UNIVERSITY OF MICHIGAN

CHEMISTRY NEWS

Fall 2024

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On the cover

Graduate student Sudipta Mondal and an observer leave the Lurie Nanofabrication Facility on U-M's North Campus to bring the thin film sample he created back to the Bol Lab in the Chemistry Building. In this issue, learn more about their work to create and evaluate ultrathin materials for electronics, electrocatalysis, and quantum technology.

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Welcome from the Chair

Dear University of Michigan Chemistry Community,

Welcome to the latest edition of the Department of Chemistry Newsletter!

As we embark on another exciting academic year, I am thrilled to share with you the remarkable achievements, ongoing projects, and signature events that define our department. This newsletter is a testament to the hard work, innovation, and dedication that characterize our faculty, students, and staff.

I want to take a moment to acknowledge Professor Emeritus Arthur Ashe for all the outstanding work he has done in helping to bring you our departmental newsletter for the last dozen years. He had a distinguished career studying the organometallic chemistry of the main group elements, and afterwards, gave generously of his time to maintain a connection with our community, particularly the alumni. He's now passing the torch and I want to say thank you on behalf of the entire department. I also want to thank Suzanne Tainter for the excellent work she does in collating content and arranging our newsletters.

Our department has been buzzing with activity over the year. From ground-breaking research that is pushing the boundaries of chemical science to inspiring student projects and community outreach initiatives, there is much to celebrate. We are eagerly anticipating the continued growth and success of our programs.

In this edition, you'll hear from our SciComm student fellows about the various paths one takes to graduate school and grasp the experience of participating in the Michigan Chemistry Opportunities for Research & Education (MCORE) program. The fellows are graduate students who are receiving mentoring in science communication from Jimmy Brancho (PhD 2017, Bartlett) and now a Lecturer IV at the Sweetland Writing Center at U-M. The SciComm program was idea of Professor Anne McNeil.

We present highlights of recent research from the labs of Professors Goodson, Wang, Ault and Lehnert. We profile Professor Ageeth Bol and her lab's work on the synthesis and integration of 2D materials.

We celebrate the promotions of Professors Jennifer Bridwell-Rabb, Wenjing Wang, and Alison Narayan.

Our faculty continue to excel in garnering major awards, including Wenjing Wang (NSF CAREER, 2024 Sloan Research Fellow); Kristin Koutmou (MBioFAR); Andrew Ault (Fulbright U.S. Scholar 2024); Kerri Pratt (Fulbright U.S. Scholar 2024); Melanie Sanford (2024 Janssen Prize for Creativity in Organic Synthesis); and Jennifer Bridwell-Rabb (ASC Bio&Med Chem Au Rising Star).

Please know that your contributions and engagement play a crucial role in making our department thrive. I encourage you share your achievements, to visit us whenever you have a chance, and to continue to support one another as we strive for excellence in all our endeavors.

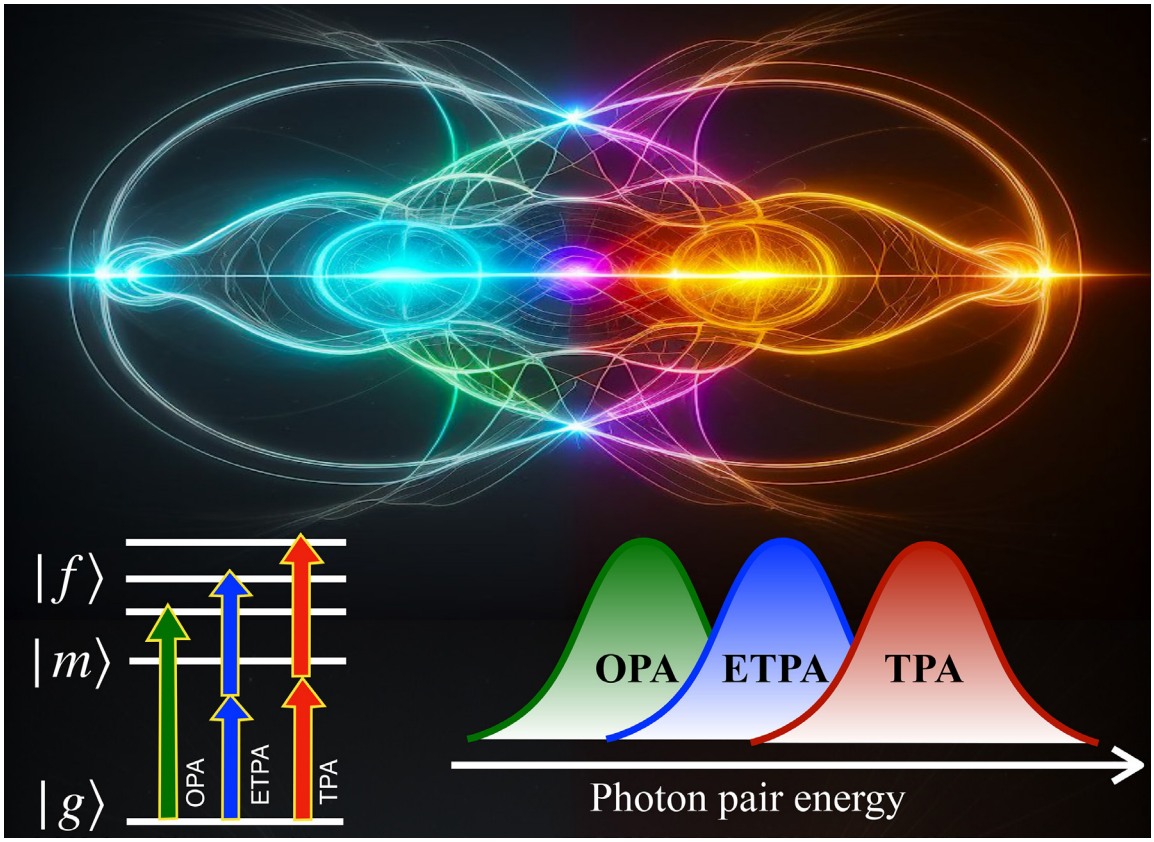
Thank you for being a part of our Chemistry community.
Here's to a productive and inspiring year ahead!

Go Blue!

Bart M. Bartlett

Chair, Department of Chemistry
Arthur F. Thurnau Professor
Professor of Chemistry

Many thanks to retiring editor of this newsletter, Professor Emeritus Arthur Ashe, III.



Schematic representation of the entangled two-photon absorption (ETPA) peak with respect to the absorption peak position for classical two-photon absorption (TPA) and for one-photon resonant absorption (OPA)

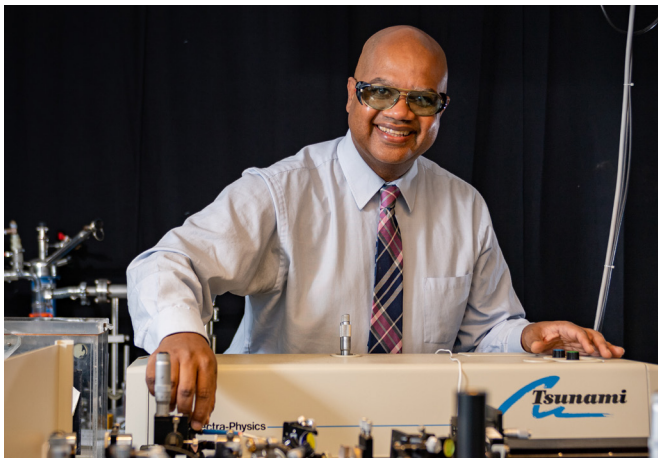
Quantum light unlocks nature's tiny secrets

By Juan Ochoa, U-M News

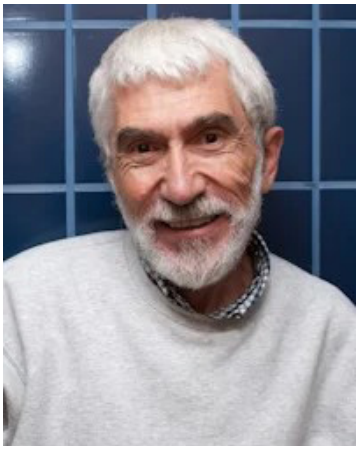
Researchers at the University of Michigan have found a way to examine tiny structures, such as bacteria and genes, with reduced damage compared to traditional light sources.

The new technique involves spectroscopy, which is the study of how matter absorbs and emits light and other forms of radiation, and it takes advantage of quantum mechanics to study the structure and dynamics of molecules in ways that are not possible using conventional light sources.

"This research examined a quantum light spectroscopy technique called entangled two-photon absorption that takes advantage of entanglement to reveal the structures of molecules and how ETPA acts at ultrafast speeds to determine properties that cannot be seen with classical spectroscopy," said study senior author Theodore Goodson, U-M professor of chemistry and of macromolecular science and engineering.



Theodore Goodson, III



Oleg Vanavski

Entangled two-photon absorption allows researchers to study molecules by using two photons that are interconnected through a quantum phenomenon known as entanglement.

Photons are the smallest possible particles of electromagnetic energy and, therefore, also the smallest particles of light, allowing details about the molecule's structure to be visible—which cannot be shown with regular light. Quantum light spectroscopy is very fast and can reveal properties that are usually hidden.

"Measurements with entangled photons may enable sensing biological signatures with high selectivity and at very low light levels to protect against photodamage," said lead author Oleg Varnavski, a research lab specialist in the U-M Department of Chemistry.

The research, published in the Proceedings of the National Academy of Sciences, used an organic molecule called zinc tetraphenyl porphyrin to study the phenomenon of two-photon absorption—where a molecule simultaneously absorbs two particles of light instead of one.

Researchers found that using pairs of photons that were quantumly entangled, the ZnTPP molecule exhibited absorption in the red spectrum. With two untangled photons, the ZnTPP molecules showed absorption in a blue spectrum.

A laser produced pairs of entangled photons through a process called spontaneous parametric down-conversion. These photons were then focused onto a cuvette containing the ZnTPP solution. The transmission was measured using a highly sensitive single-photon detector.

This work paves the way for the advancement of quantum light-based spectroscopy and microscopy, potentially leading to much higher efficiency of ETPA sensors and low-intensity detection schemes. The ability to access unique molecular states with entangled photons could improve the sensing of biological signatures with significant selectivity and sensitivity even at minimum light levels to prevent photodamage.

"This provides the opportunity to study states of molecules with nonclassical light that have fundamentally different properties than are accessible with classical light," Varnavski said.

Contributing authors include Sajal Kumar Giri, Tse-Min Chiang, Charles Zeman IV and George Schatz, all of Northwestern University. The research was supported by grants from the U.S. Air Force Office of Scientific Research, National Science Foundation and U.S. Department of Energy.

Study in PNAS: Colors of entangled two-photon absorption DOI:10.1073/pnas.2307719120

Chemical tool illuminates pathways used by dopamine, opioids, other neuronal signals

by Emily Kagey, LSI

University of Michigan researchers have developed a new tool to better understand how chemicals like dopamine and epinephrine interact with neurons.

These chemicals are among a wide variety of signals that get processed in the brain through G protein-coupled receptors (GPCRs), proteins that sit on the surface of neurons to receive messages—in the forms of proteins, sugars, fats, even light—that inform cellular behavior.

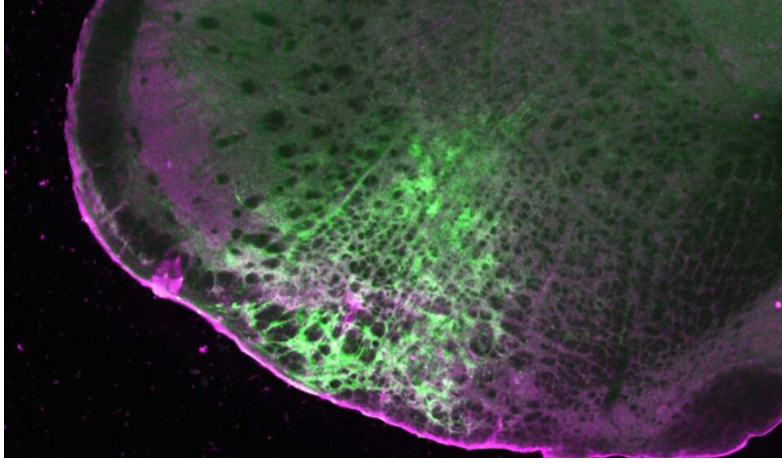
GPCRs are involved in an enormous number of biological functions, making them a prime target for treating diseases; more than one-third of FDA-approved drugs target GPCRs. But to fully understand how various molecules interact with GPCRs, researchers need to be able to detect those molecules across the whole brain with high spatial resolution. "The challenge in our field has been achieving the right balance between a detailed view and the whole picture across the brain," said Wenjing Wang, an assistant professor of chemistry and neuroscientist at the U-M Life Sciences Institute.

LSI faculty member Peng Li said most existing tools can detect a neural modulator either in a small part of the brain with high spatial resolution or in the whole brain with very low resolution.

"But we need to identify the cells that respond to the neuromodulators across various brain regions, in high resolution," he said.

In a study published in the Proceedings of the National Academy of Sciences, Wang, Li and colleagues unveiled a new chemical tool that achieves both goals for three chemicals that all target GPCRs.

Study: Single-chain fluorescent integrators for mapping G-protein-coupled receptor agonists (DOI: 10.1073/pnas.2307090121)



Mouse brainstem tissue shows morphine (green) and the expression of the SPOTIT sensor (magenta). Image credit: Noam Gannot and Peng Li, LSI

Wang's lab at LSI uses protein engineering to develop technologies that can detect how signaling molecules travel within the brain to reach and interact with specific neurons. They previously created a tool to reveal the presence of opioids, another GPCR binding partner, at a cellular level.

When the molecule is detected, the tool creates a permanent fluorescent mark in the cells. Thus, researchers can see the specific cells that are highlighted, as well as the whole picture of cells across the brain.

This latest work broadens the utility of that sensor to detect multiple types of GPCR activators, beyond just opioids. The team also expanded the tool to use both green and red fluorescence, enabling the tracking of multiple molecules at once.

"Coming from detecting just opioids, we now have a tool that we can begin to easily modulate for various signals that interact with GPCRs," said Wang. "The goal is eventually to even study the interplays of different signaling pathways simultaneously."

The team cautions that while the tool provides important visualizations of how signals travel across neurons for analysis postmortem, it cannot be used to track chemicals in real time, as it takes several hours for the fluorescence to appear. But it does offer a new path forward for improving understanding of neuronal signaling and the role of GPCRs as drug targets.

"Ideally, we aim to be able to create a brain map for multiple neuromodulators concurrently, offering a comprehensive understanding of the sites of neuromodulation," said Li.

