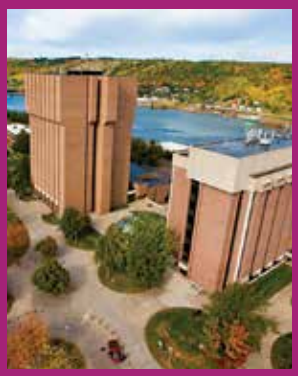
Michigan Tech

DEPARTMENT OF CHEMISTRY

2017 NEWSLETTER
mtu.edu/chemistry



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Cary Chabalowski, Chair

Hello Chemistry Alumni and Friends!

The new undergraduate teaching laboratory.

I hope this newsletter finds you and your loved ones in good health. We're now enjoying the beautiful autumn in the Keweenaw. I'm happy to say that we've just completed another successful academic year. We've completed renovations on a second teaching lab under the outstanding leadership of Lorri Riley and Aparna Pandey with the support from the Board of Trustees, who provided an additional $850,000 in funding that now brings us into Phase 2 of our modernization plan for our teaching labs. In addition, we completed upgrades to our Internet system, so all laboratories and offices now have high-speed wireless connection to assist with teaching and research.

Facilities Upgrades

Last year we continued to upgrade our laboratory teaching equipment with more than $85,000 of new equipment or made upgrades to existing systems. This included a new Nuclear Magnetic Resonance Spectroscopy (NMR) teaching instrument that will also contribute to the research tools available to our students and faculty.

With this good start to Phase 2, our next goal is to raise $2 million through various venues (including generous donations from alumni such as you!) to upgrade the two remaining first-year teaching labs and the organic chemistry lab. Eventually, Phase 3 will include the remaining four labs used for upper-level undergraduate courses, thereby completing all nine undergraduate laboratories.

Under the outstanding leadership of Don Wareham and College of Sciences and Arts Dean Bruce Seely, construction has begun on the new Chemical Stores facility that will become the operations center for chemical purchases, storage, and distribution across campus. This will reduce costs and continue to provide a safe environment related to the purchasing, handling, and storage of research chemicals. We thank again the administration and the Board of Trustees for making this possible.

Industry and Alumni Visits

In February, we enjoyed a productive visit by senior executives from ChemDesign, a leading manufacturer of specialty chemicals. Our guests included David Mielke, president and CEO; Paul Zizelman, director of technology; and Kevin Possi, a Michigan Tech alumnus from Chemical Engineering. Mielke and Zizelman gave impressive overviews of ChemDesign and spoke of opportunities for internships and employment for our students. We're grateful for the time they spent with faculty and students, and for touring Michigan Tech's new Chemical Advanced Resolution Methods (ChARM) Laboratory managed by Lynn Mazzoleni and Maryam Khaksari, both distinguished members of our department. We look forward to expanding this mutually beneficial relationship. Thank you, ChemDesign!

We were also fortunate to have visits and presentations from distinguished alumni including Manfred Philipp, Pat Hartman, Robert Lane, and Jeremy Wilmot. It was exciting to learn about their successful careers, and generous of them to share experiences with the entire department. I encourage all of you to visit and share your experiences since leaving Michigan Tech.

Support the Next Generation

One persistent departmental need is support for student research. Full support for a graduate student as a research assistant during the summer is about $10,000, and about $40,000 for a full academic year. If you feel this is a way you'd like to support the chemistry department, please consider doing so through one of our departmental funds: **Excellence in Graduate Education-2969** or **Excellence in Undergraduate Education-3093.**

On behalf of the entire Department of Chemistry, I want to thank you for your generous support of our educational activities. Enjoy the fall colors, and I hope to have a chance to meet you sometime soon!

GO HUSKIES!
Cary

Lab Modernization Plan

The first of the undergraduate teaching labs has been renovated. It's an all-new space with an open and modernized appearance, but most importantly improves the quality of instruction and lab experience for our students.

The renovated lab has all new equipment. The new hoods provide well-lit, easy-to-access space for students to conduct and observe their experiments.

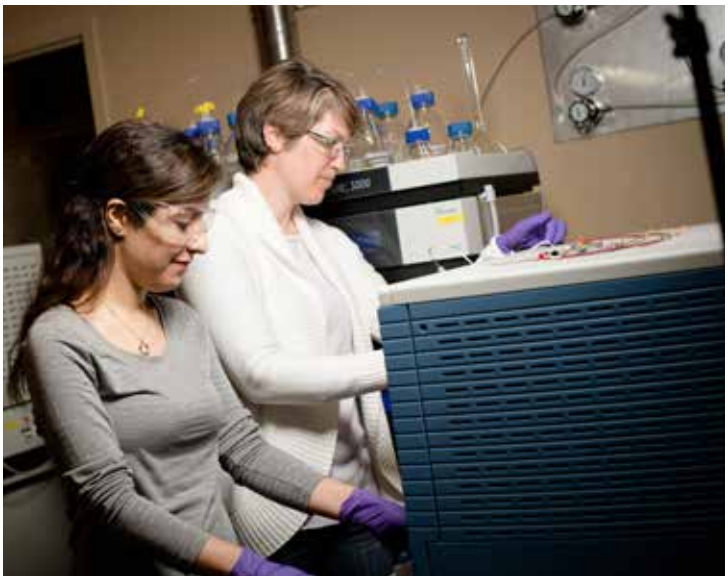
Physical Chemistry Laboratory Experiment Development

An enthalpy experiment was developed for Physical Chemistry Lab I this year. The lab's Parr Semi-Micro Oxygen Calorimeters were modified and used to determine the enthalpy of a reaction. The students were further challenged to perform the experiment as quantitatively as possible to obtain values within a 95-percent confidence interval of the literature value.

