

BADGER CHEMIST



GET TO KNOW OUR NEW ASSISTANT PROFESSOR: JULIAN COOPER

PAUL BENDER CHEMISTRY INSTRUMENTATION CENTER:
ADVANCED INSTRUMENTATION AND EDUCATION TO SUPPORT DISCOVERIES

ALWAYS A BADGER CHEMIST:
STEVE FELDGUS PH.D. '00

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Department of Chemistry

UNIVERSITY OF WISCONSIN-MADISON

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On the cover: A blue crystal of cupric sulfate pentahydrate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, shines at the center of a single-crystal X-ray diffractometer in the Paul Bender Chemistry Instrument Center, ready to be analyzed. Single-crystal X-ray diffraction, a gold standard of analytical techniques, provides a wealth of chemical information about crystal structure and composition from specimens typically measuring 5-100 microns in diameter. Credit: Ilia Guzei

On this page: A commissioned piece created by Assistant Glassblower Lauren Aria of a Tremulacin molecule, a chemical compound found in Aspen trees. Aria has been an instrumentation technician for the Department of Chemistry's Glass Shop since 2023. Credit: Ilia Guzei

From the Chair's Office



As 2024 comes to a close, I'm adjusting to my new role as department chair. I have been a UW-Madison faculty member for over 37 years, and my new position within the department has given me a new perspective. I now have a broader awareness of the incredible work underway across the large Chemistry community.

One of our most immediate challenges during my first year is to prepare a comprehensive department self-study. We have been directed by the College of Letters & Science to review our accomplishments over the past 10 years. We will use this opportunity to generate a strategic plan for the next 10 years, with the goal of maximizing outcomes for our students and scholarly contributions to the rest of the world. This exercise will have us considering our strengths, weaknesses, opportunities, and threats in the context of our instructional programs, scholarship, outreach, and administrative structure.

Another major task this year, and throughout my time as chair, will be to hire new faculty members, because we are in the midst of a wave of retirements. One search is currently underway.

Maintaining our position as a top-ranked chemistry program requires resources beyond those provided by the University. Thus, we face the perennial challenge of securing donations for the department. Finding and sustaining resources is critical to fortifying our graduate program, recruiting new faculty, helping to retain current faculty, maintaining high-end instrumentation, and enabling building renovations to support current and future research programs.

Our many achievements and innovations offer a strong case for supporting the department. I mention a couple of examples below; more will be found in this issue. An exciting advance for the department's undergraduate program is the newly created CHEM 361—Machine Learning in Chemistry. This course will bridge a divide between chemistry and data science and open new opportunities for our students. Topics will include generative models for organic synthesis, force fields, application to phase transitions, structure and dynamics of molecular systems, and AI-driven drug discovery.

We were delighted to welcome a new colleague, Prof. **Julian Cooper**, this past summer. Julian specializes in soft materials research.

We are making progress toward more equitable access to advanced study in chemistry. Our efforts in this area have been recognized by the Midwest Association of Graduate Schools with the 2024 Award for Excellence and Innovation in Graduate Education.

I invite you to read more about these and other triumphs, and the people behind them, in this issue of the *Badger Chemist*. We owe a debt of gratitude to the past, present, and future Badger Chemists who move us forward.

Best,

Professor Sam Gellman
Irving Shain Chair of Chemistry | Vilas Research Professor

CHEMISTRY OF COMMUNITY



1



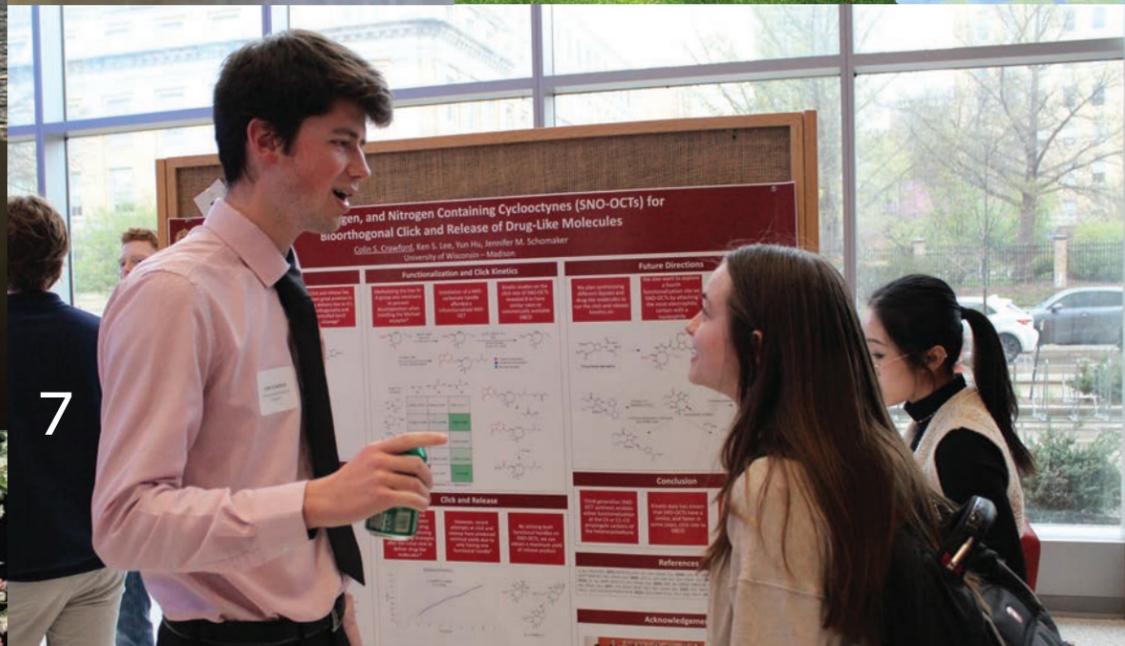
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3