Harmful Algal Blooms, Climate Change and Human Health

U-M Chemists are part of $6.5 center to study links between Great Lakes algal blooms and human health

By Jim Erickson, U-M News

Great Lakes researchers at the University of Michigan have been awarded a $6.5 million, five-year federal grant to host a center for the study of links between climate change, harmful algal blooms and human health.

Increased precipitation, more powerful storms, and warming Great Lakes waters all encourage the proliferation of harmful algal blooms composed of cyanobacteria.

Also known as blue-green algae, cyanobacteria can produce toxins harmful to humans, pets and wildlife. Though the pea-green summer blooms in western Lake Erie are the best-known in the region, cyanobacterial harmful algal blooms, or cHABs, now occur in all five Great Lakes.

"Toxic cyanobacterial harmful algal blooms are a growing threat to freshwater ecosystems, drinking water supplies and coastal communities worldwide, and the Great Lakes are ground zero for the climate-induced intensification of these blooms," said U-M environmental microbiologist Gregory Dick, who will serve as director of the Great Lakes Center for Fresh Waters and Human Health.

A key finding by U-M chemist Andrew Ault and other center-funded researchers is that cyanobacterial toxins can become airborne in tiny particles called aerosols when waves break against Great Lakes shorelines and piers.

But how much of a human health hazard do those aerosols pose?

To find out, two center-funded research projects, one led by Andrew Ault, associate professor of chemistry and the other by David Kennedy and Steven Haller at the University of Toledo, will assess the occurrence, transport and effects of aerosolized cyanobacterial toxins on human health.

Ault will team up with Allison Steiner of the U-M Department of Climate and Space Sciences and Engineering, Casey Godwin of the U-M School for Environment and Sustainability and Judy Westrick of Wayne State University to study toxin release from cyanobacterial cells—as well as the aerosolization and transport processes—to test the hypothesis that climate change will increase human exposure to cHAB toxins through ingestion and inhalation.

Kennedy and Haller's project will focus on human health effects, with special emphasis on populations that are vulnerable due to pre-existing conditions such as asthma. "Our region has long grappled with algal blooms, and communities are eager for answers regarding their impact on human health," said Kennedy, an associate professor of medicine at the University of Toledo and co-director of Great Lakes Center for Fresh Waters and Human Health.

A study led by David Sherman of the U-M Life Sciences Institute and the Department of Chemistry, in collaboration with Ashu Tripathi of the U-M Natural Products Discovery Core seeks to reveal the diversity, distribution and bioactivity of known and undiscovered cyanobacterial toxins and related compounds.

A longer article appears under News on our website.

Making it easier to "say NO"

By Suzanne Tainter, Michigan Chemistry

A team of U-M researchers has been awarded $2.1 million dollars by the National Institutes of Health to develop safer intravascular (IV) catheters. U-M chemists Nicolai Lehnert and Mark Meyerhoff, working with Michigan Medicine research scientist Alvaro Rojas-Pena, are developing the technology that will incorporate a nitric oxide (NO) generating system in the catheters.

Nitric oxide is naturally produced in our arteries and used by our bodies to suppress blood clotting and fight infections. The team aims to greatly reduce the number of fatalities related to blood clots and infection that occur with regular catheters. IV catheter infections alone take the lives of nearly 20,000 patients each year in the U.S.

The new catheter system is based on a low-cost method of producing very pure nitric oxide gas via an electrochemical reaction, called "E_NOgen." The method was pioneered by Meyerhoff and Lehnert in previous work. This approach uses a copper-containing compound as the catalyst to make NO gas from nitrite. Lehnert is an inorganic chemist whose lab group has done research on the copper complexes and is working to synthesize new, improved catalysts for greater NO generation.

"Electrochemical nitric oxide generation—E-NOgen—is simple, controllable, and inexpensive, and, importantly, can be miniaturized and incorporated in dual lumen catheters to provide them with nitric oxide-releasing properties," explains Lehnert, professor of chemistry and principal investigator on this grant.

Multiple Uses in Medicine

The E-NOgen approach could also be applied to other medical uses including inhaled nitric oxide therapy and coronary bypass operations. The ability to miniaturize the NO-generating system would also allow it to be incorporated into medical devices used in ambulances and in the field, as well as intensive care units.

Nicolai Lehnert, Professor of Chemistry

Inhaled nitric oxide (INO) therapy has become a mainstay of intensive care for lung failure patients. It is an essential treatment in neonatology, lung transplantation, pulmonary hypertension and most recently as an antiviral agent to fight COVID-19 infections. The E-NOgen system allows for the design of small, portable INO devices that could be used by medical personnel in the field, and that can be operated at much lower cost.

Another clinical use of nitric oxide is in cardiopulmonary bypass (CPB). There are 500,000 surgeries per year in US alone. A heart-lung machine makes heart surgery possible, but it can lead to inflammation and organ failure. Research has shown that adding nitric oxide in the use of the heart-lung machine could reduce these problems. Using the E-NOgen approach, nitric oxide could be produced much cheaper, on demand, in a small portable device, therefore enabling standard application of nitric oxide in CPB, the researchers explain.

Lehnert is excited by the research and gratified by its potential usefulness. "I am attracted to the project because of the intriguing combination of basic and applied science, and the prospect of improving the lives and safety of patients."

Faculty News

Melanie Sanford awarded the Janssen Prize for Creativity in Organic Synthesis

Professor Sanford is lauded as a highly creative scientist and a world leader in the fields of organic synthesis and catalysis. She has made outstanding contributions in developing novel methods for C-H functionalization and fluorination, in mechanistic studies of high valent organometallic complexes, and in designing organic electrolytes for redox flow batteries as modern energy storage systems. She is the first female winner in the Prize's 30+ year history. She was recognized and delivered a keynote lecture at the BOSS XVIII in Liège, Belgium in July.

The prize was established in 1986 by Janssen Pharmaceuticals, members of the academic chemistry community and the Belgian Organic Synthesis Symposium (BOSS) to bring attention to the positive impact of organic synthesis in drug discovery.

Melanie Sanford is the Moses Gomberg Distinguished University Professor of Chemistry, Arthur F Thurnau Professor and Professor of Chemistry

Profile of Robert W. Parry included in Science History Institute

Retired scientist Dennis Sauer, who completed his postdoctoral studies with Robert Parry at the University of Utah, sends this note:

"He takes his place in the Institute with many other very renowned scientists including Nobel Prize winners and persons that have made significant contributions to science. Certainly a well deserved honor for him and the University Chemistry Departments at Michigan and Utah.

Parry's academic career began when he joined the faculty at the University of Michigan Chemistry Department in 1946. His career at Michigan extended over some 23 years before he was recruited to the University of Utah in 1969. While at Michigan, he established himself at the forefront of boron hydride chemistry and was also recognized as an outstanding teacher contributing much of his career to chemical education and receiving recognition for his outstanding contributions in preparing study guides and books used for many years in the teaching of chemistry at the high school and university levels. He is recognized at Michigan by the establishment of the Robert W. Parry Award that is given to a graduate student who has shown excellence in the field of inorganic chemistry.

The link to Parry's bio in the Institute is:https://www.sciencehistory.org/education/scientific-biographies/robert-w-parry/.

Goodson Receives ACS Award

Theodore Goodson, III received the 2024 Senior Award in Experimental Physical Chemistry from the American Chemical Society. He was lauded "For seminal contributions to understanding ultra-fast processes & organic aggregates & metal clusters and application of quantum optics to studies of organic molecules."

Goodson is the Richard Barry Bernstein Collegiate Professor of Chemistry and Macromolecular Science and Engineering.

2024 National Brown Investigator Award for Kerri Pratt

Kerri Pratt was named to the 2024 class of Brown Investigators, the first class selected through the newly formed Brown Institute for Basic Sciences at Caltech. Pratt, a professor of chemistry and of earth and environmental sciences, will receive $2 million over five years to support her research.

Pratt studies the chemical interactions between atmospheric trace gases, particles, clouds and snow in the Arctic, which is warming faster than elsewhere on Earth. She focuses as well on wintertime environments, which are highly understudied and often experience poor air quality, she says.

Pratt will focus her project on the application of new state-of-the-art field-deployable mass spectrometers to discover and measure new chemical compounds in the atmosphere. With these instruments, they will conduct novel "lab-in-the-field" perturbation experiments to explain new chemical mechanisms in the troposphere.

"I am so excited for my research group to investigate the fundamental details of chemical reactions in the atmosphere," Pratt said. "We will use these experiments in the field to discern the details that tell us not just what, but also how and why."

By comparison, Pratt says, most field measurements and funding are focused on measuring the amount of a chemical compound over time.

The Brown Institute was established in 2023 through a $400-million gift from entrepreneur, philanthropist and Caltech alumnus Ross M. Brown. His goal is to encourage the researchers' creativity and enable them to pursue riskier innovative ideas that extend beyond their existing research efforts.

"I was shocked and honored to receive the news from Ross Brown himself," Pratt said.

Kerri Pratt

Professor of chemistry and professor of earth and environmental sciences

Brown Investigators are eight distinguished mid-career faculty working on fundamental challenges in the physical sciences, particularly those with potential long-term practical applications in chemistry and physics.

—Morgan Sherburne, U-M News

Chemistry Fraternity Recognizes Coppola

Professor of Chemistry Brian Coppola was awarded the 2024 John R Kuebler Award, the highest recognition conferred by Alpha Chi Sigma, presented biennially in recognition for outstanding service to the fraternity and accomplishment in chemistry. Brian notes that, during his award address, he had the opportunity to pose one of his favorite questions: "This question is particularly fun at the University of Michigan, home of Moses Gomberg and the discovery of free radicals. My question? Electrons were not discovered until 1897, so exactly what was the "free radical" that Gomberg wrote about in 1900, 16 years before Lewis proposes the 2-electron bond? Believe me: In 1900, Gomberg did not know about electrons or use dots!"

Kristin Koutmou

Dow Early Career Professor of Chemistry and associate professor of chemistry

MBioFAR Award for Kristin Koutmou

Kristin Koutmou is one of five accomplished scientists selected by the University of Michigan's Biosciences Initiative as a 2024 recipient of the Mid-career Biosciences Faculty Achievement Recognition Award.

MBioFAR is an annual accolade designed to promote innovative and high-risk research. It is bestowed upon mid-career faculty members as a testament to their exceptional contributions in the biosciences.

Koutmou's expertise in biochemistry centers on the intricate processes of protein synthesis in cells.

Her innovative research uncovers how RNA chemical modifications affect protein production, a crucial factor in both understanding and treating various diseases. This area of study is fundamental for advancements in mRNA-based therapies and vaccines.

Her lab's approach is multidisciplinary, blending mechanistic enzymology, biophysical chemistry and genome-wide techniques.

Koutmou's work is pivotal in decoding the "RNA epigenetic code," revealing the connections between mRNA modifications and diseases like cancer and diabetes, and potentially guiding new treatment methodologies.

The award provides $250,000 per year for two years as discretionary funds to advance her groundbreaking research endeavors.

Andrew Ault

Robert Kennedy

Two U-M Chemists Named to The Analytical Scientist Power List 2024

The Analytical Scientist features 60 scientists who are leaders and influencers in analytical science "whose work is transforming the world around us –for the better."

The journal explains: "From improving our health and wellbeing to clean water and clean energy, analytical science is playing a crucial—but often underappreciated—role. And that's why the The Analytical Scientist 2024 Power List is all about impact."

Associate Professor Andrew Ault was named a Planet Protector and Professor Robert Kennedy, a Health Hero.

Congratulations to our newly promoted faculty

Alison R.H. Narayan Promoted to Professor

Also to research professor, Life Sciences Institute

Alison Narayan has developed a highly visible research program that promises to provide new routes to chemical processes, taught core courses and mentored students with great success, and contributed to the university by leading programs and serving on significant committees at all levels.

She uses interactive and peer-to-peer approaches for teaching including adding a "think-pair-share" problem for each class. She also offers students chances to correct mistakes to relieve pressure and more opportunities to demonstrate mastery. Students are found to be well prepared for higher level chemistry.

Professor Narayan also mentors a large cadre of graduate students, postdoctoral trainees, and undergraduates in her research group.

Her research merges chemical biology and organic chemistry by studying and harnessing enzymes for organic synthesis. Enzymes are natural catalysts, however, the range of possible reactions catalyzed by a given enzyme is often not known and often enzymes must be engineered to catalyze reactions of interest. Realizing her vision to broadly use enzymes for synthesis will have broad impacts by enabling the generation of new medicines and reducing the environmental impact of industrial synthetic processes.

Jennifer Bridwell-Rabb Promoted to Associate Professor

Jennifer Bridwell-Rabb is a recognized expert in the field of metallobiochemistry. She uses many biochemical techniques to work with sensitive proteins that are very difficult to recombinantly express, purify, and study. Specifically, she works on Rieske-type Oxygenases, enzymes that are found in all forms of life, and are involved in both the degradation and the biosynthesis of organic compounds. She has discovered novel mechanisms of how these enzymes regulate their reactivity. This fundamental discovery has led to new methods to reprogram, evolve, or customize the chemical reactions catalyzed by Rieske oxygenases.

She regularly teaches Chem 351, biochemistry fundamentals, to more than 100 students per term. She developed a series of thematic games based on the TV-show Jeopardy to reinforce basic biochemistry knowledge.

She is praised for papers that "demonstrate a level of thoughtfulness and insights that go well beyond the descriptive narrative that characterizes many papers today." Her thoughtful approach to teaching is also recognized. "She is clearly taking the time to think about the teaching and learning and incorporating active learning strategies into her classroom."

These descriptions are abridged from materials for the May 16, 2024 Regents' meeting when the promotions were approved.
See: https://regents.umich.edu/files/meetings/05-24/

Wenjing Wang Promoted to Associate Professor

Also research associate professor, Life Sciences Institute

Wenjing Wang has established a renowned program in chemical biology and neuroscience.

Her lab develops optogenetic and chemogenetic technologies for neuromodulator detection and circuit manipulation in the brain. These tools enable monitoring and manipulating various brain functions, and advances neuroscience research and may lead to potential therapeutics.

She has won several prestigious awards, including the Rising Star in Measurement Science Award from ACS Measurement Science Au; the NIH Director's New Innovator Award; the Camille Dreyfus Teacher-Scholar Award; and the NSF CAREER Award that together provide nearly $3.5 M in direct funding

In the large-enrollment course required for many STEM majors, Chem 210, she notably uses real-life examples to illustrate the importance of organic chemistry concepts.

At the graduate level, she team-taught the introductory chemical biology course. Consistent with the Department of Chemistry's increased attention to incorporating a holistic model of professional development into the graduate curriculum, Professor Wang innovated in the ChemBio 502 course by encouraging critical thinking through literature-based discussions and by cultivating scientific writing skills.