Next year, students enrolled in the second semester of Physical Chemistry Laboratory (P. Chem. Lab II) will use UV spectrometers to observe the interaction of light with quantum dots. This experiment will replace the particle-in-a-box experiment that predicted and measured the length of the "box" in dyes containing conjugated bonds.

Graduate Teaching Assistant Mikhail Trought holding part of the calorimeter modified to use for the new enthalpy experiment.

New Mass Spectrometer Proves its Worth in ChARM Lab



Maryam Khaksari and Lynn Mazzoleni process samples in the mass spectrometer.

In the field of mass spectrometry, shrinking the margins of error proves a big point. In the Chemical Advanced Resolution Methods (ChARM) Laboratory at Michigan Tech, researchers analyze the chemical species in complex samples and sort the ions by their mass-to-charge ratio.

With its maximum mass resolution setting of 480,000, the lab's Orbitrap Elite mass spectrometer can pinpoint thousands of chemical species in a given sample with greater accuracy than ever before possible at Michigan Tech.

This allows Lynn Mazzoleni, associate professor of chemistry and co-director of ChARM, along with Maryam Khaksari, lab research specialist, and Elena Kirillova, postdoctoral researcher, to understand fractional changes in the chemical makeup of peatland wildfire smoke, industrial surfactants in Lake Ontario, and bioavailable organic phosphorus in wastewater, to name just a few of the samples the lab can process.

The lab's National Science Foundation-funded project to study the impact of nitrogen emissions from burning peat on ecosystems and atmospheric chemistry is nearing completion. The researchers have, in collaboration with the Desert Research Institute in Nevada, analyzed peat samples from Russia, Florida, Alaska, and Malaysia to understand how peat aerosols affect atmospheric carbon as they age. Globally, peatlands are susceptible to burning due to climate change and to clear land for agricultural use.

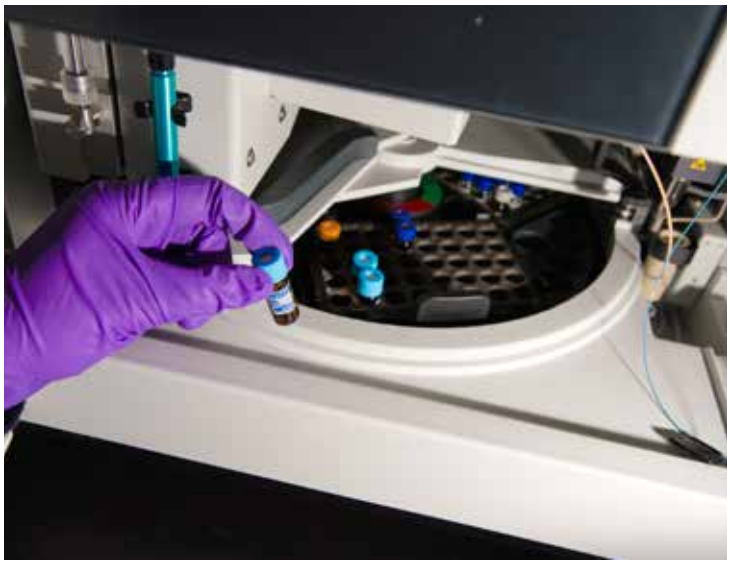
Originally meant to be a pilot project, the scope of the peat analysis work has burgeoned from a focus solely on nitrogen to include the entire soluble organic component. Mazzoleni, Khaksari, and Kirillova are studying the molecular composition of the aerosol from fires with and without simulated atmospheric aging. This provides new insight into brown carbon's effects on climate, which the research team is characterizing using the Orbitrap Elite equipment.

"Particles, which are emitted from natural fires in different parts of the world, can be short-term climate forcers. They can influence local and global climate. But also they can affect human health," Kirillova says.

Using multiple ionization techniques, Kirillova determined that an alkaline elution method reveals a lower hydrogen-to-carbon ratio in the peat-fire samples. They are more aromatic and less oxidized, showing a greater concentration of brown carbon. By artificially aging the peat samples, the research team is able to better understand the composition of wildland fire fuels and what smoke plumes deposit in the atmosphere.

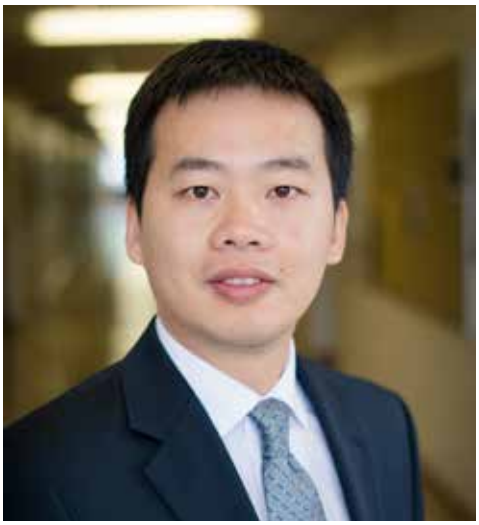
Having the Orbitrap Elite on campus has proved a boon to researchers—in the original proposal they budgeted one week to analyze peat samples at an off-campus facility; Kirillova has spent more than 10 weeks analyzing the samples and the fruits of that research are exponentially more bountiful. The research team continues to refine its method development to prepare samples for analysis with the lab's different instruments. The mass spectrometer is at the forefront of that effort.