4



7



9



8



6



5

1 In September, graduate students check the night sky through a telescope at the community building GSFLC bonfire event at Picnic Point. Credit: Rebecca Fenselau 2 Sealed in a heated crucible for weeks in the lab of chemistry Professor **Robert Hamers**, a tiny forest of trees grew from a glittering forest floor of individual crystals of lithium cobalt oxide, a compound used as the positive electrode in lithium-ion batteries. Credit: Bob Hamers 3 In June, high school educators from across the country met to engage in ChemLEAP Teacher Professional Development. Credit: Peter Jaeger 4 As night falls during Science on the Square, graduate students **Richard Botzoc** and **Jalinet Román Matías** show off luminescent crystals to explain how chemical structure is related to certain properties. Credit: Jeff Miller / UW-Madison 5 **Abayomi Awoyomi** receives the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers (NOBCCChE)

Graduate Rising Star Award-Midwest at the conference in October. The UW-Madison chapter was also reinstated at this event. Credit: Brian Foster 6 Emeritus Professor **Ned Sibert** chats with Professor **Yang Yang** and Emeritus Professor **Frank Weinhold** at the Hirschfelder Award Banquet in October. Credit: Kimberly Hazen 7 Undergraduate **Colin Crawford (Schomaker)** explains his research at an undergraduate poster session in April. 8 Bucky Badger and undergraduate **Bahar Sadat Abtahi** pause for a photo at the departmental awards ceremony in April. Credit: Kimberly Hazen 9 In July, chemistry alumni **Vilashini Rajaratnam (BS '15)** and **Kyu Bum Kim (BS '16)** hosted Badger Chemist visitors, including Undergraduate Program Director **Pam Doolittle**, at their traditional Malaysian wedding. Courtesy: Pam Doolittle

By the Numbers

More than

70
people

attended the 2024 Juneteenth Celebration

organized by the UW-Madison chapter of NOBCChE.

430
peer-reviewed articles

by our faculty and affiliates
in 2023-24

2000
square feet
of space in our newly
created Chemical
Education suite

55
conference
presentations

by faculty members in
the last 36 months

57

contributors to *The Benzine*,
an art and chemistry zine

including graduate students,
undergraduate students, faculty,
and staff *Watercolor by Meg Tetzloff*

30

patents

held by faculty since 2022

2

ACS conference receptions

for alumni and friends to reconnect

The department
received 59 grants
worth \$32.2 million
over the last 36 months.

Department of Chemistry

was represented at

5

diversity conferences this year.

Centered on the Edge

A tool for rethinking undergraduate organic chemistry laboratory curriculum

by Sam Gellman



Philip Lampkin,
a Ph.D. student in the
Gellman Group

A recent manuscript from collaborators in the UW-Madison Department of Chemistry represents a very significant contribution to the undergraduate organic chemistry laboratory curriculum. A reviewer characterized this as "one of the highest quality manuscripts that I have reviewed in the past decade" and along with being published in the *Journal of Chemical Education*, this paper was selected to be featured as an ACS Editors' Choice.

Authors with passion and expertise for education and research

The stars of this story are the first and last authors.

Philip Lampkin is a Ph.D. student in the Gellman Group, and he collaborated closely with **Dr. Nick Hill**, who is the Director of our Undergraduate Organic Chemistry Laboratory Program. Hill's efforts have enhanced the education of thousands of UW-Madison undergraduates over many years. Lampkin excels both in experimental research and as an educator (he recently won a Campus-Wide TA Award). The second author, **Angie Xu**, was an undergraduate who played a major role in this effort. (Xu joined Teach for America after she graduated from UW-Madison.)

The study of light as a method for inducing chemical reactions

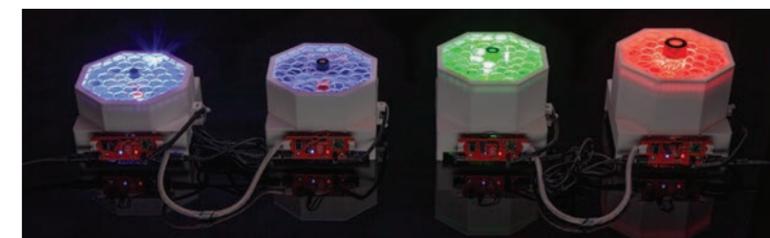
Organic chemists have studied the ability of light to induce reactions for over a century, but this field has expanded dramatically in the past 15-20 years through the use of photocatalytic strategies. (UW professor **Tehshik Yoon** has played a pioneering role in this field.) The *Journal of Chemical Education* paper shows how modern photochemical methods and concepts can be incorporated into the undergraduate

laboratory. This contribution should be very impactful in terms of pedagogy because enormous numbers of undergraduates take an organic chemistry laboratory course in the US each year.