She is recognized for her "great depth of scholarship and a tremendous commitment to broad applicability and robust methods, while simultaneously demonstrating herself to be a thoughtful and dedicated mentor and educator."

Tim Cernak Promoted to Associate Professor

Tim Cernak's main appointment is in the Department of Medicinal Chemistry, but he also has a courtesy appointment in the LSA Chemistry and has graduate students from our department. He is a nationally and internationally recognized scientist at the forefront of investigating how high-throughput experimentation and artificial intelligence can be used to change how chemists design and study reactions and synthesis.

Among his interests are having state-of-the-art medicinal chemistry tactics used to prevent the extinction of endangered species and applied in the emerging area of conservation medicine. A current project aims to develop better strategies to control the spread of hemlock woolly adelgid, a invasive sap-sucking bug, which he views as a disease of hemlock forests.

With colleagues from U-M and the Smithsonian Zoo, he has a "Meet the Moment" award from LSA to develop effective treatments for fungal infections in endangered species – specifically frogs and bats.

Professor Cernak is also engaged in outreach efforts in northern Michigan, as well as outreach activities for younger students.

MAKING NEW MATERIALS ONE THIN LAYER AT A TIME

Demand for ever smaller electronics that use less energy is pushing research into new ways to manufacture novel thin films on an industrial scale. Ageeth Bol's lab is up to the challenge.

Ageeth Bol returned to her chemistry roots when she joined the University of Michigan Department of Chemistry as a professor of chemistry in January, 2022. She is also a professor of materials engineering and applied physics.

"In our group we pioneer atomic layer deposition (ALD) to synthesize two-dimensional nanomaterials. ALD is a scalable, low temperature preparation method for thin films which offers precise thickness control," explains Ageeth Bol, professor of chemistry and materials engineering.

"We've known that materials have very different properties at atomic levels compared with the bulk material."

Graphene, for example, behaves differently from graphite yet both are arrangements of carbon atoms. Graphene is a superior conductor of electricity because its single-layer structure allows electrons to move freely. Graphite being many layers of graphene has weak bonds between the layers and is a less good as an electrical conductor.

A challenge is how to manufacture the single layer materials that have useful properties.

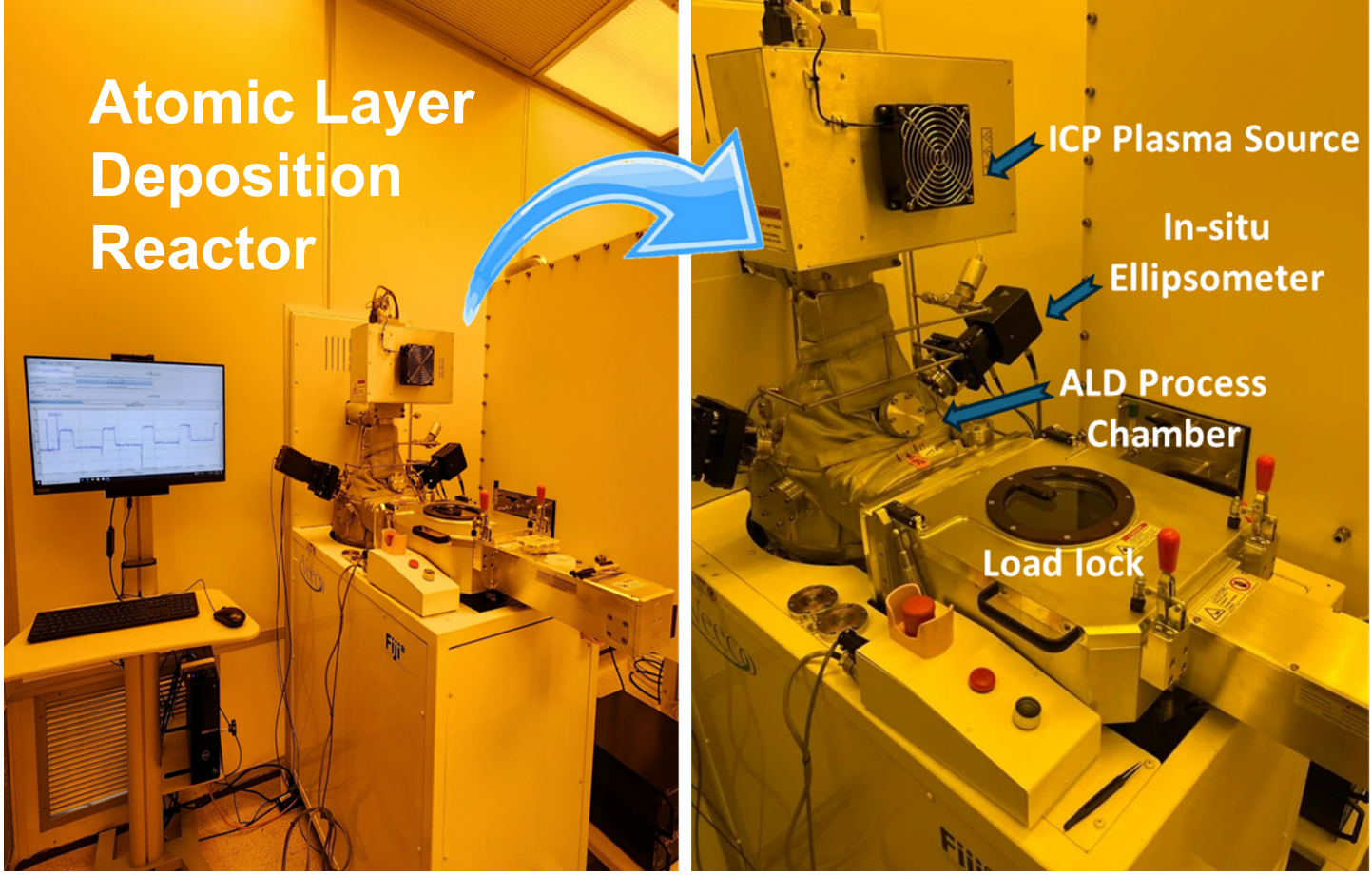
In 2004, physicists Andre Geim and Kostya Novoselov discovered graphene by sticking a piece of scotch tape on a block of graphite and then analyzing the material stuck to the tape.

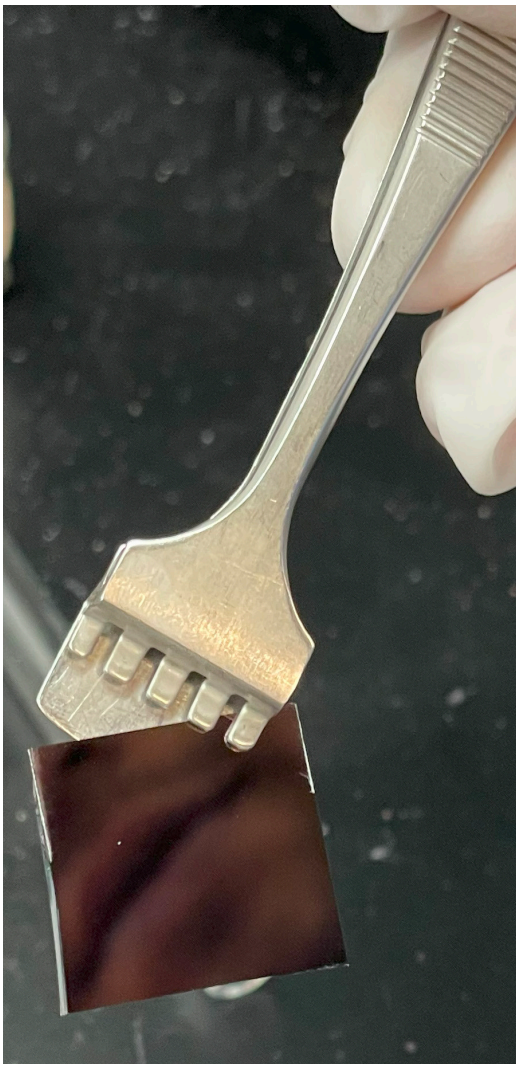
Since the discovery of graphene many other 2D materials have been discovered using the scotch tape method or exfoliation—where a monolayer is peeled off a block of material.

While scientists have learned quite a bit from this sampling technique, it is not scalable for manufacturing the sort of wafers needed for electronic devices, sensors, or quantum computing.

Device makers are looking to make ever tinier devices. Yet there is a limit to how much this can be accomplished on the most commonly-used material—silicon. Bol's group is looking for materials that will function in a single layer to replace silicon in devices.

"Our focus is on ALD of 2D transition metal dichalcogenides (2D-TMDs)," she explains. These are a particularly important group of 2D materials since many of them, including the molybdenum disulfide (MoS_2) and tungsten disulfide (WS_2), are semiconductors, unlike graphene which is a semimetal.





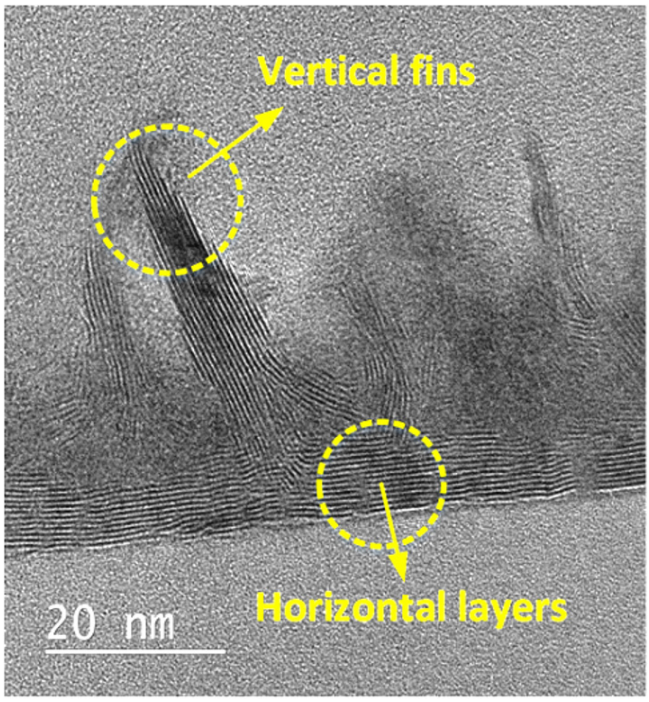
ALD reactor in the Lurie Nanofabrication Facility. The ALD deposition technique uses self-limiting surface reactions to grow single-atom-thick layers on large wafers.

How to make a thin film

- Step 1: Pump into the reaction chamber of the Atomic Layer Deposition reactor a precursor molecule such as $C_{12}H_{30}MoN_4$ in gas form. The precursor reacts with the substrate surface until all the active sites are used and then stops.
- Purge the unused precursor and byproducts with an inert gas.
- Step 2: Pump the co-reagent, such as hydrogen sulfide gas, into the chamber causing reaction reaction between the hydrogen sulfide and the organometallic species that are absorbed on the surface, forming the desired transition metal dichalcogenide.
- Purge
- Repeat until desired thickness of film is achieved.

Reactions in each step take only seconds.The resulting film is very uniform, smooth, and contaminant-free.

“By tuning parameters such as reaction temperature, gas mixture and chamber pressure we obtain good control over the material’s stoichiometry and uniformity,” explains Bol.



High-Resolution Transmission Electron Micrograph showing the atomic structure of a thin film

Different Morphology for Different Applications

Films with grains aligned in horizontal layers offer a broad range of electronic properties desirable for (opto)electronics and quantum computing

Vertically aligned layers offer large surface area and active edge sites useful for electrocatalysis and sensors.

The Bol group can "tune" their process for the desired morphology.

For example, for nanoelectronics, out-of-plane growth layers (fins) are defects, reducing their desirable properties. Insights from the HRTEM studies led the Bol group to ways to suppress fin development.

Bol's work spans the U-M campus from the Lurie Nanofabrication Facility and the Michigan Center for Materials Characterization on North Campus to a shiny new specially equipped lab in the Chemistry Building.

"For synthesis of transition metal chalcogenide materials, we primarily use our ALD tool, which is hosted at the Lurie Nanofabrication Facility," Bol says. The tool is placed in the clean room at the LNF because the facility is equipped to handle the toxic gases (H_2S and H_2Se) the Bol group uses. Also dust is detrimental to the devices made from the films.

This tool is capable of plasma-enhanced ALD (PE-ALD) as well as thermal ALD. Use of plasma-assisted ALD processes allows the researchers to use lower temperatures than would be required for thermal ALD and to have greater control over the microstructure of the film than thermal ALD would allow.

"Also the PE-ALD is equipped with an ellipsometer, a device that provides us with the ability to track the changes in thickness of the deposited films in real time," she adds.

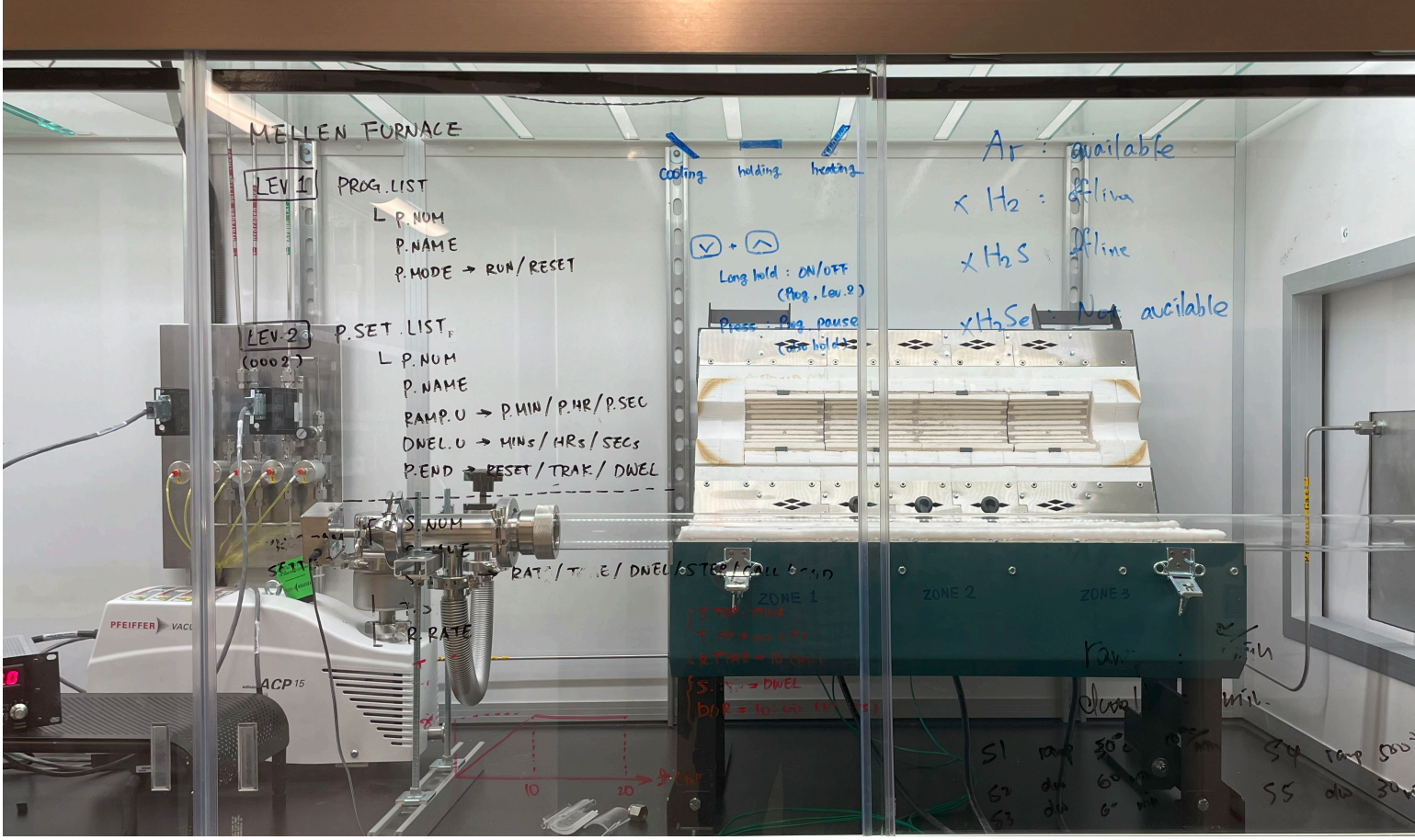
Soon, a built-in mass spectrometer will let the researchers monitor the reaction products in real time to understand the process. "Then we will be able to watch the chemistry as it happens," Bol says.