"How far can we push this? What's the next thing we can discover?" Mazzoleni wonders. "We have so much molecular resolution we have to write our own codes to process the data."



The Orbitrap Elite has a minimum mass resolution setting of 480,000.

Color of Chemistry: Xiaohu Xia Wins Career Award



Earlier this year, Xiaohu Xia, assistant professor of chemistry, won a prestigious early career award grant from the National Science Foundation (NSF). The chemist wants to make color-coded testing of diseases easier.

Xia hopes to use palladium, platinum, ruthenium, and other corrosion-resistant metals to refine tests to detect biomarkers for cancer and infectious diseases. To do so, he plans to use nanostructures made of these noble metals that mimic natural enzymes. When they interact with biomarkers, the peroxidase enzyme-based assays generate distinct colors.

"Colorimetric tests are common and inexpensive, but not exact," Xia says. "Over the past decade, researchers have proposed peroxidase mimics to improve the assays."

To make them more effective, Xia will push the catalytic activity of the mimics to improve diagnostics for disease biomarkers like those for cancer detection. Improvements come down to structure. The peroxidase mimics that Xia studies have a core-shell nanostructure. That is, they have a palladium core with a surface coating of another noble metal, which could be platinum, gold, or others. Xia compares the nanostructures' careful atomic arrangements to the masonry of a building; he needs to optimize the size, shape, and composition of the parts to make a seamless whole. Precision is essential.

The grant covers five years, totaling $457,783, and enables Xia to dig deep into the structure-property relationships of the bimetallic peroxidase mimics at the atomic level. Even small changes in nanostructures can produce big results, demonstrated by his lab with improvements in the catalytic efficiencies of iridium-coated palladium and ruthenium nanostructures.

Cary Chabalowski, chair of the Department of Chemistry, says Xia's work aligns with the university's goals to expand nanotech and surface science research.

"His work holds great promise for significant breakthroughs in general fields of nanoscience, nanobiomedicine, and biomimetic catalysis," he says, adding that the project also introduces "students to the fascinating area of the nanoscale world where quantum-meets-classical behavior and amazing phenomena can be seen."

The nanostructures Xia works with are best seen with a scanning electron microscope (SEM); many of them have distinct forms, which make them helpful for K-12 education.

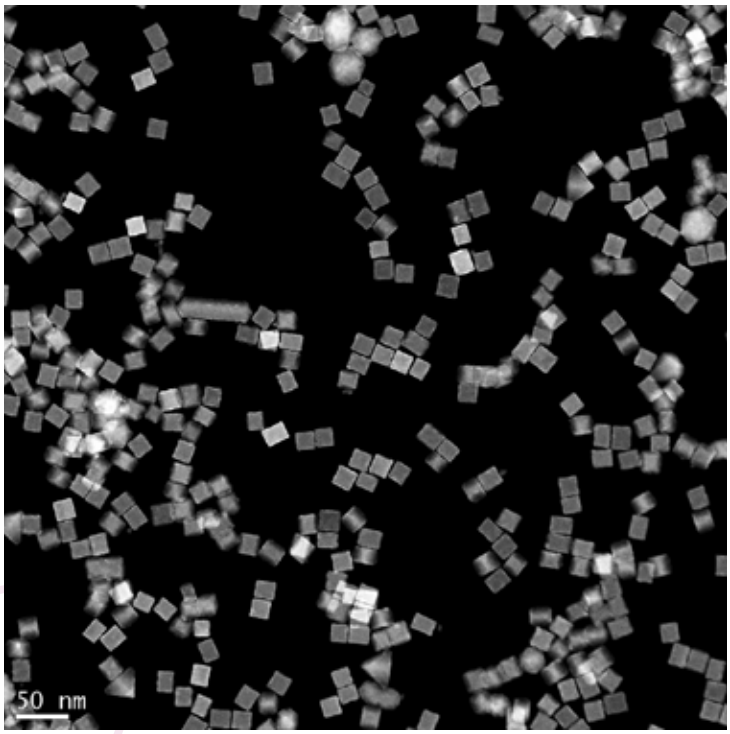
To inspire students, Xia is willing to go to kindergarten classes and bring high schoolers to campus.

"The kids are very interested in the shapes, for example," he says of showing microscopy images to five- and six-year-olds at a local elementary school. "We work with a group of very uniform and well-shaped structures—seeing examples of such materials helps foster their interest and curiosity about nanoscience."

Xia will have one or two high school research positions in his lab during the summers, in addition to visiting schools and participating in local science festivals.

Xia is also enthusiastic about educating undergraduate students. During the past two years, he has worked with more than 10 undergraduate students for research projects; four of them have published research papers in peer-reviewed journals.

From inspiring youth to improving cancer detection, Xia's work is a colorful example of innovation in nanotech.



The nanostructures Xia works with are best seen with a scanning electron microscope (SEM); many of the nanostructures have distinct forms, which make them helpful for K-12 education.