The challenges to learning (and teaching) about light as a catalyst

The paper has its roots in the frustrations Lampkin felt during the general prohibition of laboratory work at the start of the pandemic. Lampkin's pursuit of photocatalysis research led him to recognize that reproducibility in this field can be problematic because equipment is not standardized. He bought a 3D printer and began working at home to develop what became the Wisconsin Photoreactor Platform (WPP), a versatile open-source resource that has been adopted in many academic and industrial laboratories.

Expanding a resource for broader application



The "Wisconsin Photoreactor Platform" 3-D printed device provides a way for undergraduate students to replicate photocatalytic reactions in a teaching lab environment. Credit: Ilia Guzei

The publication introducing the WPP caused Hill to initiate a collaboration to harness Lampkin's innovation for undergraduate education. The resulting contribution illustrates a synergy between cutting-edge academic research, as

pursued by doctoral students, and undergraduate education efforts led by committed

colleagues such as Hill. This synergy is uniquely possible at a large university with strengths in both domains, such as UW-Madison.

Details about this study:

"Energy Transfer Photocatalytic (E)->(Z) Isomerization of 2-Nitrocinnamaldehyde Using an Inexpensive, 3-D Printed Photoreactor Monitored by ¹H NMR Spectroscopy and Computational Modeling"

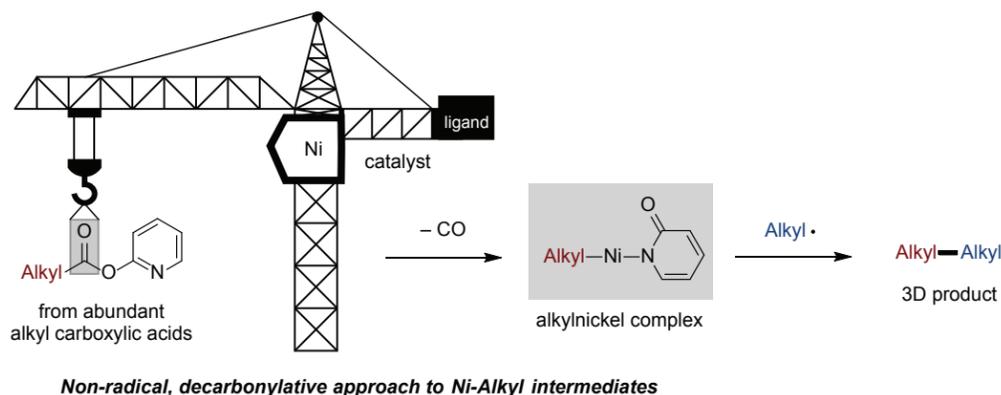
P. P. Lampkin*, A. E. Xu, B. J. Esselman, C. E. Schwarz, S. D. Thompson, S. H. Gellman and N. J. Hill*
(*corresponding authors) *Journal of Chemical Education* **2024**, <https://doi.org/10.1021/acs.jchemed.4c00620>

Centered

A new approach to building 3-D molecules for better drugs

by Dan Weix and Zhidao Huang

A recent report in the journal *Science* from researchers in the UW-Madison Department of Chemistry represents a significant advance in making the types of molecules needed in drug development. Molecules with three-dimensional complexity are known to be better for drug development than flatter molecules, but accessing molecular complexity has historically been challenging. The work in this paper sets the stage for addressing this long-standing problem.



Non-radical, decarbonylative approach to Ni-Alkyl intermediates

Figure. The “missing link” in 3D molecule (alkyl-alkyl or $C(sp^3)-C(sp^3)$ molecule) synthesis is an alkylnickel complex (gray box). Researchers at UW-Madison developed a new catalyst by pairing nickel (Ni) with a specialized ligand that forms this species from abundant alkyl carboxylic acid derivatives by removing carbon monoxide (decarbonylation).

The synergy of teaching and scholarship

The breakthrough reported in this paper illustrates the interplay of teaching and scholarship at UW-Madison.



Professor Dan Weix

Faculty member **Dan Weix**, while revisiting classical studies as part of teaching an advanced course to undergraduate and graduate students, was struck by the potential of a reaction known as “decarbonylation” to address the central challenge of creating more molecules with three-dimensional complexity. Translating this idea to reality took a team of researchers

with varied training and the outstanding facilities available at UW-Madison: postdoctoral organometallic chemist **Zhidao Huang**, computational chemist **Michelle Akana** (Ph.D., '23), and X-ray crystallography expertise provided by **Kyana Sanders** (Ph.D., '24).