The Bol group is working to optimize the creation of desired films.

The process can be manipulated by temperature, varying the chemicals, creating alloys, doping, and other techniques to obtain desired morphologies and features for electronics, electrocatalysis, and quantum technology.

Once the films are created, the researchers evaluate the properties of the films using a wide range of spectroscopy and microcopy. "Some of our materials characterization we do at the Michigan Center of Materials Characterization on North Campus."

The films can be further processed to improve various properties, for example, heat treatments to crystallize the molecules and control functionalities. "We typically do this in our Central Campus lab," Bol says.



Bol Lab in the Chemistry Building

"Our Department of Chemistry lab consists of equipment to perform measurements of electric and catalytic behavior," Bol explains.

The tube furnaces can be used for further processing of the materials such as annealing experiments to crystallize the thin films and for chemical vapor deposition. "Each student has their own tube."

The Bol group uses very toxic gases so the lab is equipped with special safety equipment. The toxic gas cylinders are in gas cabinets. The lines are monitored constantly. If a sensors detects a leak, the gas flow can be shut off automatically.

The lines are coaxial—a tube within a tube—so if the inner line breaks, the outer line will contain the gas. The line that carries the extremely toxic hydrogen selenide is extra thick.

The Lurie Nanofabrication Facility, having experience with use of toxic gases, helped specify the precise safety equipment needed and built the gas facilities for her lab, she says.

Follow along as a Michigan Chemistry grad student creates 2D materials

Double gloves, mask, goggles, coveralls, and hood—Sudipta is ready to enter the clean room.

He uses the computer interface to control the ALD reactor, specifying the "recipe" and parameters he is interested in manipulating.

We begin at the North Campus Lurie Nanofabrication Facility

First the shoe covers, then a hair net, one set of gloves, a mask, a hood, coveralls, booties that snap on to the coveralls, hard-soled booties over those, some goggles, a second pair of gloves, a strap-on pocket—finally Sudipta Mondal is ready to enter the clean room at the Lurie Nanofabrication Facility on the U-M North Campus.

This is where the group tinkers with various "recipes" to create the thin films that could be the future of electronics, sensors, and quantum computing.

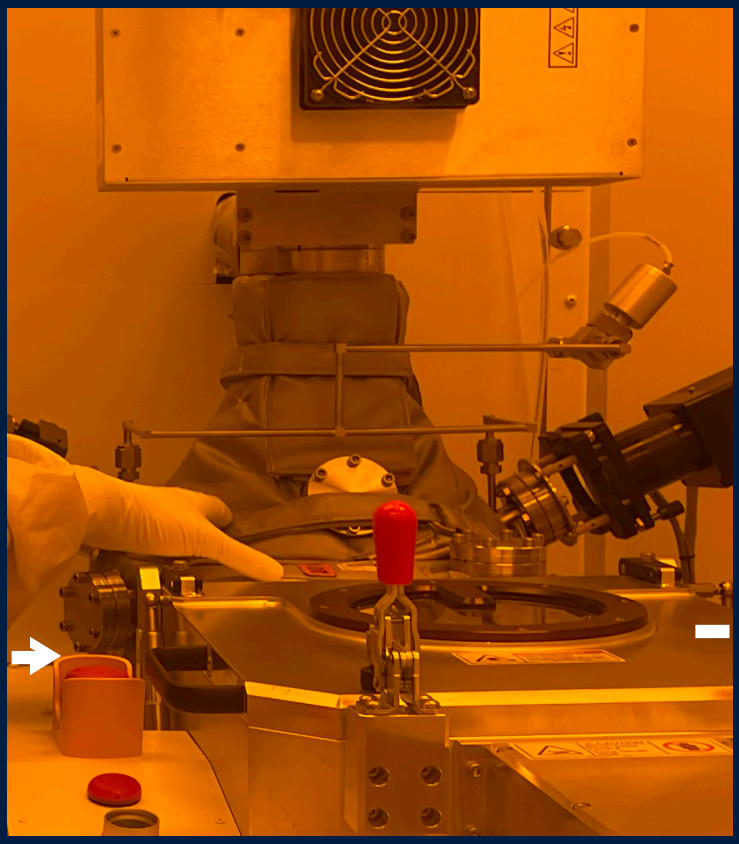
A third-year graduate student in Ageeth Bol's group, he is making 2D transitional chalcogenide metal films.

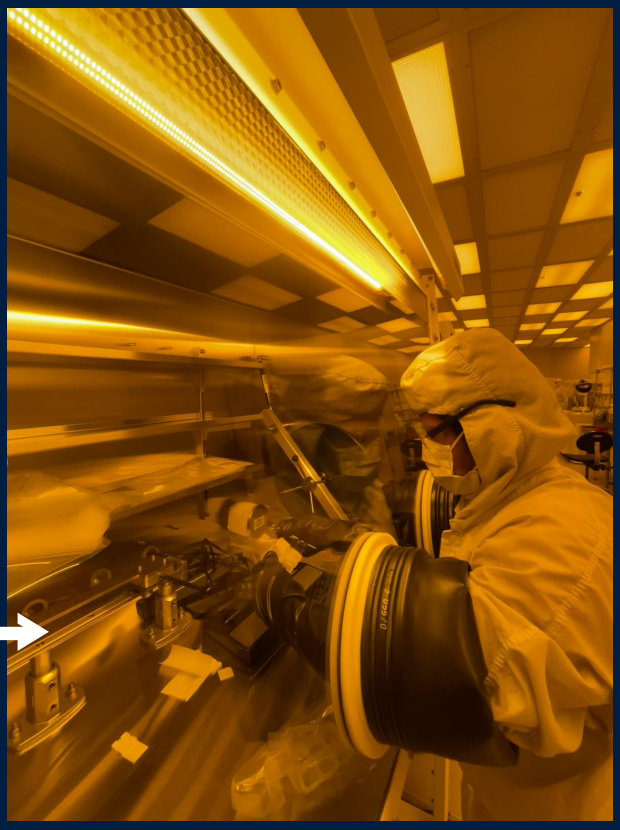
From the computer, he controls the ALD reactor to specify the reactant gases, the temperature, the dose times, the number of repeating cycles, and other parameters for depositing the thin films.

There is a built-in ellipsometer to watch the film growth as it happens and a connected glove box.

Once his sample is created, he may do further processing and will use various techniques for characterization of the material.

If the film is air-sensitive, it can be moved into the glove box and a then into a vacuum-sealed container for transport to the Bol Lab on Central Campus or other facilities on North Campus.





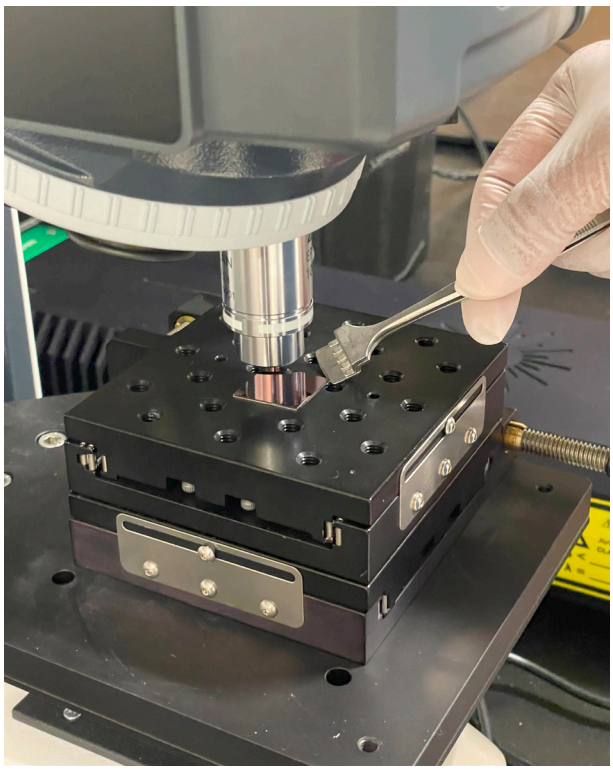
Close-up of the ALD reactor. The device includes an ellipsometer and a plasma source. Air-sensitive samples can be moved directly into a glove box connected to the load lock of the ALD reactor.

He loads his samples into his “tackle box” and leaves the clean room. He stops to remove all the coverings, and then hops on a campus Blue Bus to Central Campus and the Bol Lab in the Chemistry Building.

In the Bol Lab in the Chemistry building, Sudipta may use a furnace to crystallize or post-process the material in different gaseous environments.

He will analyze it using Raman spectroscopy and various other options for evaluating the material.

Sudipta completed his BS and MS degrees in Chemistry at the Indian Institute of Science Education and Research, Kolkata in 2022. He says he got interested in materials as an undergraduate for solar cells in particular. He now works on ALD synthesis of oxides, sulfides, and selenides of indium for electronic device applications.



CENTER FOR MATERIALS INNOVATION
UNIVERSITY OF MICHIGAN

Cross Campus Collaboration for Materials Innovation

Chemistry profs Ageeth Bol, Stephen Maldonado, and Paul Zimmerman are part a NSF- funded Materials Research Science and Engineering Center at U-M

The Center for Materials Innovation at Michigan is a campus-wide ecosystem to accelerate the design, discovery, and use of novel materials to address critical needs of the future, including advanced manufacturing, clean energy, sustainability, artificial intelligence, and semiconductors.

The $18 million center, funded by the National Science Foundation for five years, is headed by Rachel Goldman, professor of materials engineering and applied physics.

Focusing on the integration of research and education, the center also aims to broaden participation in materials research through year-round opportunities for students and teachers.

The center includes U-M researchers and collaborators from industry, academia, and national laboratories. Interdisciplinary research groups combine computational, statistical, theoretical, and experimental approaches.

The center's two main thrusts are: 1) novel semiconductor materials for advanced quantum information and 2) reconfigurable polymers that are environmentally sustainable.

Novel 2D Materials

Next generation nanoelectronics, optoelectronics, quantum information technology, and energy efficient computation require fundamental discoveries of new materials. Also needed are new ways to employ those discoveries for large scale synthesis, materials processing, and device fabrication procedures.

Ageeth Bol's atomic layer deposition films have the potential to be key materials in these technologies.

Stephen Maldonado's research has long focused on novel materials for photovoltaic cells for renewable energy applications.

Professor Bol and Maldonado are a part of the team developing contacts involving layers of stacked 2D materials. The work requires a multidisciplinary approach that brings together scientists with expertise in chemistry, physics, materials, and computation.

Recyclable plastics

Organic polymeric materials are presently used extensively in construction, automobiles, textiles, and medical applications, and an expected growing demand for the foreseeable future. A majority of discarded plastics are presently burned, stored in landfills, or pollute waterways and the air.

A second group of researchers, including theoretical chemist Paul Zimmerman, is concentrating on the next generation of polymers that could be self-healing, reconfigurable, and fully recycled.

A potent strategy to increase the ability of plastics to be recycled is to incorporate molecules that form reversible covalent bonds between chains that can break and reform in response to temperature or light. Such covalent adaptable network (CAN) polymers have tremendous potential for materials design and discovery, resulting in fully recyclable plastics with tailored and optimal physical, thermal, and chemical properties.

The researchers are investigating these materials using simulations and data-driven design of the CAN systems, looking for the most promising designs.

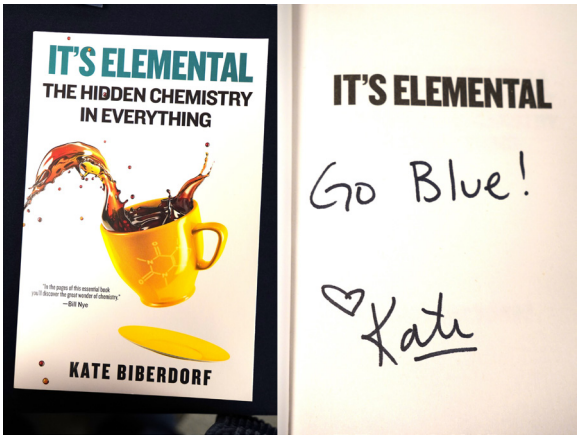
Happenings

Summer Undergraduate Research Program awardees with Professor John Wolfe (far right)

Undergraduate Accomplishments Rewarded

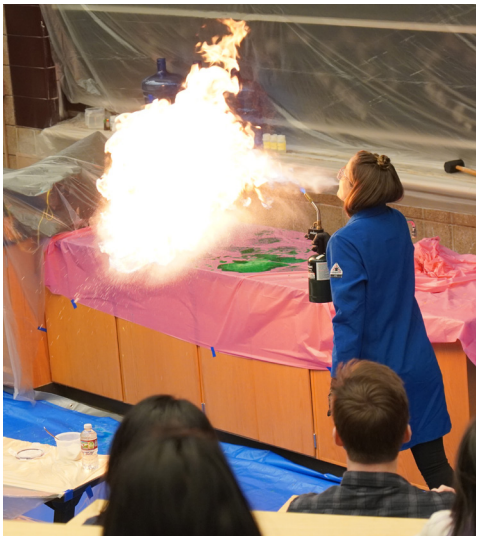
The Department of Chemistry celebrated the accomplishments of 71 students at the annual awards lunch this spring, including 29 students selected for Summer Undergraduate Research Program. Professor John Wolfe, associate chair for undergraduate studies, calls the presentation of the awards one of his favorite duties. Alum Blane Zavesky joined us virtually to share his journey after U-M Chemistry as a grad student at the University of North Carolina and now as a research scientist at Corteva Agriscience.