A Year of Achievements for Professor Loredana Valenzano-Slough

In the fall of 2016, Loredana Valenzano-Slough travelled to India as an invited speaker at the "Nanotechnology: Insights into Properties of Materials from Computational Modeling Methods" workshop at the Guru Jambheshwar University of Science & Technology, Hisar-Haryana (India) involving participants from across India. Valenzano-Slough played a major role by delivering three two-hour long morning lectures and leading afternoon hands-on tutorial sessions during which participants learned practical techniques on electronic structure calculations applied to nanomaterials. She also took the opportunity to describe Michigan Tech's strategic plan and the important role that women and minorities play in making Michigan Tech a more competitive and inclusive research institution. Valenzano-Slough described her trip as a rewarding experience that deepened her appreciation for the opportunities afforded to faculty at Michigan Tech.

More recently, Valenzano-Slough gave two invited talks in the United Kingdom (UK) at the Imperial College London entitled: "The Potential of Metal Organic Frameworks in Petroleum Refining Processes: Separation, Diffusion, and the Ad Hoc Engineering of Efficient Membranes," and "Active Pharmaceutical Ingredients Addressed at Electronic Structure Level: From their Physico-Chemical Properties to their Nucleation/Growth Mechanisms." ICL was ranked ninth in research universities around the world by the QS World Rankings 2016! While there, she discussed research topics in materials simulation with faculty and students, as well as common challenges faced by educators, including the need for wider inclusion of underrepresented groups in STEM (science, technology, engineering, and math) fields in the US and the UK.

To round out her year, Valenzano-Slough was recognized by Dean Bruce Seely at the 2017 Deans' Teaching Showcase as one of Michigan Tech's 12 outstanding instructors, and was commended by Provost Jackie Huntoon as one of the best instructors on campus with student teaching evaluations of 4.8/5 for two consecutive semesters in her large physical chemistry courses. Finally, Valenzano-Slough and graduate student Gemechis Degaga published two important papers in a high-impact journal: (1) "Part I: C_2-C_4 hydrocarbons separation addressed via molecular cluster models carved out from periodic MOF-74-Mg/Zn structures," *Chemical Physics Letters* 660, 313-319, 2016; and (2) "Part II: Quantum mechanical prediction of heats of adsorption for C_2-C_4 hydrocarbons in MOF-74-Mg/Zn periodic structures", *Chemical Physics Letters* 682, 168-174, 2017, capping a very productive year for Assistant Professor Loredana Valenzano-Slough!

A Note from Marina Tasanova

Hello Michigan Tech and alumni! It has been an exciting year for me and the students in my research laboratory. After establishing a research program, setting up equipment, training students, and finding a talented postdoctoral researcher, we are finally moving towards our goal to specifically target cancer for imaging and diagnostics.

How? It's all linked to nutrition! We need food to live and function, just as cells need food to survive and propagate. And cancer cells need it much more! The nutritional requirement differences between normal cells and cancer cells have been recognized for decades. What has also been recognized is that fructose is much more nutritional for cancer cells and they tend to make more transporters to take up fructose than normal cells. How come? Unlike normal cells, cancers use fat to grow, and fructose makes fat in cells. Our lab was successful in directing an imaging probe to one fructose transporter that is specifically linked with cancer development, progression, and metastasis.

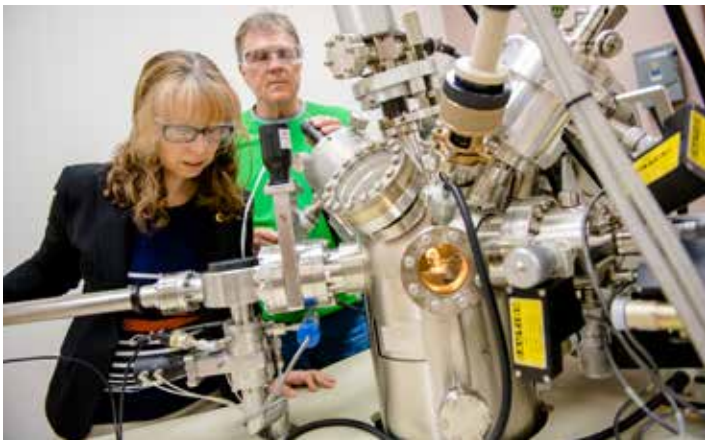
What do we gain? We now have a tool to identify cancer cells in patient samples and contribute to more effective and precise cancer diagnostics.

Where we go from here? Well, it is a long and broad path that includes development of cancer-targeting imaging agents for MRI, PET, and other techniques used to identify cancer in patients.

Of course, the work in the lab is not limited to one line of research. As an organic chemistry laboratory, we are developing new synthetic methodologies to obtain drug-like compounds, and as a chemical biology lab we seek to understand the mechanisms associated with anticancer drugs.

How is this possible? Many thanks go to the department, the staff, the colleagues at Michigan Tech and outside, and to our donors! A special thank you is necessary for the Pruett family for supporting the chemistry department, as well as providing funds to hire and support a postdoctoral associate, who contributed greatly to development of different research directions in the lab. I hope I will have many more interesting discoveries to report in the future newsletters.

Kathryn A. Perrine Helps to Acquire New XPS Surface Analysis Instrument for Michigan Tech



Assistant Professor Kathryn A. Perrine and ACMAL Director, Owen Mills, transfer a sample into the new XPS instrument for surface analysis.