The background and challenges

Methods to quickly form flat molecules are some of the most-used methods in drug development, but molecules with three-dimensional complexity usually perform better as drugs. Reactions that quickly make molecules with 3D complexity are not as efficient because they require specialized starting materials or form complex mixtures of products. Dan Weix’s group is known for inventing reactions that rely upon readily available starting materials and unusual mechanisms but finding an approach that utilized abundant feedstocks and avoided mixtures required thinking about a new way to use the classic decarbonylation step.

The breakthrough and outlook

The team systematically studied the decarbonylation process and hit upon a catalyst with the right properties to favor decarbonylation, but disfavor other undesirable steps. By providing a new, convenient way to access the key intermediate, an alkylated nickel complex, from a common starting material pool, alkyl carboxylic acids, this study sets the foundation for rapid advances in 3D molecule synthesis.

Details about this study:

“A decarbonylative approach to alkylnickel intermediates and $C(sp^3)-C(sp^3)$ bond formation.” Zhidao Huang, Michelle E. Akana, Kyana M. Sanders, and Daniel J. Weix* (*corresponding author) *Science* **19 Sep 2024**. Vol 385, Issue 6715. pp. 1331-1337. DOI: 10.1126/science.abi4860

On the Edge

Wisconsin Center for Origins Research (WiCOR) launches, Widicus Weaver named director

by Aaron R. Conklin

WiCOR, the brainchild of **Eric Wilcots**, the Dean of the College of Letters & Science and the Mary C. Jacoby Professor of Astronomy, was designed to connect researchers from multiple science-focused departments in the College, pairing them on research projects centered on the origins of life in the universe and synergizing their expertise. On Thursday, September 19, the Center debuted its new, renovated office and research space on the sixth floor of Sterling Hall.

Originally, WiCOR included seven departments at UW—chemistry, astronomy, botany, integrative biology, geoscience, atmospheric and oceanic sciences (AOS), and bacteriology (in the College of Agricultural and Life Sciences). As the idea has evolved and picked up steam, faculty from even more departments have expressed interest in becoming involved.

“We have people from all across campus that want to join the center now,” says **Susanna Widicus Weaver**, WiCOR’s provisional director and the Vozza Professor of Chemistry and Astronomy. “It’s growing quite dramatically.”

Along with Widicus Weaver, Assistant Professor **Zoe Todd** (chemistry and astronomy), Professor **Ke Zhang** (astronomy), Professor **Juliette Becker** (astronomy), Professor **Zach Adam** (Geoscience), Professor **Thomas Beatty** (Astronomy), Professor **Jessi Cisewski Kehe** (Statistics), Professor **Melinda Soares-Furtado** (Astronomy and Physics), and

Professor **Hannah Zanowski** (Atmospheric and Oceanic Sciences) are examining how exoplanets form. This is one of WiCOR’s first research projects and will be supported by a UW-Madison Research Forward 2024 Grant. It centers on the study of hycean exoplanets, potentially habitable exoplanets in nearby galaxies that feature a liquid ocean and a hydrogen atmosphere. These exoplanets are the perfect size to be observed by the James Webb Space Telescope, launched into space two years ago.

“If these hycean exoplanets are there, what else could be in the ocean?” asks Widicus Weaver. “Can the ingredients for life be there? If there is some sort of biology happening on one of these worlds or even prebiotic chemistry, would we be able to see signs of that in the atmosphere?”

Collaboration on the initial research project is already yielding benefits.

“We thought about what science we wanted to do next, and we realized no one’s ever done it before,” says Widicus Weaver. “Everything we’re doing is brand new, and it is open-ended in terms of what we can do with the science. It’s completely opened my horizons in terms of research because I never would have been in a situation to be able to do this work before—I wouldn’t have had the expertise on my own.”



Professor Susanna Widicus Weaver thanks donors and members of the Department of Astronomy’s Board of Visitors. Photo by Paula Yu.

Cavagnero Group

Silvia Cavagnero is the recipient of the 2025 Emily M. Gray Award from the Biophysical Society. This honor recognizes Silvia for her development of undergraduate and graduate courses at the interface between chemistry and biology, innovation in instructional methods, mentoring students at all levels, and promoting diversity in biophysics. Cavagnero Group Ph.D. alumna **Rachel Hutchison Dietrich** has begun a faculty position at her Alma Mater, Roberts Wesleyan University in the Department of Chemistry. Rachel is teaching chemistry and biochemistry, focusing her research on discovering connections between chemistry and food science. Cavagnero Group graduate student **Jinoh Jang** was selected as an oral speaker at the 17th Midwest Protein Folding Meeting at Notre Dame University in April 2024. Undergraduate student **Sofia Merrick** received a 2024 Sophomore Research Fellowship to do research in the Cavagnero Group and undergraduate student **Evan Schmidt** has been awarded a 2024 National Science Foundation REU Research Fellowship.

Burstyn appointed to the NSF

Judith Burstyn will join the National Science Foundation (NSF) Division of Chemistry as its division director in January 2025. Judith was the Irving Shain Chair in Chemistry from 2017 to 2021. She is an accomplished researcher in biological inorganic chemistry. She has been recognized with several awards and fellowships, including selection as a Fellow of the American Association for the Advancement of Science and as an Alfred P. Sloan Foundation Fellow. She has served in several roles in service to the chemistry community, including as a member of the Editorial Advisory Board of the American Chemical Society Journal of Inorganic Chemistry and as chair of the Gordon Research Conference on the Chemistry and Biology of Tetrapyrroles.