Traditionally, our first year student awardees receive a book. This year's was special—"It's Elemental: The Hidden Chemistry in Everything," by Kate Biderdorf aka "Kate, the Chemist" a U-M chem alum, who also autographed the copies.



Igniting excitement for science

Alumna Kate Biberdorf (BS, 2008) aka "Kate, the Chemist" inspired U-M undergraduates at an event sponsored by LSA. *Right*: Kate points to the place she always sat in 1800 Chem near the top row. She recommended that current students sit a bit closer to the front of the auditorium. *Far right*: Her signature fire breathing demo. She is now the first "Professor for the Public Understanding of Science" at Notre Dame. You can see more of her educational entertainment at katethechemist.com.



Alum and speaker Kerry Engle (center front row) with faculty in full academic regalia for the celebration at the Michigan Theatre

Celebrating our 2024 graduates

In May, the Department of Chemistry celebrated our graduating students with commencement ceremony at the Michigan Theater. We recognized 185 bachelors students, 4 master's degree students, and 38 doctoral students for reaching this milestone.

The commencement speaker was Keary Engle, Scripps Research Institute chemistry professor. Engle earned his BS in Chemistry in 2007 with additional majors in economics, math, and statistics. As an undergraduate, he gained research experience in Adam Matzger's lab, where he worked to characterize self-assembled physiorbed monolayers using scanning tunneling microscopy.

The student speaker was Meredith Holm, who earned a BS in Biochemistry with major honors. She was also the recipient of the Walter Yates Award, which is presented to a senior to recognize excellence and scholarly achievement.

View Okiye's speech on the Michigan Chemistry YouTube Channel linked from our website. Or see the entire event, including the hooding of our PhD graduates, on the U-M YouTube channel https://www.youtube.com/watch?v=I6f2hx1aC8M

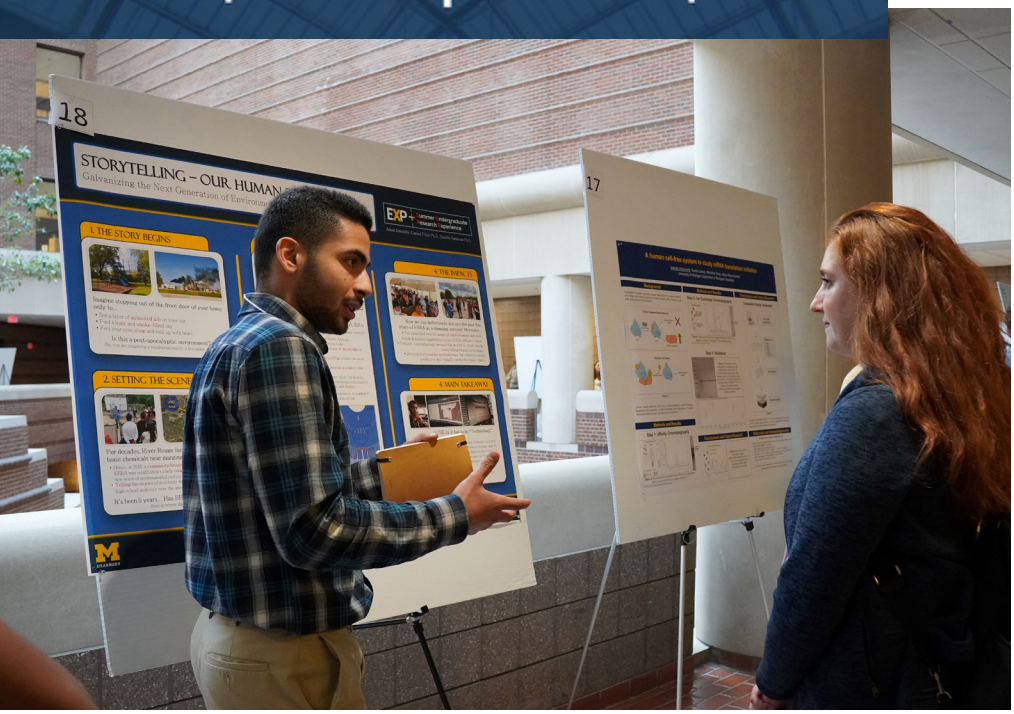
Okiye Inspires in Rackham Address

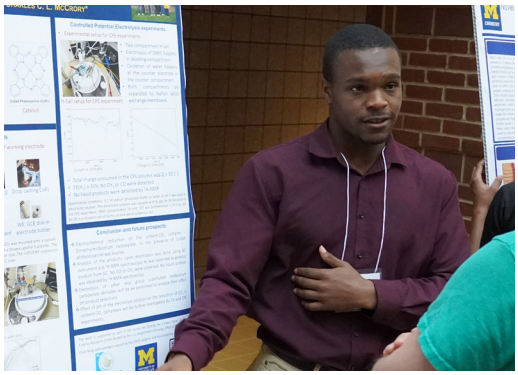
Chemical Biology doctoral student Maribel E. K. Okiye (PhD 2024, Sherman) was selected as speaker for the 2024 Rackham Graduate exercises on May 3.

She inspired the audience with her reflections on her experiences over recent years, including a pandemic, and charged them to reinstate compassion as a guiding principle.

"In a world that seems increasingly complex, finding our footing amidst the cacophony has become a daunting task... [T]here's a profound truth that stands out: it's not merely what we've learned or achieved that defines us, but how we've engaged and uplifted those around us... While the facts we learn and the achievements we accumulate are significant, the legacy we leave behind is ultimately crafted by the feelings we evoke in others. How we make people feel — through our words, actions, and gestures of kindness — becomes our indelible mark on the world, our most enduring legacy."

Alum|NUM | URAN|UM





Chidi Nnaji, D-RISE student in the McCrory Lab, with his poster at URAN

Left: U-M Dearborn student Adam Almaleky explained to Rachel Kirpes (PhD 2019, Pratt) the research he did to evaluate a program aimed at informing Dearborn students about environmental issues in their own backyards.

In late July, Michigan Chemistry held its annual alumni networking event, Alum|NUM, which brought alumni back to campus to meet and mentor our current graduate students and trainees. Held in conjunction with that event is a program for undergraduates, URAN|UM, that includes a poster session with our summer undergraduate researchers, REU students, as well as students from other universities in the area, and our D-RISE high school students.

That was followed the next day by the Karle Symposium, a day-long series of research presentations from our graduate students. Both events are organized by our graduate students. Sponsors are Corteva, Dow, DuPont, PPG, and the Department of Chemistry.

Follow these links for 2025 summer events:
sites.lsa.umich.edu/alum-num/
sites.lsa.umich.edu/karle-symposium

Karle
19 K 20
24 S 16
Symposium

The 2024 Karle organizing committee.

2023-2024 First Years Fun

The Chemistry Graduate Student Council organized our first ever pickle ball event for our first year graduate students.

“Kicking off” the new academic year

Our Fall 2024 Department of Chemistry Picnic featured great food, weather, conversation, and competition! A team of elite 2024-25 first year graduate students won our second annual kickball tournament.

Nurturing the Next Generation of Scientists

Brandee Dallas got these youngsters interested in her research in the Kennedy Lab on optimizing stability of neurochemicals in microdialysis samples.

D-RISE SUMMER SCIENCE

For another successful summer, the Department of Chemistry collaborated with Detroit high schools to give students a taste of the college research experience. Six students spent seven weeks living in Ann Arbor and working full time alongside graduate students in research labs. The D-RISE participants also got training in science communication through a program with the U-M Museum of Natural History. They showed off their ability to explain their research to summer visitors at a "Science Spotlight." Each student also presented a science poster at the URAN event.

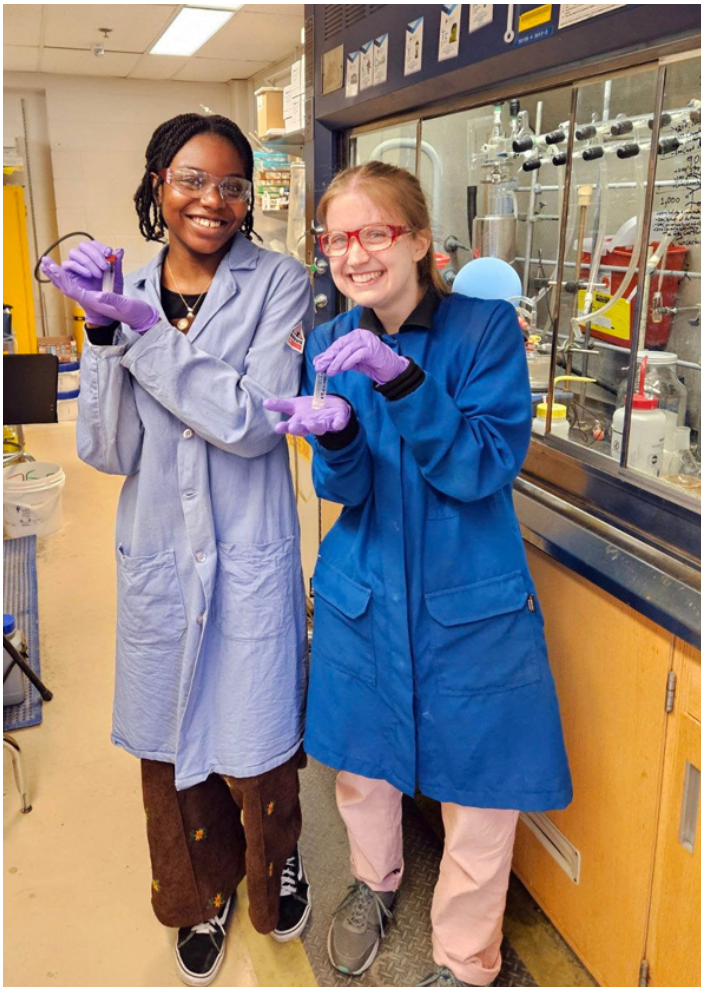
Unaisa Islam (front) worked closely with graduate student Shae Hagler in the Bartlett Lab on synthesizing new materials for battery cathodes.

MMSS & GISE

Other high school students had hands-on experiences with chemistry as part of the **Michigan Math and Science Scholars** (MMSS) program. MMSS offerings included "Catalysis, Solar Energy and Green Chemical Synthesis" "Surface Chemistry" and "Sustainable Polymers."

Chemistry sections of the **Girls and Science Engineering (GISE)** camp sponsored by the Women in Science and Engineering program offered 7th and 8th grade girls some hands-on science.

An MMSS participant tests the tensile strength of the polymer she made in the "Sustainable Polymers" course offered by Prof. Anne McNeil



REU student Esther Oko (left) with grad student Natasha Perry of the Nagorny group

REU 2024

The department hosted 17 students during the 2024 offering of its NSF-funded REU (Research Experiences for Undergraduates) Site. Drawn from around the US and recruited mainly from schools without graduate education programs, the students participate in a 10-week, full-time research experience a department research groups.

The 2024 cohort and their host groups: Samuel Roter, Muhlenberg *(Chen)*; Philip Mancino, Cornell (*Geva*); Esther Oko, Muhlenberg (*Nagorny*); Ella Chu, Bowdoin (*Wolfe*); Aiden Cosgrove, Haverford *(Montgomery)*; Matias Moreno, Penn State *(Bartlett)*; Olivia Lyon, Dickenson (*Bartlett*); Mireya Haran, Seattle *(Sanford)*; Nina Aagaard, Amherst *(Sanford)*; Andrew Robles, Williams *(Soellner)*; Lizzet Solache Salgado, Carleton *(Mapp)*; Sophia Lemieux, Brandeis *(Lehnert)*; Samuel Chackerian, Carleton *(Matzger)*; Rachel Lee, Cooper Union *(Maldonado)*; Fatima Danazumi, Amherst *(Marsh)*; Stephanie Reyes Vargas, UPR-Rio Piedras *(Sherman)*; Amanda Browne, Hamilton *(McCrory)*.

Brian Coppola, the PI on the REU grant since 1989, notes "the faculty perspective has not changed over these 30+ years of hosting the REU. Our colleagues know that an undergraduate experience research can have a transformative effect. Nearly everyone sees the REU as a way to help pay forward the chance that someone gave them when they were young."

MCORE Preview Weekend

Demystifying Graduate School by Making Connections

By Vaidehi Shastri, SciComm Fellow

Founded more than a decade ago, the Michigan Chemistry Opportunities for Research and Education (MCORE) preview weekend now serves more students than ever. It has grown but never lost its focus on broadening the recruitment of graduate students from underrepresented backgrounds by connecting students with the chemistry community.

Every fall, approximately 15-20 prospective graduate students are accepted to preview the Michigan Chemistry Department. During the two-day, no-cost visit, applicants stay on campus and have opportunities to speak with current graduate students and faculty about daily life in the program, research opportunities, and tips for applying to graduate schools.

These students are hosted by current grad students who are often MCORE alumni themselves, a testament to the program's longevity. The program is championed by a group of faculty, staff, and graduate students that are united by their desire to demystify graduate school in chemistry and support future generations of students.

For some students, the MCORE program is their first real insight into chemistry PhD programs. First-generation students, immigrants, and students from regional universities or primarily undergraduate institutions often have little exposure to the types of research-intensive chemistry programs common at larger universities such as the University of Michigan.

Opening Eyes to Research

Guillermo Rodrigo Vazquez then a junior at Northern Arizona University and participated in MCORE in November 2023. Due to a lack of chemistry research labs at his school, he participated in a summer of research through an NSF-REU program where he learned the "basics" of grad school. He was then encouraged to apply to the MCORE preview weekend by a trusted professor, and the experience cemented his desire to apply to graduate school in chemistry next year. Reflecting on how he and many of his peers are only exposed to professional graduate programs like medical school, Vazquez remarked "…not a lot of people know about [graduate school in] chemistry, so that's something we need to do more for undergrads."

One faculty member that helped establish the program is Professor Nils Walter. His recruiting efforts for the department have been guided by the idea that "the breadth of ideas is what drives modern science. As a consequence, we all have realized over time how important a diverse set of views is… to bring about the best science we can do."