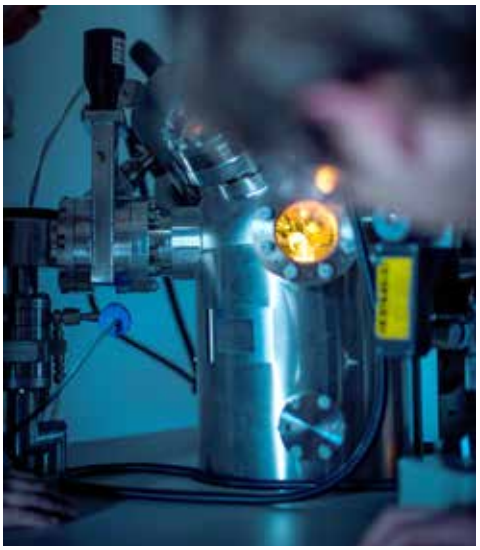
Assistant Professor Kathryn A. Perrine is the newest faculty member in the Department of Chemistry. Her research focuses on understanding the surface chemical reactions and changes of inorganic materials.

"Many people do not realize that chemicals adsorb and react on the surfaces of every material they come into contact with every day, from minerals in the environment, hygiene products, adhesives, etc.," she says. "Many of our technologies that advance the electronics and clean energy industries are rooted in understanding and controlling surface chemistry at the nano- and atomic-scale."

Perrine's research team utilizes surface chemistry to grow unique architectures at the nano- and meso-scale on surfaces. Additionally, her group determines surface reactions for understanding the energetics of heterogeneous catalysts and environmental processes. Perrine uses several surface analytical techniques to understand fundamental chemistry at the molecular level, particularly X-ray Photoelectron Spectroscopy (XPS). XPS is a surface analytical technique that determines the electronic structure and chemical bonding of the top 10 nanometers of the surface of a material. This instrument is ideal for analyzing metals, polymers, semiconductors, catalysts, and related materials. XPS can determine materials compositions for most elements in the periodic table and oxidation states, chemical binding energies, and depth of layers for thin films.

Early last year, Dr. Perrine discovered, through pricing quotes with vendors, that the US Army Research Laboratories were about to dispose of an XPS instrument. She contacted Chemistry Department Chair, Cary Chabalowski, to help make connections at the Army Research Labs (ARL). Chabalowski found that the ARL could donate the equipment to Michigan Tech. Perrine helped assess the quality and determine the useable features of the instrument. She then contacted Owen Mills, director of the Applied Chemical and Morphological Analysis Laboratory (ACMAL) core facility at Michigan Tech, to find appropriate space to house the instrument to make it accessible to other researchers. Mills found a space at ACMAL near the electron microscopes. This XPS instrument adds to the suite of surface analysis capabilities for Michigan Tech. Timothy Leftwich, new research faculty in the Department of Materials Science and Engineering, also an expert in surface science, joined the effort to help pack and ship the instrument from the ARL to Michigan Tech. He is currently working on the installation, repair, and calibration of the XPS instrument in ACMAL. Several departments on campus supported the repair of the XPS instrument that greatly enhances the surface science capabilities at the ACMAL facility. Most researchers send their samples off campus for routine XPS analysis. This instrument, along with the new environmental STEM instrument, will help advance the research projects across campus. The PHI 5800 XPS is equipped with dual source, aluminum and magnesium, anodes, a hemispherical analyzer for XPS, an electron gun source for Auger analysis, elemental mapping capabilities, an ion sputter gun for depth profiling, and stage tilting for angle-resolved XPS.

In addition to the XPS, Perrine's research group has designed and is currently building their customized Surface Analysis instrument at ACMAL that will allow for controlled surface science experiments under various pressures and temperatures. The instrument has four spectroscopies that will help to determine chemical reactions, mechanisms, and physical changes of surfaces under controlled conditions. Determining the fundamental chemical and physical principles behind surface reactions will help the Perrine research group understand how surfaces participate in reactions relevant to environmental science and clean energy production. In addition, they investigate fundamental chemical principles behind engineered surfaces to grow unique nano- and meso-scale particles for designing new heterogeneous catalysts. These principles will give them the knowledge to tailor new materials of various architectures to advance energy-efficient technologies.



An XPS surface analysis instrument greatly enhances the surface-science capabilities in ACMAL.

Tarun Dam's Work Built on Foundation of Exceptional Lab Environment

Tarun Dam, associate professor of chemistry, understands that it doesn't take a lab outfitted with the latest and greatest equipment for important discoveries to happen—it takes good ideas and a lot of hard work.

Dam has been honored recently with numerous awards. He received the Michigan Tech Distinguished Teaching Award in 2015, and in 2016 he received the Exceptional Graduate Faculty Mentor Award as well as the Bhakta Rath Research Award with doctoral student Melanie Talaga.

Awards and published work highlights Tarun's commitment to exceptional quality, but he says his success is a journey, not a destination, and comes down to the day-to-day work he and his graduate students do in the Laboratory of Mechanistic Glycobiology.

"We do basic science. We pave the path. We are the road makers, the laborers," Dam says. "The ultimate destination may be far away. Sometimes we are unsuccessful but sometimes at the end of the road we find something; an application (for the science) comes at the end of the road."

Dam notes that much of his success comes from empowering the students who work in the lab to learn well and do good work. Dam and his students have published four papers and a book chapter together, which he says are fundamental to the field of glycobiology.