Outreach

High School Research Intern (HSRI) Program

The HSRI Program is an exciting opportunity for students who are rising seniors to conduct authentic scientific research alongside a mentor in research labs during the summer months. Interns work over 9 weeks during the summer, earning high school credit, college credit, and the Wisconsin Youth Leadership Certificate from the Dept of Public Instruction. Interns also participate in seminar sessions throughout their experience where they learn the skills necessary for research and build connections between this opportunity and their future goals. As part of their research experience during the summer, students participated in a poster session open to the public at the UW–Madison campus.

Outreach

ChemLEAP Teacher Professional Development

This past June, 20 high school teachers from across the country met with UW researchers to consider how to focus chemistry classes on making sense of intriguing, relatable phenomena. This community grapples with challenges and opportunities that emerge when students work to figure out phenomena they experience. Tools, practices, and resources were shared to address problems of practice and to inform the design of a shared system of curricular materials. This important work has been grant-funded for the past several years. As this grant ends in 2025, the outreach office will continue to seek federal grants and private donations to support this work.

Tenure news

The Physical Sciences Divisional Committee resoundingly approved tenure cases for **Zach Wickens** and **Andrew Buller**. In the summer of 2018, Zach Wickens joined the Department of Chemistry and his research interests focus on advancing new reaction design principles to alter the intrinsic reactivity patterns of small organic molecules. These interests lie at the interface of synthetic organic, organometallic, and supramolecular chemistry. Andrew Buller has been with the department since 2017. His research is focused on how to engineer new biocatalytic reactions and to do so in a broad substrate scope, a major challenge in enzymology.

Ediger Group

Mark Ediger retired this summer. He and his former students celebrated their years together with the Supercool Symposium at the beginning of March. Twenty-eight of Mark's former Ph.D. students/postdocs were able to attend. The Symposium featured a day and a half of talks—some by former students/postdocs and some by Mark's collaborators—along with a banquet. In June, Mark traveled to England to present the Kelly Lecture at the University of Cambridge, in the Department of Materials Science and Metallurgy. A highlight of this trip for Mark was giving the lecture at the Cavendish Laboratory and seeing their scientific equipment museum. This fall, Mark spent three weeks in Spain, visiting groups with expertise in vapor-deposited glasses.

Hamers Group

The Hamers Group studies surface chemistry with a focus on nanoparticle–environmental interactions, photoelectrochemistry of diamond, and the chemistry of lithium-ion battery electrolytes. Group members have recently discovered several findings in these areas. **Connor Protter** showed how copper sulfide nanoparticles selectively bind to thiol-containing molecules such as glutathione and cysteine through a novel surface disulfide linkage, providing insights into how intentional exposure of plants to copper-based nanoparticles influence plant health and ability to resist disease. **Louis Morris** and **Cesar Ortiz** identified the critical chemical pathway by which Silatronix organosilicon electrolytes inhibit the autocatalytic reactions that lead to lithium-ion battery failure. **Anand Ode** and **Nate Rieders** are studying the fundamental pathways by which diamond surface and nanoparticles emit electrons into water, producing solvated electrons and other high-energy reaction intermediates. Nate has implemented a highly sensitive transient absorption apparatus able to directly measure the spectrum of solvated electrons and other intermediates produced at surfaces.

The next year will be a year of big transitions. The NSF Center for Sustainable Nanotechnology that Bob leads will complete its 13-year funding run in August 2025. A symposium at the ACS Spring 2025 meeting in San Diego on “Nanomaterials and Sustainability: A Chemistry Perspective” will highlight some of the CSN's successes. Bob's last (70th) Ph.D. student will also graduate this year. After that Bob is looking forward to staying research-active by playing in the lab himself.

Hamers Group alumni are planning an all-group reunion in Madison the weekend of July 25–27, 2025. All former group members at any level, 1990–present, are welcome to participate. Anyone interested should contact Bob at rjhamers@wisc.edu to get on the event mailing list.

Lab Notes

Background: The Boros Group. Left to right: Darek Śmiłowicz, Owen Glaser, Eszter Boros, Emma Phuong Tran, Minhua Cao, Zhouuran Zhong, Georgia Sands, Axia Marlin, Andrey Joaqui, Abhijit Bera, Edith Amason, Morgan Dierolf, Jennifer Whetter

Inset: The Weix Group

Boros Lab

The **Boros** research group is a multidisciplinary team of chemical biologists, imaging scientists, and medicinal inorganic chemists who apply coordination chemistry and an extensive toolkit of transition and rare-earth metals to develop molecular imaging probes and therapeutic agents for personalized medicine.

The Boros Lab has also focused its efforts on studying metallophores—natural products that play a crucial role in transporting essential trace metals in bacteria—with the aim of gaining deeper insights into the chemistry and biology of these ion carriers essential for bacterial survival. This research seeks to uncover ways in which these mechanisms can inspire and guide the development of new antibacterial drugs.