Originally started with just a few students and their mentors from local partner schools, MCORE has grown steadily over the years. Now, an average of 15-20 undergraduate students from across the country participate in the annual weekend-long visit with Michigan Chemistry. This unique form of engagement that emphasizes community-building between current and prospective graduate students and faculty has resulted in an increase enrollment of graduate students from underrepresented groups--from less than 5 percent to about 20 percent , according to Walter.

Current graduate student and former MCORE participant Madeline Clough says her first-hand experience with the lack of opportunities to learn about PhD programs is one of the main driving forces behind her continued involvement as a student host for the program. "MCORE was the first eye-opening experience of what graduate school looks like. Thinking about students who maybe don't have that resource, like me… It's nice to show other people what graduate school actually looks like."

Walter notes that this "feedback loop" of positive experiences and fellowship amongst students that have participated in the program "has really improved the way we can think about diversity and inclusion across all groups."

Another highlight for many prospective students is feeling welcomed by members of the U-M chemistry department. Though graduate student hosts serve as primary points of contact, prospective students also attend dinners and social events with other graduate students and faculty members during the preview weekend, including a tour of the "Big House."

Making Connections

Many come away from the experience with an expanded chemistry network consisting of faculty members, current graduate students, and even fellow visiting students; many of the students from the most recent MCORE cohort stayed in touch and kept each other updated throughout their graduate school application journeys.

MCORE participant Amir Johnson-Sammy, now a senior at Ohio State University, explains, "I felt like I had a lot of time to connect with all the other people that were visiting, and it just felt more intimate, and I liked that. We each got to meet pretty much one on one, if not two on one with the professors that we wanted to meet with. So that was pretty cool."

Though graduate enrollment in science and engineering is slowly increasing for women and racial and ethnic minorities, many students are still searching for more meaningful engagement with those with similar experiences to them in the chemistry community.

MCORE's focus on broadening graduate student recruitment makes a meaningful difference to students when they get to campus and spend the weekend with people from a diverse range of backgrounds.

MCORE participant Daniel Godoy, a senior at Lawrence University and first-generation college student, says this representation is why he recommends the program to other historically underrepresented groups in chemistry. "I got to meet other Hispanics in chemistry, [who] are not very common in my institution here. So, I would really recommend it for everyone, but specifically people with those identities because seeing them in person and seeing that we're all in that group trying to learn about grad school was really nice."

Editor's note: Year and institution attributions for students in this article date from spring 2024.

No one path to grad school for our students

By Colin Tichvon, SciComm Fellow

In 2022, only 18,000 out of over 2 million college graduates earned their degree in chemistry or biochemistry. Of that small number, 14 percent have gone on to pursue a graduate degree in the same field according to the Pew Research Center. The decision to attend graduate school is a difficult one, but each member of this cohort made the same rare choice. What led them to take this leap?

Were they prepared for the challenges they would face? What have they learned through their experiences so far? To answer these questions, we sat down with four students in the chemistry department at the University of Michigan to learn more about their paths to graduate school. We found a great diversity of timelines, motivations, and stories, but plenty in common as well.

For most, graduate school starts the same year they earn their bachelor's degree. This was the case for **Michela Maiola**, a fourth-year student in the Buss group who started at Michigan following her graduation from the University of Rochester. "I think my undergrad prepared me for sure," she said. "The balance of research, teaching, and school started very early…Nothing was a surprise to me." As an undergraduate, she performed research in the lab of Professor Ellen Matson while also taking classes and serving as a TA for a lab course.

Despite having experienced the expectations and schedule of a graduate student, she still felt lost while applying for the NSF Graduate Research Fellowship Program her senior year as an undergraduate, finding it difficult to write about new science. However, she viewed it as another challenge to be met and had

the support of her mentors to achieve what she had envisioned for herself.

Less Traditional Paths

For students who take a less traditional path to graduate school, the journey is still filled with valuable experiences and unexpected difficulties. **Lindsay Heagle**, a second-year in the Bailey Lab, took a gap year after not being admitted to graduate school when she initially applied.

"I was crushed that I didn't get in, but it was my professors telling me 'I can't believe you didn't get in, I have faith in you' that really did encourage me to apply again later."

In the meantime, she worked as a quality control analyst for Millipore-Sigma testing specialized compounds. It gave her the opportunity to continue practicing her skills as a chemist while giving her a glimpse into the industrial work environment. Ultimately, it reaffirmed her commitment to reapply to PhD programs.

"In general, I was happy to take kind of a step away from academics for a year and just know whether or not I actually wanted to pursue grad school."

It also helped her to examine her own motivations for wanting to continue doing research. "It's just a completely different environment, the expectations are different in both places, your ultimate goals are a lot different…At the end of the day in academics, here we can fail a million times and we're learning something each step."

Developing a growth mentality

Kyle Chong, a first-year student in 2023-24, said that the teachers he had in high school had inspired him to pursue chemistry. He chased this passion at the University of Illinois Urbana-Champaign but had to be adaptable when the COVID-19 pandemic began in 2020.

"Getting into a lab for research was very difficult," he said, especially as an undergraduate. Once he joined Professor David Sarlah's group, he was able to participate in research and build his skills with his mentor. "I felt behind—I focused a lot of time into trying to catch up to what I thought was being at par with everyone."

His mentor provided him with named reactions to learn mechanisms and prepare him for what graduate school had in store. Throughout this, Chong says he gained a lot of perspective about how to use his time effectively and to focus on his own growth. "I'd rather honestly be the worst in the room because at that point I have so much I can learn from everybody else…That's the mentality I try to keep."

Jarrod Stanley, a third-year student in the Montgomery lab, felt that his experience serving in the United States Navy was formative and prepared him to pursue his own goals. He says he didn't know if he would have been as successful if he had started college immediately after high school. "The Navy gave me the opportunity to fail safely and fail forward… It gave me a little more confidence and being able to recognize self-doubt more readily."

After leaving the military, he attended the University of North Carolina at Greensboro and began to work with Professor Mitchell Croatt. Stanley says that Croatt drastically changed his perspective on chemistry and many other facets of life. After Stanley completed his master's degree, he began to consider graduate school at the strong urging of a mentor in his lab.

The move to Michigan had its own challenges, but Stanley was driven to overcome them. "Looking back on it, it doesn't seem that significant, but when going through that turbulent first two years, it felt really, really hard…It also kind of like shook my confidence in myself as a chemist and my knowledge, but it also drove me."

In the end, their paths to graduate school have been challenging for each of these students in unique ways, but their perseverance and the support of their mentors continues to guide them in graduate school and beyond.

Maiola plans on becoming a post-doctoral researcher at a national lab. Chong wants to pursue a career in drug discovery. Stanley plans on attending law school.

And Lindsay Heagle hopes to be a professor, lifting up students the way she was by her own mentors. "If I could be that to somebody else someday, I think I'd be really happy."

PhDs

Askari, Maiko Judy — McCrory/Kim
Electrochemical Nitrate Reduction to Ammonium by Electropolymerized Molecular Catalyst Films

Boggs, David — Bridwell-Rabb
Enzymes Involved in Chlorophyll Metabolism

Booth, Peter-Philip — Kennedy
Improvements in Capillary Electrophoresis-Based Analysis of Biomacromolecules

Champagne, Sarah — Narayan
Investigation of flavin-dependent monooxygenases towards indole oxidations

Chen, Yuting — Zgid
Machine Learning DFT Functionals and Intermolecular Interaction Energies from Self-Consistent GW

Crum, Vivian — Kubarych
Investigation of Solvation Dynamics Inside and Outside of Optical Cavities

Cruz, Kevin Enrique Rivera — McCrory/Zimmerman
Modulating CO_2 Reduction Activity by Systematically Modifying the Molecular Catalyst Electronic Structure

Dai, Liuhan — Walter
Advancing Quantitative DNA Biomarker Detection through Single Molecule Fluorescence Kinetic Fingerprinting

Datar, Prathamesh Madhav — Marsh
Mechanistic Studies on the Prenylated- Flavin-Dependent Phenazine-1-Carboxylic Acid Decarboxylase

Duran-Camacho, Geraldo — Sanford
Development of C–X (X = O, F, C) Bond Forming Reagents and Reactions through Academia-Industry Collaborations

Gao, Jinpeng — Chen
Elucidating molecular behaviors of polymer brushes, proteins, and surfactants at buried interfaces using SFG

Gonzalez, Gabriel A — Wolfe
Studies on the Development of Palladium-Catalyzed Alkene Difunctionalization Reactions for the Synthesis of Nitrogen-Containing Heterocycles

Hall, Ian — Keane
Characterization of non-coding regulatory RNA from Listeria monocytogenes

Harmata, Alexander — Stephenson
Photochemical synthesis of imine-substituted ring systems via biradical intermediates

Herderschee, Hayley — Kennedy
Liquid Chromatography-Mass Spectrometry Method Development for Enhanced Understanding of Biomolecules and Biological Systems

Horikawa, Mami — Sanford
From Organic Chemistry Lab to PET Neuroimaging

Jett, Brianna — Sanford
Organic Redox Flow Batteries: Investigation and Mitigation of Crossover in Non-Aqueous Systems and Adaptation of Cyclopropenium Catholytes for Aqueous Media

Kim, Scott — Schindler
Synthesis and Application of Strained Ring Systems

Kroning, Kayla Elizabeth — Wang
Engineering Genetically Encoded Fluorescent Integrators for G-protein-coupled Receptor Agonist Detection

Larson,Virginia Ann — Lehnert
Earth Abundant Transition Metal Molecular Complexes for Water Splitting

Lasky, Matthew Richard — Sanford
Development of Photocatalytic Methods for the Construction of Aryl Carbon-Nitrogen Bonds

Lenhart, Ashley Erin — Kennedy
Development of Microfluidic, Immunoassay, Liquid Chromatography, and Mass Spectrometry Methods for Analysis of Islet Cell Secretions

Levesque, Iliana — Ruotolo
Development of Native Ion Mobility-Mass Spectrometry Methods for the Analysis of Membrane Proteins from Various Membrane Mimetics

Li, Siqi — Bartlett
Electrochemical Oxidation of Bio-derivable Alcohols Using Inorganic Materials and Mediators

Liu, Yichen — Walter
Investigating Riboswitch-Containing Complexes via Molecular Dynamics Simulations

Manickas, Elizabeth — Lehnert
Model Complexes for Reactive Intermediates in NOx Interconversions in Nature and Applications in Medicine

Maxwell, Danielle — Shultz
Latine Undergraduate Students' Science Identity Formation

McCalpin, Sam — Ramamoorthy
Biophysical Characterization of Polymorphic Amyloid and Lipid Aggregation Associated with Type 2 Diabetes

Meserve, Krista — Bailey
Diagnostic and Prognostic Profiling of Infectious Diseases Through Multiplexed Protein Assays

Norwine, Emily Elizabeth — Szymczak
Borane-Appended Ligand Design Strategies for Small Molecule Capture and Reactivity

Okiye, Maribel Esele — Sherman/Tripathi
Exploring the Metabolic Diversity of the Human Oral Microbiome for the Discovery of Novel Bioactive Secondary Metabolites Using Anaerobe Culturomics, Metabolomics, and High-Throughput Screening

Orr, Meghan Elizabeth — Goodson
The Investigation of Ultrafast Charge Dynamics within Conjugated Organic Ladder Semiconducting Materials for Optoelectronic Applications

Pitts, Winston — Pecoraro
Designing Metalloenzymes by Controlling the First and Second Coordination Spheres Using Non-Traditional Design

Punzalan, Exequiel — Zimmerman
Computational Investigations of Conformational Effects in Organometallic Polymerization Catalysts

Robinson, John — Matzger
Improving Kidney Stone Treatment through Materials Chemistry

Roldan, Bec — Stephenson
Leveraging the Persistent Radical Effect in the Synthesis of Resveratrol Natural Products

Romero, Evan — Narayan
Chemoenzymatic Total Synthesis Enabled by Non-Heme Iron Enzymes

Shen, Jiaqi — Wang
Designing Chemical- and Light-Activated Protein Switches for Regulating Peptide Functions

Shi, Lirong — McCrory
Spectroscopic and Electrochemical Study on Interfacial Structure and Interactions of Nonionic Surfactants and Self-assembled Monolayers for Various Applications

Shim, Eunjae — Zimmerman/ Cernak
Aligning Machine Learning with Chemists to Aid Decision Making in Organic Synthesis

Szot, Carson Wayne — Hakansson
Improved Liquid Chromatography-Mass Spectrometry Approaches for Characterization of Therapeutic RNA

Tami, Jessica Leigh — McNeil
Developments in Aqueous and Nonaqueous Organic Redox Flow Batteries

Villafuerte-Vega, Rosendo — Ruotolo
Development of Native Ion Mobility-Mass Spectrometry Approaches for the Structural Characterization of Antibody-Based Therapeutics

Wearing, Emily Rose — Schindler
Development of New Visible-Light-Mediated Methods to Access Azetidines and Azetines

Wilhelm, Catherine Anne — Koutmos
Substrate Recognition and Specificity of a Minimal Protein-Only RNase P

Williams, Phoenix Niaimani — Mapp
Benzothiophene-based Fragments Act as Reversible and Irreversible Covalent Probes for Dynamic Coactivator Med25

Wortman, Alan — Stephenson
The Synthesis of Strained Carbocycles and A Mechanism- and Technology-Supported Approach to Enabling Light-Driven Radical Reactions

Wu, Henry — Maldonado
Electrodeposition of Intermetallic Compounds via Electrochemical Liquid-Liquid-Solid Method

Yang, Cheng — Stephenson/Maldonado
Mechanism-guided Development of N-oxyl Hydrogen Atom Transfer Electrocatalysts for Lignin Oxidation

Zaimi, Ina — Shultz
Contextualizing Organic Chemistry Students' Reasoning in Their Learning Experiences

Zhang, Rui — Cernak
Developing Methods for Reaction Informatics and Automation

Zhelavskyi, Oleksii — Nagorny/Zimmerman
Diastereoselective and enantioselective catalysis for sustainable synthesis of carbohydrates and heterocycles

Masters

Zhengcheng Chen
Hannah Flaherty
Eric Liu

Accelerated Degree Program
Emma Sollner

Alumni Notes

1950-1999

Sara Callaghan (BS Chemistry 1999, Toogood & Roush) Sara Roberts Callaghan is currently living in Ann Arbor and teaching in the chemistry department at Washtenaw Community College. She and her husband Brian C. Callaghan (BS '99) met as undergraduate student instructors for Chem 210H in 1998 and just celebrated 20 years of marriage in April. Brian is the Eva L. Feldman Professor of Neurology at U- M and has a joint appointment at the Ann Arbor VA Hospital. They enjoyed a summer sabbatical in Europe in 2023 with their two daughters, Anna (14) and Emma (11).