The papers include an article in *BIOCHEMISTRY* that redefines the functions of a cancer-related protein that contributes to cancer and inflammation research, an article in the journal *Methods in Enzymol* about measuring multivalent binding interactions by isothermal titration calorimetry, a paper about glycan-dependent mutual and reversible sequestration of two thyroid cancer biomarkers in the journal *Thyroid*, and another *BIOCHEMISTRY* paper that has the potential to improve drug development based on lectin-glycoconjugate interactions.

Dam is the first to mention that his graduate students contribute in their own ways to the research.

"They are trained pretty well and they are confident. I did my part, but they did their part," he says. "In a big lab they don't spend this much time on grad students, but we want to make graduate education robust. I cannot lecture on superior graduate education without doing that. For the last five years I have seen results."

Dam said that he has had the fortunate experience of realizing his ideas, a rarity in any scientific field. The biochemist says that his lab plans to produce two more papers soon that he also hopes will be fundamental game-changers for the field. But characteristically demurring, Dam says with a smile: "All is 'if' in science."

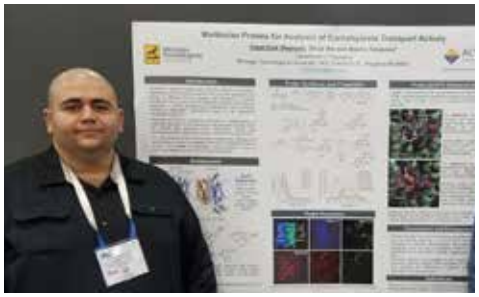
Tarun Dam examines research data with doctoral students Melanie Talaga (left) and Ni Fan (right).

Tarun Dam shares the joy of discovery with graduate students (from left) Ni Fan, Melanie Talaga, and Robert Brown.

Reflections on the 253rd National American Chemical Society Meeting

From top to bottom: Our department was well represented at the 253rd National American Chemical Society meeting in San Francisco by our graduate students Ashok Khanal; Shuai Xia, postdoctoral fellow Lukasz Weselinski, graduate student Chelsea Nikula and husband Ben; Xia, Weselinski, and graduate student Vagarshak (Vaho) Begoyan.

Five graduate students and one postdoctoral fellow from the chemistry department joined almost 19,000 other chemists at the 253rd National American Chemical Society meeting in San Francisco, California, in April. These presenters described their experiences by saying:

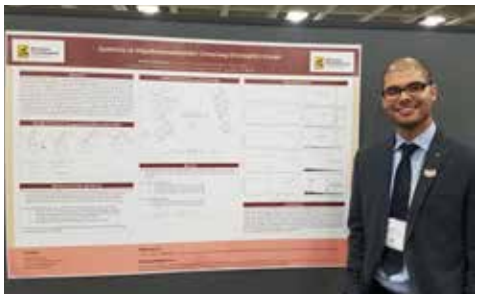


Vagarshak (Vaho) Begoyan

"It was fantastic to meet new people who are equally interested in your field but have different visions for it's future. The conference felt like a breath of fresh air after having been focused on my own studies for so long."

Chelsea Nikula

"There was a really [an] excellent session called Hollyweird Chemistry that featured speakers who worked on shows such as Breaking Bad, Star Trek, The Universe, *and* Nova. *It reminded me just how creative scientists can be and how important it is to reach beyond academia to get others excited about science."*



Shahien (Shawn) Shahsavari

"I was also able to peer into what was being done in other fields of chemistry, and witness the passion everyone has for their research was reinvigorating."

Spring 2017 Graduates

Some of the graduates have plans to begin doctoral programs at the following institutions: University of Michigan, University of Minnesota, Northwestern University, and University of Montana. Others have secured or are in the process of securing full-time work opportunities in industry. Congratulations to all!

Graduating seniors with Blizzard T. Husky from left to right: Jared Bazile, Braden LaNore, Browning Schult (anticipated class of 2018), Randall Wilharm, Ramandeep Rekhi, Theodore Buckley, Robert Rauschendorfer, Alexander Vizurraga, and the chemistry graduation marshal Professor Paul Charlesworth. Graduates not pictured are Patrick Kidwell and Peter Winegar.

Jared L. Bazile, biochemistry and molecular biology with a chemistry focus

Theodore J. Buckley, cheminformatics

Patrick E. Kidwell, chemistry

Braden W. LaNore, biochemistry and molecular biology with a chemistry focus

Robert J. Rauschendorfer, pharmaceutical chemistry

Ramandeep S. Rekhi, biochemistry and molecular biology with a chemistry focus

Alexander L. Vizurraga, pharmaceutical chemistry and biochemistry and molecular biology with a chemistry focus

Randall K. Wilharm, chemistry

Peter H. Winegar, chemistry

Departmental Student Awards

Outstanding Student in First Year Chemistry
Shaun Burriss

Doc Berry Award
Ramandeep Rekhi

Undergraduate Award in Inorganic Chemistry Sponsored by the American Chemistry Society, Division of Inorganic Chemistry
Tyler Leverton

Undergraduate Award in Organic Chemistry Sponsored by the American Chemistry Society, Division of Organic Chemistry
Patrick Kidwell

Undergraduate Award in Analytical Chemistry Sponsored by the American Chemistry Society, Division of Analytical Chemistry
Tyler Leverton

Biochemistry Research Award
Alexander Vizurraga

Outstanding Senior Research Award
Randall Wilharm

Outstanding Senior
Peter Winegar

Leslie Leifer Award in Physical Chemistry
Shelby McGuire

Departmental Scholar
Tyler Leverton

Rebecca Sandretto and Susan Stackhouse Summer Fellowship
Alexis Ferrier

Outstanding Lower-Division Chemistry Teaching Assistant Award
Patrick Kidwell and Jainheng Bi