Since relocating to Madison in the summer of 2023, the Boros Lab has achieved significant milestones, establishing strong collaborative networks within the UW community. These connections have fostered highly productive collaborations, especially with research groups at the University of Wisconsin

School of Medicine and Public Health (SMPH). In one of the lab's latest collaborative publications, led by **Wilson Lin** (member of the Engle Lab, in the Department of Medical Physics) and **Dariusz Śmiłowicz** (Boros Lab member), the team explores azamacrocyclic ligands as chelators for cobalt and examines how these ligands influence the oxidation state ($\text{Co}^{2+}/\text{Co}^{3+}$) of cobalt complexes. Through spectroscopic, electrochemical, and radiochemical methods, the study reveals structural features of azamacrocyclic ligands that allow for precise control over the radioactive cobalt's redox behavior. These findings are crucial in guiding the selective synthesis of stable cobalt coordination complexes, particularly those incorporating the radioisotopes cobalt-55 and cobalt-58m, a promising pair for the development of dual-purpose diagnostic and therapeutic agents useful in nuclear medicine. Furthermore, this work provides the basis for redox-sensitive radiopharmaceuticals that can selectively deliver the isotope in especially reducing environments, such as hypoxic cancer tissues.

Weix Group

Research in Professor **Daniel Weix's** group is focused on the development of new, catalytic methods for forming C-C and C-X bonds, with a particular emphasis on understanding mechanism and the use of first-row transition metals. The major focus of the group continues to be the selective cross-coupling of two electrophiles and the use of earth-abundant, first-row metals. Big advances in the past year were new ways to discover ligands, new mechanisms for accessing alkylnickel intermediates, new coupling partners, and advances in electrochemistry (in collaboration with the **Stahl, Rafiee, and Paton** Groups). To document the tremendous growth of cross-electrophile coupling over the past decade, Dan and his group have written an accepted review article for *Chemical Reviews* on the topic—it is 173 pages and has over 600 references. In the past year, a paper on the topic was published about every 48 hours.

Dan has been teaching Organometallic Chemistry of the Transition Elements and Structure Determination for the past few years and has learned so much while continuing to refine the excellent materials developed by his colleagues. Teaching these classes has had a big influence on his own research program, especially the new decarbonylative chemistry in the group.

This year included many comings and goings. **Sileen Alomari** graduated in May, her paper with **Omar Beleh** was published in August, and she is applying to medical training programs. At the same time, **Isabella Priest, Benjamin Ahern,** and **Tianrui Wu** passed their oral exams and were awarded master's degrees. **Alyssa Olszewski,**

Julianna Mouat, Alex Cruz, and Anthony Castro all passed their research proposal and advanced to Ph.D. candidacy. **Michelle Akana** (Ph.D. '23) completed her Ph.D. work

and moved to the Boston area with labmate/soulmate **Brett Akana-Schneider** (Ph.D. '23). They are both pursuing postdoctoral training, Michelle at USARIEM (Buller) and Brett at Boston University (DeRosa). **Nathan Loud** (Ph.D. '23) is now the director of the Univ. of Pennsylvania High Throughput Experimentation Center. Finally, **Mareena Franke** (Ph.D. '24) departed for a process chemistry job with Gilead in Edmonton, Canada. Many new undergraduate students joined the group and departed over the summer and fall, including **Zachary Farmer** (UW-Madison), **Cristian A. Morales-Borges** (Univ. of Puerto Rico-Cayey), **Ethan Duy Pham** (UW-Madison), **Jason Nguyen** (UW-Madison), undergraduate student **Gray Cicmanec** (UW-Madison), **Chuxiong Meng** (UW-Madison), and **Sarah Danielson** (UW-Madison). The group also welcomed Ph.D. student **Herman Recendiz** to the group. Herman is from Dallas but did his undergraduate training at Lawrence University in Wisconsin.



Feature

The Paul J. Bender Chemistry Instrumentation Center: Advanced instrumentation and education to support discoveries

By Ilia Guzei and Kimberly M. Hazen

Nuclear magnetic resonance (NMR) spectroscopy provides detailed information about the structure, dynamics, reaction state, and chemical environment of molecules.

In the 1920s, the Department of Chemistry at UW–Madison was already recognized as a center for chemical instrumentation that attracted outstanding scientists such as **The Svedberg**, the famous Swedish physical chemist who developed the modern ultracentrifuge. Professor **Villiers Merloche** who joined the department around this time also recognized the importance of chemical instrumentation and in the late 1920s, a small instrumentation center was established on the first floor of the chemistry building, which is now known as Chamberlin Hall.

In the late 1950s, Professor **Paul Bender** led the development of the Chemistry Instrumentation Center. To Professor Bender, the importance that students understand the experiments being performed was the hallmark of the center's operations. This, and the philosophy of hands-on learning allowed students using the instruments to not only collect their own data but to fully understand the science behind the measurements. The culture of guidance and understanding is still a priority for the center today. Years after Professor Bender's retirement, the facility was renamed the Paul J. Bender Chemistry Instrumentation Center (PBCIC) in recognition of Professor Bender's contributions. Later, a bequest from Professor Bender and his wife **Margaret McLean Bender** stabilized the financial security of the center.