William L. Gebo (BS Chemistry 1967, MBA 1968) I took additional graduate level finance courses at Central Michigan University plus course work in Marine Insurance and Maritime Law. I worked for Dow Chemical Company for 36 years, mostly in the area of Supply Chain Management. I lived in Midland, MI (Dow's headquarters) twice, Texas twice, and Brazil and Belgium for three years each. My work mainly involved the management of tank ships owned and leased by Dow and later the management of Dow's railroad business, including its fleet of 29,000 railroad cars. After retirement, I stayed in the Midland, MI area and got involved in forest and watershed preservation work, serving on the boards of several related organizations. I was also on the board, for six years, of an insurance company that does business in 48 states. My hobbies are golf, downhill skiing, fishing, biking, boating and foreign travel. I have two grandkids who attend the University of Michigan. One is in the engineering and the other is an economics major.

Michael H. Chen (MS, PhD, 1988, Wiseman) I would like to know more about the current faculties and their research in their labs.

Dawn Chitty (BS Chemistry 1994, Koreeda) Dawn and her business partners, Mark Ammann PharmD and Mara Holinger PhD, recently co-founded a new pharmaceutical regulatory consulting business, Quantum Regulatory Solutions.

Erich Jensen (BS Chemistry 1974) Retired from the Pharmaceutical Industry and now using chemistry in cooking, gardening, and special relationships!

David Kessel (MS 1954, Elderfield) I received an MS (Chem) in 1954 and was then lured into biochemistry by the appearance of a new chair and upgrade of departmental facilities. My chemistry training meant that, when necessary, I could complete a synthetic project without endangering either myself or the adjoining structures. Chemistry was always a strong department and has only gained in strength over the years.

Walter Roberts (BS 1977, Gordus and Phoenix Memorial Lab) Earned an MS and PhD in Medical Physics and an MD at Wayne State University and began a career as a radiation physicist and radiation oncologist; retired from clinical practice and is now developing an intra-operative radiation therapy surgical robotic device. A commercial pilot and aviation medical examiner. He spent 40 years in Ann Arbor, mostly doing R&D on advanced radiation therapy treatment planning systems and working on the KMS Fusion Inertial Confinement Fusion Program in the 1980s and 1990s.

Rachel Rohde (BS 1994, Chemistry and Cell/Molecular Biology) After graduation, I moved to Boston for medical school at Harvard and M.I.T. I trained in orthopaedic surgery at the University of Pittsburgh Medical Center, and completed a fellowship in hand surgery at Hospital for Special Surgery in NYC. I returned to Michigan (family ties!) after training. Since 2006, I have been an orthopaedic hand surgeon and partner of Michigan Orthopaedic Surgeons and am an associate professor at Oakland University William Beaumont School of Medicine. I enjoy spending time with my husband and two children. I just went back to Ann Arbor for the Art Fair and showed my teen daughter the old hangouts (and the ones that were no longer there!). I was in one of the first classes to enjoy the brand new 1800 Chem back in 1990. How time flies...

Dell Rosa (MS 1994, PhD 1998, Coucouvanis) Since 2022, working for Dart Container, in Mason, MI as an Analytical Chemist. It is nice to be back in Michi-

Myra Beaudoin Bertrand summited Everest on May 29, 2024. "I did bring a flag with U-M on the summit. Chemistry can bring you far! It was amazing!" she reports.

gan, and hopefully soon I can visit Ann Arbor again. Funny how I miss my old schlenk line!

2000-2010

Stephen Antonucci (BS Biochemistry, 2003) is an assistant professor, UC San Diego School of Medicine.

Myra Beaudoin Bertrand (PhD 2008, Wolfe) summted Mount Everest on May 29, 2024. She moved to Colorado in 2020. She is Director, Search & Evaluation for Jazz Pharmaceuticals.

Murphy Brasuel (PhD 2002, Kopelman) In the spring/summer of 2024 I celebrated the birth of my second grandchild (Callahan Brasuel) born to my son Leonard Brasuel and daughter in law Madeline Brasuel in Milwaukee, Wisconsin and I was promoted to Professor at Colorado College where I am a member of the Department of Chemistry and Biochemistry and currently direct the Bridge Scholars Program.

Christian Casper (MS 2001, Coucouvanis) I switched fields in grad school, eventually earning a PhD in rhetoric at North Carolina State University with a fo-

cus on rhetoric of science. I'm in my fourteenth year back at U-M, in the Program in Technical Communication in the College of Engineering, where I'm now a Teaching Professor. I learned recently that the original owners of my family's house here in Ann Arbor were late U-M chemistry professor Ralph Rudolph and his family.

Caitlyn Davis (BS Biochemistry 2007, Walter), an assistant professor at Yale, gave a seminar at U-M in September, "Protein dynamics: Connecting in vitro, in cell, and in vivo."

Keary Engle (BS Chemistry 2007, Matzger) Keary was the Department of Chemistry Commencement Speaker for the Class of 2024 and shortly thereafter was appointed Dean of Graduate and Postdoctoral Studies at Scripps Research, where he is a Professor in the Department of Chemistry.

Amran Gowani (BS Chemistry 2003, Pearson) After a post-chemistry career spanning pharmaceutical marketing and investment banking, I sold my debut novel LEVERAGE—a propulsive, darkly satirical Wall Street thriller—to Simon & Schuster. The book will be published in Summer 2025.

Michael Kheir (BS Biochemistry, Psychology 2007; Mark Banaszak Holl) Forever a wolverine. After graduating from U-M, I got my MD from the University of Pennsylvania, took time off to do orthopaedic basic science and clinical research at the Rothman Institute at Thomas Jefferson University, then went to a 5-year orthopaedic residency program at Indiana University, and lastly completed a 1-year fellowship at the Hospital for Special Surgery at Weill Cornell Medical College, the #1 orthopaedic hospital in the nation. Life came back full circle when I started working at my alma mater two years ago and I am currently an assistant professor of orthopaedic surgery at Michigan Medicine. When I'm not working, I enjoy hiking locally, hanging out with my old friends, and visiting campus with my family, reliving the memories of undergrad with my kids when I walk along the Diag and particularly near the chemistry building where I spent a majority of my time. I owe a lot to my educators at the University of Michigan Department of Chemistry! Forever Go Blue!

2011-2024

Manasi Anantpur (BS Honors Chemistry 2022, Schindler) She is now an associate scientist at Merck in Boston and pursuing an MBA through Ross School of Business. During her undergraduate days, she was a Study Group Facilitator for Organic Chemistry and researcher in the Schindler group.

Avinash Bevoor (BS Biomolecular Science 2021)After receiving my degree I applied and was accepted into veterinary school where I am now currently enrolled. My path to vet med was a bit uncommon but if anyone has any interest in following a similar career plan please don't hesitate to reach out!

Paul Bruno (PhD 2016, Mapp) has been appointed Chief Business Officer at Atavistik Bio.

Matthew Culberson (MS 2021, PhD 2024, Wolfe) He is he Felicia Penzell Weber Jewish Community High School Science Teacher and the advisor to the science advisor to the National Honor Society. He is also an adjunct professor in the Department of Chemistry and Biochemistry at Kennesaw State University.

Andrew Davis (BS Biomolecular Sciences, Entrepreneurship 2017) I was briefly in the Kristina Hakansson lab before I realized that bench science was not for me. I turned to the business side of the chemistry/biotech industry. This was inspired by Gary Glick's freshman seminar, the business of chemistry. Now I work as an account manager on the business development team for a company called Emerald Cloud Lab. So for those that don't like the bench side of chemistry, there are alternate paths. At Emerald Cloud Lab we are actively trying to change the nature of lab work. We allow scientists from all over the world to control their science remotely through a software interface. Right now I am actively spreading adoption for cloud labs for research. We recently built a cloud lab at Carnegie Mellon, have users at Stanford and Wisconsin, and getting a lot of adoption in large pharma.

Sarah Davis (BS Biochemistry 2016) (née Thompson); 2018 MS, Grand Valley State University, Cell and Molecular Biology; 2024 PhD, University of South Carolina, Pharmaceutical Sciences. I am currently a

postdoctoral fellow at Temple University Center for Substance Abuse Research where I am investigating the effects of SARS-CoV-2 and cocaine on the blood brain barrier. In undergrad, I marched Clarinet in the Michigan Marching Band. I did research with Dr. Regina Baucom (Ecology and Evolutionary Biology,) which helped introduce me to research as a career path. Since then I've earned an NIH F31 NRSA award, and am currently a T32 NIH trainee fellow. I married my college sweetheart—we met as freshmen in the Michigan Marching band. We welcomed our first child in 2022.

Yvonne DePorre (PhD 2018, Schindler) She has recently completed 3 years as a Senior R&D Scientist for Charlotte's Web, Inc. based in Louisville, CO. She has presented her team's work, "GC-MS terpene analysis throughout drying processes of Charlotte's Web hemp cultivars CW1AS1, Kirsche, and Lindorea," at several meeting in 2022. More recently, her work has been showcased at ICRS (International Cannabinoid Research Society) 2024 "The Stability of Minor Cannabinoids." During her time at Charlotte's Web, she developed a line of 4 dietary supplement gummies that contain CBD paired with botanical extracts to benefit athletic performance, sponsored by Major League Baseball and certified by NSF Ann Arbor for sport use. She also worked on the Charlotte's Web dietary supplement gummy "Stay Asleep" that is based on clinical studies of the minor cannabinoid CBN (cannabinol), which was found to be effective for reducing sleep disturbances.

Taylor Evans (BS Honors Chemistry 2014, Bartlett) is leading the setup of an analytical chemistry lab for medical device testing at WuXi AppTec, Munich.

Jack Googasian (BS Chemistry 2018, Bartlett) defended his PhD in chemistry from Indiana University, Bloomington in 2024, and is now a Postdoctoral Scientist at Ballydel Technologies in Wilmington, DE.

Zack Hall (BS Biochemistry 2016) After graduating, I did Teach for America in Indianapolis (2017-2019) and taught high school science and math. I then went on to medical school at Indiana University (2019-2023). Now I am a radiology resident at The Medical College of Wisconsin. What a journey it has been, but my time at Michigan prepared me well. I think one of my favorite memories is when Dr. Coppola set up a study abroad for us in Shanghai. It was my first time traveling outside the US, but what a wonderful experience full of both personal and professional growth! I recently wrote a book! It is a guide to becoming a medical doctor from high school graduate to MD. It explains the training process to those unfamiliar with the medical field and has all the advice I wish I had gotten earlier in my career. I think it may be of interest to some Chemistry students =). It is on amazon and I have linked here: https://shorturl.at/SM37G

Charles Lhermitte (PhD 2017, Bartlett) began a research scientist position in applied electrochemistry for redox flow batteries at Lockheed Martin.

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or send a note to:
Department of Chemistry,
930 University Ave., Ann Arbor, MI 48109-1055
Attn: News

Daniel Nasrallah (PhD 2020, Schindler) Last year, I completed a post-doc at UCLA with Prof. Neil Garg where I taught and conducted research which was funded through the teacher-scholars program. In the Fall of 2023, I started as an assistant professor of chemistry at Roanoke College in Roanoke, VA. I teach organic, general, and advanced chemistry classes and supervise undergraduate researchers.

Virginia Larson (PhD 2023 Lehnert) is now a post-doctoral fellow at the National Renewable Energy Laboratory.

Siqi Li (PhD 2024, Bartlett) began a postdoctoral fellowship working in the Hydrogen from Next-generation Electrolyzers of Water (H2NEW) consortium at the National Renewable Energy Laboratory.

Kyle Palka (BS Chemistry 2022, Wolfe) I am currently attending graduate school at Boston College, working on my PhD in Organic Chemistry in the Morken Lab.

Sethu Pitchiaya (PhD 2012, Postdoc 2013, Walter) now U-M assistant professor of pathology was recently awarded an NIH grant for research on transcriptional stress response mechanisms.

Hang Ren (PhD 2016, Meyerhoff) is an assistant professor in chemistry at University of Texas. He will receive the 2025 Royce W. Murray Young Investigator Award, Society for Electroanalytical Chemistry, at Pittcon. His current research interests include developing electroanalytical methods to understand the fundamentals of electrochemical interfaces during electrocatalysis, battery, and corrosion.

Jeremey Schwartz (BS Chem 2021, MSE Material Science & Engineering 2027, Meyerhoff) My education and experiences in Chemistry at U-M helped me land a position in U-M's Lurie Nanofabrication Facility. Now I assist graduate students and researchers with their chemical etching needs, while also learning the ins and outs of semiconductor processing. The position is amazing! And because I am also an employee of the university, I can make progress on my Master's degree in Material Science & Engineering. I am extremely grateful for the skills and connections that I made during my time in UMich Chemistry. Go Blue!

Mary Show (BS in Biomolecular Sciences and Middle Eastern Studies 2023) I'm excited to announce I will be attending the Oakland University William Beaumont School of Medicine Class of 2028. I could not have done it without the amazing Chemistry Department and its wonderful educators. Thank you!

Kevin Skinner (PhD 2022, Zimmerman & Narayan) has accepted a tenure-track position at Cincinnati State University.

Brad Terry (PhD 2022, Bartlett) is one of two electrochemists at Masco Corporation who helped launch a hot-tub water quality sensor product for the first time.

Nicholas Thabit (BS Chemistry 2024, Bartlett) is excited to start as a PhD student at UCLA this fall.

Julia Windom (postdoc 2014-18, Walter) is an assistant professor at University of Oregon. She returned to U-M to give a seminar in August, "Spectroscopic studies of nucleic acid structure, dynamics and photophysics"

Anthony Woodward (BS Biochemistry 2004; MBA 2011) With the U.S. Army he served two tours of duty in the Iraq War, and is now a medical device territory manager at Abbott Laboratories. He has been a San Francisco resident since 2012.

Cheng Yang (PhD 2024, Stephenson/Maldonado) has been named a Damon Runyon Fellow by the Damon Runyon Cancer Research Foundation. He is among just 16 early-career scientists selected this fall to receive four years of independent funding to investigate the causes, mechanisms, and prevention of cancer. He is now a postdoctoral fellow at Princeton University in the lab of Chris Chang.

In Remembrance

Henry Griffin 1937-2024

Henry Claude Griffin, 87, of Black Mountain, NC, passed away Wednesday, August 21, 2024. Born February 14, 1937 in Greenville, SC, he was the son of the late Arthur Gwynn Griffin and Christa Wilson Griffin. He graduated from the Hill School and Davidson College, and received his PhD in Chemistry from the Massachusetts Institution of Technology. Thereafter, he was a research associate at Argonne National Laboratory. In 1964, he joined the faculty of the University of Michigan, and was a Professor of Chemistry there until 2005 when he was named professor emeritus. Professor Griffin's work focused on nuclear chemistry and physics. A devoted educator, he taught undergraduate physical and general chemistry courses and graduate level nuclear chemistry courses. He was especially interested in teaching innovations in the large, lower-level general chemistry classes, where he pioneered the use of computers and other innovative techniques for acquiring data. He authored and co-authored over 100 publications during his career.