Outstanding Upper-Division Chemistry Teaching Assistant Award
Simeon Schum

Ray E. and Eleanor K. Cross Endowed Graduate Fellowship in Chemistry
Ashok Khanal

Robert and Kathleen Lane Outstanding Graduate Student Research Award
Gemechis Degaga

Outstanding Graduate Student Leadership Award
Simeon Schum

Ambassador Awards
Ema Bagnasco, Danielle Langdon, Ramandeep Rekhi, Jacob Mohar, Alexis Ferrier, Emily Lilla, Joe Vermeylen, Alex VanSumeren, Liz Hegecock, Brian Burtka, Alex Vizzurraga, Jessica Krycia, Alyssa Cinder, Zach Nelson, Robert Rauschendorfer

Spring Awards Program Speaker: Jeremy T. Wilmot '04

Our department was pleased to welcome back to campus Jeremy Wilmot '04 as the key speaker at our spring awards program April 19, 2017. Our tradition of inviting alumni back to campus encourages them to speak informally about how their experience as a student has enhanced their future path, what that path is, and what they are currently doing. In Jeremy's talk, "There and Back Again: Journey of an MTU Chemistry Grad" was well received and there were opportunities to chat with Jeremy after, during the evening at the Keweenaw Brewing Company in downtown Houghton, and the next morning at an open house/coffee in the Chemistry Learning Center.

While Jeremy was on campus, he was able to meet with the Dean of the College of Sciences and Arts, Bruce Seely, along with other department chairs to discuss our informatics programs available through biology, chemistry, computer science, and mathematics. He also met with our undergraduate programs committee to review our Cheminformatics Bachelor of Science degree, and made some excellent specific suggestions for improving this program.

Jeremy graduated from Michigan Tech with a BS in Chemistry in 2004. From there, he joined the lab of David Gin at the University of Illinois in Urbana/Champaign, which moved to Memorial Sloan Kettering Cancer Center in 2006. In 2010, he received his PhD in natural product total synthesis and began his career at Dow AgroSciences in Indianapolis, Indiana, where he currently works in Discovery Chemistry as a research scientist.

Thank you, Jeremy, for taking the time to return to campus!

Research Awards

Tarun K. Dam, 9/1/16–8/31/19
"The New Identity of Glaectin-3 as a Glycosaminoglycan Binding Protein," National Science Foundation. $420,965

Xiaohu Xia, 1/1/17–12/31/21
"Engineering Bimetallic Nanostructures as Peroxidase Mimics for Diagnostic Applications," National Science Foundation CAREER award. $457,783

Lynn Mazzoleni, 9/1/17–8/31/18
(additional funding)
"Aqueous Phase Oxidation of Biomass Combustion Emissions in Clouds," NASA. $35,172

Sarah A. Green, 9/1/16–5/31/17
"Stamp Sand Threat to Buffalo Reef and Grand Traverse Bay: LiDAR/MSS Assessments Prior to 'Trough' Dredging," WOOLP. $25,227

Xiaohu Xia, 6/1/16–5/31/17
"Commercialization of Pd-Ir nanocubes as artificial peroxidases," Zytog. $121,667

Research Excellence Fund (REF) Research Seed Awards

Xiaohu Xia
"An Enzyme-free Amplification Technique for Ultrasensitive ELISA of Disease Biomarkers," $30,700.

Kathryn A. Perrine
"Designing tailored metal oxide mesostructures using functionalized carbon surfaces," $20,000.

Marina Tanasova
"Cancer Toolbox: Facilitating GLUTS targeting for theranostic applications," $20,000.

Momoko Tajiri
"High-throughput screening of biomolecules to study gene regulations in malaria parasite," $15,986.

Lanrong Bi
"Targeting Mitochondrial Oxidative Stress–An Integrated Nanoplatform for Delivery of Antioxidants to Stressed Mitochondria," $8,500.

Portage Health Foundation Awards

Xiaohu Xia, $15,700
Marina Tanasova, $10,000
Momoko Tajiri, $13,986
Lanrong Bi, $7,500

Faculty Awards

Deans' Teaching Showcase: **Andrew Galerneau** in 2016 and **Loredana Valenzano-Slough** in 2017.

Giving

A big THANK YOU to our loyal alumni and friends.

The students, staff, and faculty in the Department of Chemistry would like to extend a most sincere thank you and express our gratitude for the tremendous generosity of our alumni and friends. Your donations make it possible for us to maintain high-quality educational and research programs in the department!

Call Him Mr. Mineral: Travis Olds '12 has Characterized Six New Minerals

A specimen of Shinkolobweite found in the Shinkolobwe uranium and radium mine in the Katanga province of the Democratic Republic of Congo.

It's not every day someone discovers a new mineral. Travis Olds '12 has spent some time in the limelight recently following his discovery of three new minerals found in old uranium mines. Altogether, the Michigan Tech alumnus can boast a role in the discovery of six new minerals.

After completing his BS in Chemistry at Michigan Tech, Olds began a PhD at the University of Notre Dame. The Ishpeming native studies the chemistry and mineralogy of uranium and neptunium, and is a fellow of the US Department of Energy Carlsbad Field Office, which is funded through the Oak Ridge Institute for Science and Education.