"I worked closely with the instrumentation team to get publishable kinetic NMR data," Kim explains. "Without the insight I received from the instrument data, I am uncertain if I could have achieved half of what I have done."

—Jed H. Kim

Today, the PBCIC employs six award-winning Ph.D. scientists with Professor **John Berry** serving as its director. **Dr. Heike Hofstetter**, **Dr. Cathy Clewett**, and **Dr. Gabi Carosio** provide guidance and expertise for magnetic resonance (NMR and EPR), **Dr. Martha Vestling** serves as the director of the mass spectrometry labs, **Dr. Ilia Guzei** is the center's X-ray crystallographer, and **Dr. Bob Shanks** provides expertise for mass spectrometry, X-ray, and electron paramagnetic resonance facilities. There are also four teaching assistants employed by the center.

Graduate student **Jed H. Kim** says the NMR instruments and guidance are critical to his research. "I worked closely with the instrumentation team to get publishable kinetic NMR data," Kim explains. "Without the insight I received from the instrument data, I am uncertain if I could have achieved half of what I have done."

Staying on the cutting edge of instrumentation development and maintaining the center's state-of-the-art instruments valued at more than \$11.3 million is no easy task. Fortunately, UW–Madison has recognized the critical role of the PBCIC in the scholarly enterprise of the department and the university by awarding the center three recent UW–Madison Research Core Revitalization grants: "Replacement and Upgrade for Workhorse GCMS in the Chemistry Instrument



Dr. Ilia Guzei, director of the X-ray lab, and graduate student Danica Gressel (Fredrickson) discuss an X-ray diffraction measurement.

Center for Characterization of Small Molecule Synthesis Products and Side Products" (PI Prof. John Berry) in 2020, "Upgrade for Workhorse 500 MHz NMR for Catalysis and Materials Research" (PI Prof. **Ive Hermans**) in 2022, and "Acquisition of a Workhorse Single-Crystal X-ray Diffractometer in the Molecular Structure Laboratory that will Replace and Upgrade Two Older Diffractometers" (PI Prof. John Berry) in 2024. Other avenues for funding include federal grants, the university's Instructional Laboratory Modernization grants, bequests, private donations, and corporate sponsorships.

Pushing the boundaries of scientific research requires a strong knowledge of the chemistry fundamentals and experimental techniques, thoughtful investigation, and



The Paul Bender Chemistry Instrumentation team pictured left to right: Dr. Ilia Guzei, Leah Garman, JP Habumugisha, Y Dang, Dr. Martha Vestling, Dr. Robert Shanks, Dr. Cathy Clewett, Dr. Heike Hofstetter, Julianna Mouat, Dr. Gabi Carosio

precise measurements. The center boasts the state-of-the-art equipment that you expect to find at a world-class research institution. Yet, equipment alone cannot support researchers in their goals to confirm discoveries, analyze compounds, and measure their properties.

That is why six experts in the fields of magnetic resonance, mass spectrometry, crystallography, and instrumentation science provide advice, education, and guidance in the characterization of new compounds and synthetic intermediates, and aid in the design of

“The instrumentation center is the heart of the UW–Madison Chemistry department. When prospective students tour the chemistry building, the instrumentation center is a key resource that they are excited about and remember from their visit.”

–Tahoe Fiala

highly customized experiments. Investigating more than 150,000 samples yearly, the center supports over 3,000 undergraduates and 360 graduate and postdoctoral students in chemical, environmental, life, material sciences, and engineering fields across the UW–Madison campus, the nation, and the world. The PBCIC offers exactly what these investigators require—high throughput and precision measurements, and both routine and custom-designed experiments.

The PBCIC is engaged in the research education of the next generation of scientists; the center is integrated into the curriculum at the BS, MS, Ph.D., and post-doctoral

levels. All the CIC staff teach at the graduate level in core classes as well as provide individual instruction, and students as early as their sophomore year use the facility as a major component of their classes.

Graduate student **Jennifer Whetter** works in the Boros Group which is focused on developing radiopharmaceuticals for diagnosis and treatment of cancer. Through this work, Whetter makes scandium complexes that also contain hydrogen, carbon, fluorine, and phosphorus. Whetter explained that the NMR-active isotopes of these atoms enable her to probe the chemical environment of the metal complexes, which informs the understanding of the radioactive analogs. For Whetter, instruction from the center has been invaluable and exceptionally student-focused. “It has proven to be a very friendly learning environment where it is safe to ask questions and try new things,” explained Whetter. “This environment has helped me grow into a more competent, curious, and independent spectroscopist.”

