to wastewater, infant tears to porewater in peat.

The instrument is an Orbitrap Elite mass spectrometer with sufficiently high scan rates. The scan rates matter, Mazzoleni says, because getting structural and quantitative data for trace components in complex samples is an intensified version of *The Princess and The Pea*. Quantitative measurements for such delicate and small molecules require fast chromatography, which is the separation and analysis of mixtures, and minuscule mass measurements in femtograms, or 0.000000000000001 grams.

The availability of the Orbitrap Elite will save travel to other facilities around the country and will open up new possibilities for a number of researchers, especially those conducting environmental analyses.

"We absolutely need ultrahigh, resolving power to see the molecules in extremely complex mixtures in order to learn more about various natural systems, including aquatic systems, terrestrial systems, biological systems, and atmospheric aerosols," Mazzoleni says.

Delving into such complexity requires a large team. In addition to Mazzoleni, the project's co-investigators include Evan Kane from the School of Forest Resources and Environmental Sciences, Adrienne Minerick, associate dean for research and innovation in the College of Engineering and professor of chemical engineering, and Daisuke Minakata, assistant professor of civil and environmental engineering.

The instrument is located in Michigan Tech's Great Lakes Research Center, part of its new Microanalytical Facility, a core facility specializing in mass spectrometry equipment. The initiative, and the new Orbitrap Elite instrument, are supported by more than 10 institutes and departments across campus.

"This project is a model of the deeply interdisciplinary collaboration that not only characterizes the nature of contemporary science, but which also marks many of the most exciting

research activities now underway at Michigan Tech," says Bruce Seely, dean of the College of Sciences and Arts, adding that Mazzoleni's efforts to obtain the equipment span more than three years.

"This is also a great example of how persistence and determination in the pursuit of external support can pay off for the researchers and the campus at large. I congratulate her and the team for their efforts."

The new equipment also opens doors for students. Annie Putman, a Michigan Tech alumna and current doctoral student at the University of Utah, says her experiences working with Mazzoleni developed her research skills, which have helped her succeed in graduate school.

"The ease of access to measurement lowers barriers to students proposing and completing projects of their own design," she says, reflecting that her own process involved traveling across the country. Currently Mazzoleni shows videos in class to explain how high-resolution mass spec equipment works.

"Now, students will be able to walk up and see this instrument in action, which is so much better than watching a video on the internet," she says, adding, "Having the machine will not only make us more competitive, but actually give us the opportunity to lead new avenues of research in our respective fields."

Department welcomed Markku Savolainen to speak at annual Awards Program



Before classes end each spring, we have one of the annual department highlights: the Spring Awards Program. Faculty, staff, and both undergraduate and graduate students gather in the ballroom of the Memorial Union Building to listen to a distinguished alum who shares how their chemistry education at Michigan Tech has enhanced their career. It's usually a lighter, non-technical talk, sprinkled with some humor. Following the speaker, we proudly recognize our current students with various awards.

This year, we were pleased to welcome [Markku Savolainen, PhD](#) back to campus. He graduated from Michigan Tech with

a bachelor's in 2002 and his master's in 2005. After completing his studies, he took a co-op position at GlaxoSmithKline in process chemistry for one year in King of Prussia, Pennsylvania. Following the co-op, he worked as a research scientist in medicinal chemistry at the biopharmaceutical company Adolor (now Cubist), preparing CB2-selective agonists for pain management in Exton, Pennsylvania (2005–07). Following Adolor, he worked at the DuPont Experimental Station in Wilmington, Delaware, in the materials science division (2007–08).

He then began doctoral work at Dartmouth in the laboratories of Professor Jimmy Wu, engaging in synthetic organic methodology research, receiving his PhD in spring 2015. Following his doctoral work at Dartmouth, he accepted a Postdoctoral Research Associateship in the Chemistry Department at the US Naval Warfare Center, Weapons Division (NAWCWD) at the Naval Air Weapons Station, China Lake, California. This associateship is awarded through the National Research Council on behalf of the US Federal Laboratories.

Markku is a native of Ishpeming, Michigan. His talk "From the UP to Both Coasts: A Chem Alum's Journey through Industry, Academia, and Government" was very well received and many students were eager to connect further with him, both at the evening social at the Ambassador Restaurant and the next morning during an open house coffee social in the Chemistry Learning Center.

Many thanks to Markku for returning to Michigan Tech and inspiring us with his accomplishments!