Olds specifically studies uranyl minerals because, as radioactive materials, it is important to know where they are found and how they change in different environments. Within the past year, he found three new uranium minerals in Red Canyon, Utah: leesite, leószilárdite, and redcanyonite. He characterized them along with a small team including alumnus Shawn Carlson '91 and staff scientist Owen Mills '08 who runs the Applied Chemical and Morphological Analysis Lab (ACMAL) at Michigan Tech.

Olds' additional minerals descriptions approved by the International Mineralogical Association include gauthierite, ewingite, and shinkolobweite, which he and a team of crystallographers and mineralogists from around the world worked together to characterize.

"The Shinkolobwe mine was an important uranium mine in the 1940s and 1950s," he says. "It was where the US got enough uranium to construct the atomic bomb during World War II. It's the most diverse, in terms of uranium minerology in the world."

Shinkolobweite contains an uncommon form of uranium in that it has a pentavalent oxidation state (5+). Though this should mean that the mineral is unstable, the opposite is actually true; Olds says his sample has been stable for more than 100,000 years.

The mineral discovery helps mineralogists understand how uranium can affect natural systems as it degrades.

"Once it's oxidized to 6+, it's very soluble and moves into groundwater easily," he says. "You want to stop it from forming into 6+ so it doesn't get into the groundwater."

Gauthierite gives mineralogists insight into understanding how lead and uranium combine to form certain crystal structures, while ewingite is the most structurally complex mineral known, with the largest cluster of atoms found naturally.

After defending his dissertation in June, Olds hopes to find a position at a national laboratory to continue studying uranium mineralogy, especially samples containing water, using single-crystal X-ray diffraction (XRD) or neutron instrumentation. His specialties include single-crystal XRD structure refinement, electron microscopy techniques—energy dispersive spectrometer (EDS), wavelength dispersive spectrometer (WDS) microprobe, and transmission electron miscrosopy (TEM)—various spectroscopic methods including Raman spectroscopy and X-ray photoelectron spectroscopy of uranium and neptunium compounds, as well as mineral identification and photography.

Alumni Updates

Nicholas White, PhD

Following graduation in May 2010 with a BS in chemistry (environmental concentration) and minor in Spanish, I enrolled in the PhD program at Michigan State University to study analytical chemistry. Working with Dr. Merlin Bruening, I studied ultrathin polyelectrolyte films as functional coatings of commercially available membranes for ion separations and water treatment. Much of my work combined surface science, electrochemistry, and materials engineering to probe coating efficacy and transport mechanisms.

My time at MSU led me to collaborate with and visit Turkey's National Research Center on Membrane Technologies (MEM-TEK) at Istanbul Technical University. I also presented my work at the American Chemical Society National Meeting in Denver, Colorado, and at the North American Membrane Society Annual Meeting in Boston, Massachusetts. After completion of my PhD in December 2015, I began working as an instructor at Mott Community College in Flint, Michigan, before beginning my current position as a Research & Development Chemist for Munich-based Wacker Chemical Corporation. My role focuses on the implementation of a new research facility in Ann Arbor, Michigan—Wacker's first in North America, as well as new product development specifically targeting the Americas. I still love to visit Tech and the Keweenaw, and have made it back at least once every year since I graduated!

Tsitsi Hungwe

Since graduating from Michigan Tech, I pursued a degree in dentistry and graduated in 2016 from the University of Louisville School of Dentistry. I was blessed and so grateful to have received a full scholarship through the National Health Service Corp. while in school. The program aims to provide health care providers with an opportunity to help the underserved through their profession. I will fulfill my four-year service obligation at a health center in Saint Paul, Minnesota.

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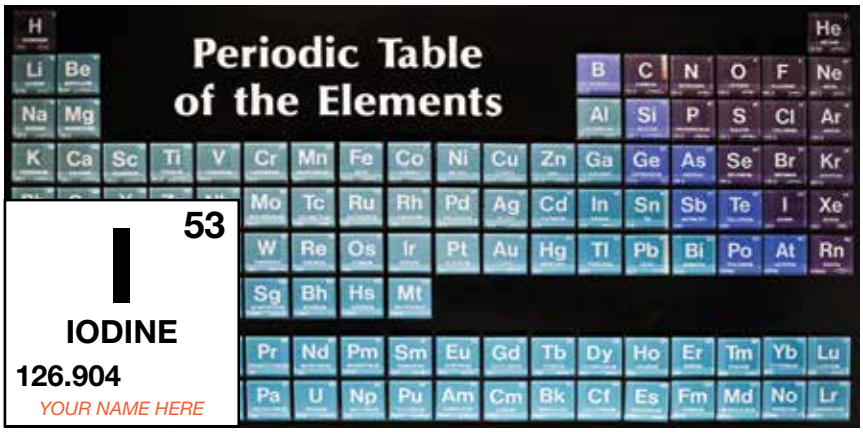

Elements of Success–2942

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 iodine. Iodine was discovered in 1811 by French chemist Bernard Courtois while extracting sodium and potassium from seaweed. It is the least reactive element of the halogens, but it's an important element for human health. Iodine was an early antimicrobial topical medication and is essential to the chemistry of our nervous system and thyroid gland. So cheers to this year's element of success: Iodine!

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

Other Giving Opportunities

All gifts to the Department of Chemistry are used to enhance the education of our students. We have a giving web page–mtu.edu/chemistry/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.

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.