Henry married Barbara Jean Pierson in 1960, and they enjoyed many adventures together over their 64 years of marriage. Henry loved to travel, especially with their group of friends affectionately called "the Gallivanters." Always a gracious host, he particularly enjoyed sharing his love and knowledge of wine with friends and aficionados alike. He was an avid tennis player, and fierce competitor on and off the court.

Henry's research work also allowed for two year-long sabbaticals, first to the Swiss Federal Institute for Reactor Research in 1971; and then Lawrence Livermore Laboratory in 1978.

While in Switzerland, Henry climbed the Swiss Alps, which was the beginning of his lifelong love of mountain climbing. He later climbed Chimborazo and Cotopaxi, volcanoes in Equador; as well as some of the highest peaks in Western US and the White Mountains in New Hampshire.

That he and his wife ultimately retired to the Blue Ridge Mountains was no surprise.

Although a true scientist, Henry was also a man of deep faith. He was a loyal member and contributor to the First Baptist Church of Ann Arbor, MI, serving as Treasurer, Sunday School Teacher, Choir Member and discussion group leader. After retiring to Black Mountain, NC, he joined Black Mountain Presbyterian Church. Henry always valued service to others, and he got great joy visiting with his "clients" when delivering meals for Meals on Wheels.

Henry was incredibly proud of his two daughters, but he particularly reveled in the accomplishments of his grandchildren.

In the last few years, Henry had his challenges, having been diagnosed with Parkinson's and Alzheimer's. This was a particularly cruel set of diagnoses for someone who was so strong mentally and physically; but he kept an amazingly positive outlook and a sweet demeanor until the end. He died peacefully at the Healthcare Center of Givens Highland Farms, having been lovingly cared for by his wife and their two daughters.

Surviving are his spouse of 64 years, Barbara Pierson Griffin; daughter, Gwen Van Ark and her husband, Jonathan, of Carrboro, NC; daughter, Lyle Griffin Warshauer and her husband, Michael, of Atlanta, GA; and grandchildren, step-grandchildren, and great-grandchildren.

A memorial service will be held in November.

https://www.penlandfamilyfuneralhome.com/obituary/Henry-Griffin

ENDOWMENTS—A Legacy

Endowments have been established by former students to recognize beloved professors and by alumni whose lives were transformed by their college experiences. Some aim to "pay it forward" to the next generation of scholars. Others are just grateful for their association with the department. Whatever the motification, endowments create a legacy. They keep giving year after year as the interest earned provides current support for our missions while the principal maintains a solid foundation for the future.

Among these are:

Richard J. Cook and Teresa M. Lahti Undergraduate Research Endowment

Hillig Graduate Student Endowed Fellowship

Masato Koreeda Research Fund

Robert Kuczkowski Endowed Faculty Research Fund

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Kathleen Haller Ryan Scholarship Fund

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Wayne A. and Carol H. Pletcher Fellowship

If you would like to explore giving opportunities, please contact Bart Bartlett, Chemistry Chair.
chem-chair@umich.edu
phone: 734-647-2125

Daniel T. Longone 1932 – 2024

Daniel "Dan" T. Longone, University of Michigan Professor Emeritus of Chemistry and well known culinary and wine historian passed away peacefully on January 28, 2024, in Ann Arbor Michigan, at the age of 91.

He earned a PhD at Cornell University. After a year as a postdoctoral research fellow at the University of Illinois, he joined the U-M in 1959. His research interests were in organic chemistry, particularly the synthesis and behavior of novel structures and the preparation of synthetic polymers with unusual properties. He retired from the U-M in 1987 having taught thousands of students during his tenure, many of whom he kept in touch with throughout his life.

He was a Fulbright Scholar at the University of Cologne, American Chemical Society Fellow, visiting professor at the University Barcelona and visiting professor in Marburg, Germany Catania, Sicily, and Istanbul, Turkey. He held various consultantships in polymer research and had a long tenure with General Motors Research.

He and his wife, Janice "Jan" Bluestein Longone, founded The Wine and Food Library in Ann Arbor, Michigan in 1972, which is renowned for being one of the most extensive collections of antiquarian culinary resources in existence.

While Jan was recognized as the foremost authority on the history of American cooking, Dan's expertise was on the history of grapes and wine in America. In 2009, he was the curator of a highly acclaimed exhibit and lecture titled "500 Years of American Grapes and Wine: A Remarkable Journey" at U-M's William L. Clements Library.

The Longone's collection of more than 20,000 pieces is now the Janice Bluestein Longone Culinary Archive housed at the University of Michigan.

He is survived by his brother-in-law, and many nieces, nephews, cousins, and dear friends.

obits.mlive.com/us/obituaries/annarbor/name/daniel-longone-obituary?id=54273642

John Wiseman 1936 – 2024

John Robert Wiseman, Professor of Chemistry Emeritus at the University of Michigan, peacefully passed away on July 30, 2024. Dr. Wiseman was 88 years old and under hospice care at the time of his death. He struggled with pulmonary fibrosis and Alzheimer's disease in his final years.

Born on May 4, 1936, in Patriot, Ohio, John spent his formative years in southern Ohio. His parents, who were both dedicated educators, nurtured John's love of learning; a trait that would define his life and distinguished career. At the age of 17, his family relocated to Estes Park, Colorado, where John graduated valedictorian of his high school, and the Rocky Mountains sparked his life-long appreciation of the natural beauty of the Western American landscape.

At the University of Colorado in Boulder he studied pharmaceutical sciences and met Carolyn Fansher. Their connection over a game of bridge blossomed into a lifelong partnership; they married in 1956.

Following graduation, John's career path took him all over the United States. As a commissioned officer in the US Public Health Service he worked at the USPHS Hospital, Brighton in Massachusetts. He subsequently relocated to the then-called Navajo Indian Reservation in Arizona. He worked from1958-1960 as a pharmacist at Tuba City Indian Hospital, serving the local Navajo population. John resumed his academic journey in 1960, taking graduate-level chemistry courses at Colorado University. The following year, he began his PhD studies at the University of Wisconsin-Madison and subsequently followed his thesis advisor, Dr. Eugene Van Tamelen, to Stanford University in Palo Alto, CA. After earning his Ph.D. in Organic Chemistry in 1964, Dr. Wiseman accepted a National Science Foundation postdoctoral position at the University of California, Berkeley under the auspices of Dr. William Dauben. Dr. Wiseman joined the faculty at The University of Michigan in 1966 as a tenure-track professor in the Department of Chemistry and was promoted to full professor in 1976.

Dr. Wiseman's pioneering research at the University challenged the well-established Bredt's Rule, which posited that double bonds could not exist at the bridgehead of bicyclic systems due to excessive strain. Dr. Wiseman's synthesis of bicyclo[3.3.1]non-1-ene, a highly strained anti-Bredt compound, provided definitive evidence that such structures could indeed be stable, overturning decades of scientific consensus. His innovative approach not only demonstrated the limitations of Bredt's Rule but also led to the exploration and characterization of numerous compounds that defied it, significantly advancing the field of physical and synthetic organic chemistry.

In addition to his research, Dr. Wiseman was a dedicated educator who taught a broad range of organic chemistry courses, from large pre-medical classes to advanced laboratory techniques. Dr. Wiseman also contributed to the pharmaceutical industry as a consultant for Parke-Davis in Ann Arbor, where he advanced the synthesis of complex antibiotics, including tetracyclenes. Colleagues have praised his career as a monumental achievement that opened new directions in chemistry and remember him as a tenacious, skilled, and accomplished scientist, scholar and teacher.

After retiring in 2001, Dr. Wiseman embraced an active and fulfilling life. He generously volunteered with local organizations, sang in the choir at First United Methodist Church, achieved Bronze Life Master status as a bridge player, and traveled extensively domestically and abroad. Dr. Wiseman was known for his unwavering willingness to lend a hand. He was equally adept at practical tasks-like rewiring an electrical outlet-as he was at offering comfort, whether soothing an anxious grandchild or assisting a neighbor in need.

Dr. Wiseman is survived by his wife of 67 years, Carolyn; his son, David Lowell Wiseman, and his wife, Teresa Wiseman; his daughter, Barbara Morgan, and her husband, William David Morgan; and his daughter, Kathryn Wiseman, and her husband, Dr. Stephen Brian Swanekamp; and his "German son," former exchange student Michael Schröder of Hamburg, Germany. John embraced his role as a grandfather and step-grandfather to all his 15 grandchildren and 14 great grandchildren.

legacy.com/obituaries/name/john-wiseman obituary?pid=207363482

Gifts

July 1, 2023 – June 30, 2024 as reported by the University of Michigan Office of Development.

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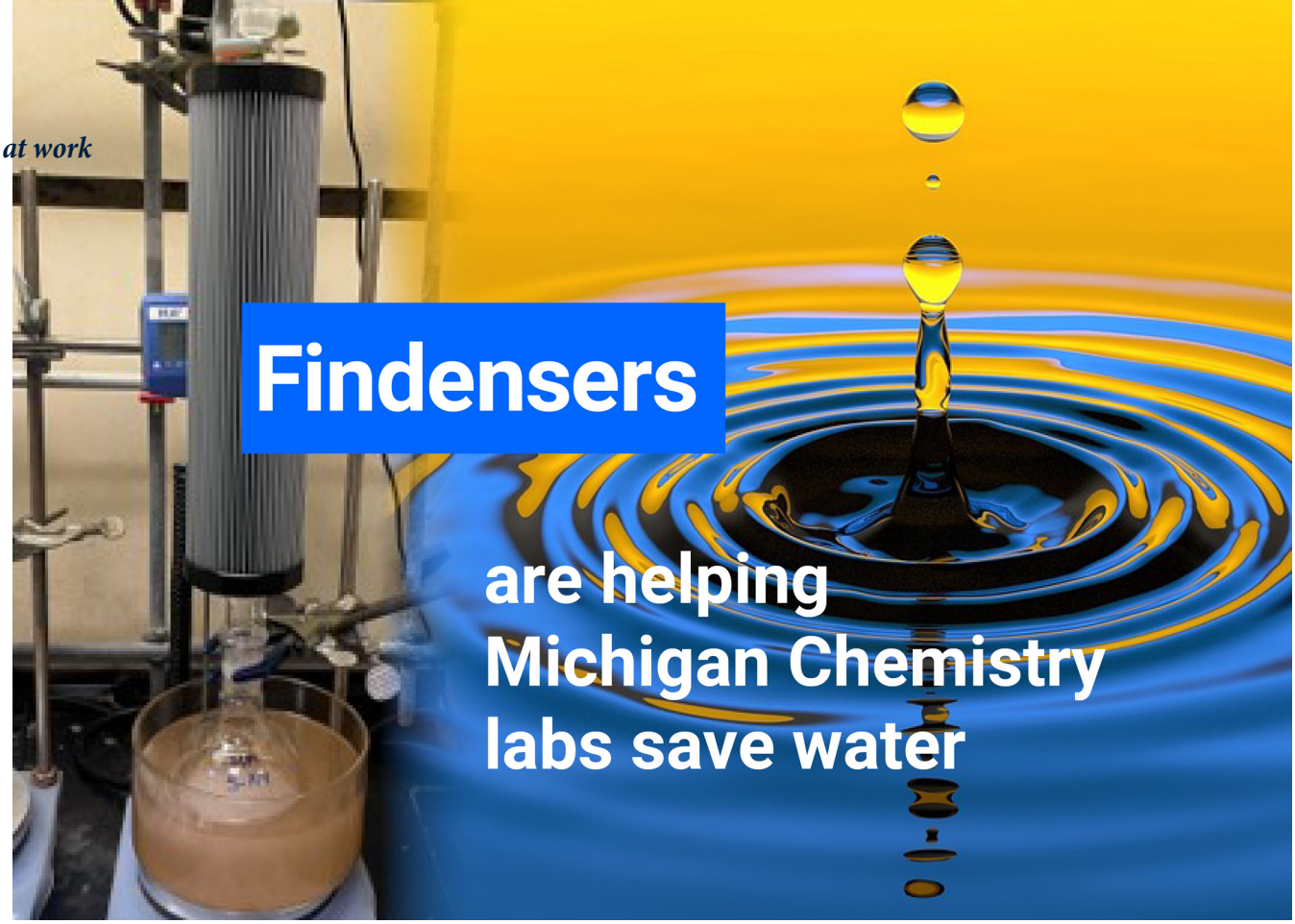

Findensers are helping Michigan Chemistry labs save water

Graduate student Dylan Vitt was searching for more sustainable practices for the Maldonado lab when he learned about Findensers. These air-cooled condensers do not require water or energy inputs to cool evaporated solvents. They can replace the single-pass water-cooled condensers in most applications.

Single-pass water-cooled condensers used for a year can use twenty times as much water as a household flushing a toilet five times a day. This wasted water must be processed through treatment plants—an energy cost.

Chemistry professor and sustainability advocate Anne McNeil suggested Vitt make this technology known throughout the department and he followed up by surveying labs for interest in the Findensers. "The more orders for Findensers, the more water saved," he points out. Each Findenser costs about $200.

With a grant from the LSA Incentive and Innovation fund, and additional support from the Department of Chemistry, Vitt was able to purchase 121 Findensers that are now in use in labs throughout the building: 40 in teaching labs, and 81 distributed among 13 different research labs.

The U-M Chemistry installation is the largest in the United States and second largest in the world aside from Oxford University, according to the representative from Radleys, the UK company that manufactures this device and a range of chemistry tools.

The Findensers are proving to be effective across a range of applications, using different solvents and processes, according to Vitt.

Just how much less water will be used because of the Findensers is being tracked in monthly building water use but the devices have only been in place since May. The Findensers will be used for the first time in the fall in the teaching labs in a reaction that requires overnight use. That use alone could result in a drop in building water use.

In addition to the water savings, the Findensers are also safer to use, Vitt points out. There there are no moving parts, there is no risk of flooding the lab, and they can be used overnight without supervision.

"It really is laissez faire—install it and forget it," Vitt says.

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BS Chemistry Class 1894 with some famous figures from U-M Chemistry history

Standing left to right: W.R. Pyle, G.W. Davison, E.C. Sullivan, Dr. Moses Gomberg, G.W. Wallaka, B.S. Summers Middle seats: Fred H. Strudfestaudt, Richard Fisher, L.D. Carr Front row: Clare Briggs, Professor E.D. Campbell, Nellie E. Goldthwaite Bentley Historical Library photo