Departmental Student Awards

UNDERGRAD

Outstanding Student in First Year Chemistry

Kyle Schwiebert

Studio Lab Excellence Award

Alyssa Cinder

Doc Berry Award

Andrew LeSage

Biochemistry Research Award

Tracy Mulka

Outstanding Senior Research Award

Kaley Annis

Outstanding Senior Award

Ashley Schuman

Leslie Leifer Award in Physical Chemistry

Erin Mathews

Departmental Scholar

Alexander Vizurraga

Rebecca Sandretto/Susan Stackhouse Summer Fellowship

Emily Lilla

Ambassador Awards

Ema Bagnasco, Grace Billman-Benvenista, Alexandra VanSumeren, Braden LaNore, Ashley Schuman, Brian Fisk, Alex Vizurraga, Jacquelyn Hood, Zach Nelson, Ramandeep Rekhi, Danielle Langdon

Peter Winegar is only the 10th Michigan Tech recipient of the prestigious Goldwater Scholarship. Goldwater Scholarships, established by Congress to honor the late Arizona Senator Barry Goldwater, are based on academic merit, research experience, and intent to pursue a career in science, engineering, or mathematics.

Graduate students **Christina Welch** (Dam) and **Chelsea Nikula** (Thompson) and undergraduate student **Angela Small** (Valenzano) from the Michigan Tech chemistry department were winners at the 2016 UP ACS Student Research Symposium.

Ni Fan (Dam) received a Graduate Merit Award at the First Annual Research Forum sponsored by the Life Science and Technology Institute (LSTI) in September. Twenty-seven graduate and undergraduate students conducting research in life science, biotechnology, human health, and related areas presented posters.

Chelsea Nikula received the award for Exceptional Leadership in Student Governance at the 22nd annual Student Leadership Awards.

Melanie Talaga (and her advisor Tarun Dam) won the 2016 Bhakta Rath Research Award. The award is given to an exceptional doctoral student and their advisor who have made a difference with their research.

Sarah Hopson was honored by receiving the Graduate School's Outstanding Graduate Student Teaching Award.

Ni Fan was selected to receive a Portage Health Foundation Graduate Fellowship, based on her research, publication record, and contribution to the mission of Michigan Tech.

Ni Fan won Second Prize and **Melanie Talaga** won Third Prize for their oral presentations at the 2016 Graduate Research Colloquium at Michigan Tech in February.



Graduate School Award Winners (L-R) Sarah Hopson (Teaching); Ni Fan (Teaching and Research Presentation); Professor Tarun Dam (Exceptional Mentor); Melanie Talaga (Research and Dean's Award for Outstanding Scholarship).

AMERICAN CHEMICAL SOCIETY AWARDS

Undergraduate Award in Inorganic Chemistry, sponsored by the American Chemical Society, Division of Inorganic Chemistry

Peter Winegar

Undergraduate Award in Organic Chemistry, sponsored by the American Chemical Society, Division of Organic Chemistry

Randall Wilharm

GRAD

Outstanding Lower Division Chemistry Teaching Assistant
Ashok Khanal and Joseph Fedie

Outstanding Upper-Division Chemistry Teaching Assistant
Ni Fan

Ray E. and Eleanor K. Cross Endowed Graduate Fellowship in Chemistry
Sarah Hopson

Robert and Kathleen Lane Outstanding Graduate Student Research Award
Ashok Khanal

Outstanding Graduate Student Leadership Award
Chelsea Nikula

Ambassador Awards

Joe Fedie, Melanie Talaga, Sarah Hopson



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Giving

Periodic Table of the Elements

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**Actinide Series

Elements of Success—2942

Our Elements of Success Periodic Table, located on the first floor of the Chemical Sciences Building, honors donors who give \$1,000 or more to the chemistry program. Your name (or a name of your choice) will be engraved on your sponsored element and you will also receive your own personal tile. Our goal is a sponsor for each of the 118 elements on the Periodic Table.

This year's featured element is Magnesium. This busy little workhorse is the eighth most abundant element in the earth's crust. Its flammability makes it useful for glorious fireworks displays, but it is also essential to more than 300 biochemical processes in the human body. Magnesium is involved in almost everything on earth. Why not our department too?

You can see the lists of sponsored and available elements at mtu.edu/elements.

Other Giving Opportunities

All gifts to the chemistry department are used to enhance the education of our students. We have a giving web page—mtu.edu/chemistry/department/giving—to make sure your gift goes to the right place. Donations of any amount are welcome, and listed below are a few of the areas to which you can direct a gift. You may also use the enclosed envelope to make a gift.

Excellence in Undergraduate Education—3093

Support undergraduate student research and the development of valuable professional skills.

Excellence in Graduate Education—2969

Support graduate student research, travel, and professional development activities.

Chemistry Learning Center—3181

The CLC is an important part of our department. Funding helps to provide quality coaching in a comfortable, supportive learning environment. This service continues to have a substantial impact on student success and retention.