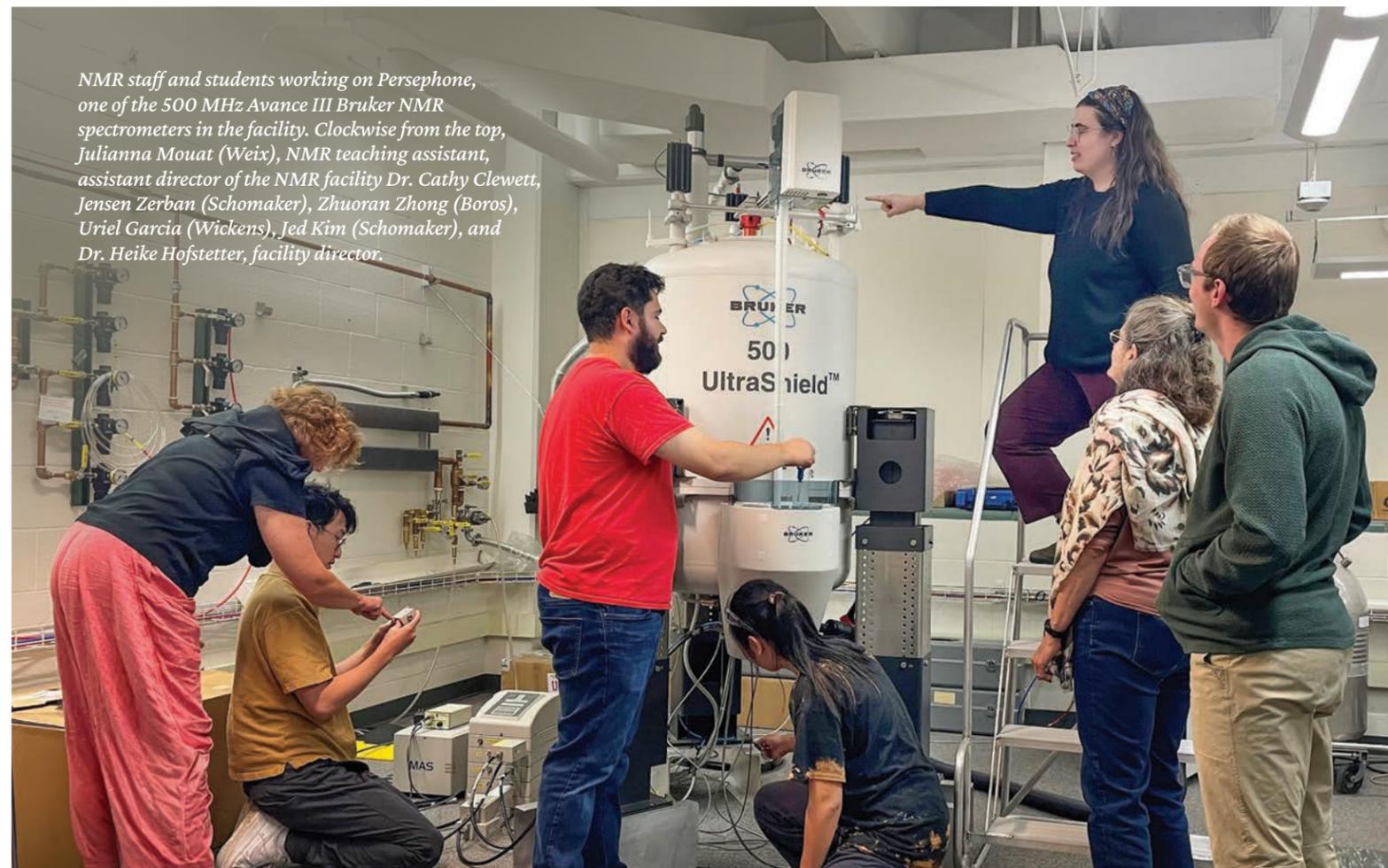
The center’s scientists have authored and co-authored more than 840 patents, workshops, short courses, presentations, and publications, some of which grace journal covers. In the last decade, at least 439 publications mentioned successful national grants obtained by the Chemistry Department’s members to purchase shared instruments hosted in the PBCIC. These publications appeared in premier scholarly journals such as *Nature*, *Science*, and the *Journal of Chemical Education*.

As state-of-the-art scientific instrumentation continues to play an essential role in modern chemistry, the PBCIC aims to stay on the forefront of discovery with the latest instrumentation and expert instruction. **Tahoe Fiala**, a graduate student in the Yoon lab, says he is grateful to have access to the center. “The instrumentation center is the heart of the UW–Madison Chemistry Department,” Tahoe explains. “When prospective students tour the chemistry building, the instrumentation center is a key resource that they are excited about and remember from their visit.”

Dr. Martha Vestling, director of the mass spectrometry labs, evaluates data from the Thermo Q Exactive Plus (orbitrap) mass spectrometer with postdoc Ariel Kuhn (Gellman), graduate student Lauren Eehalt (Weix), and undergraduate student Gray Cicmanec (Weix).



NMR staff and students working on Persephone, one of the 500 MHz Avance III Bruker NMR spectrometers in the facility. Clockwise from the top, Julianna Mouat (Weix), NMR teaching assistant, assistant director of the NMR facility Dr. Cathy Clewett, Jensen Zerban (Schomaker), Zhuoran Zhong (Boros), Uriel Garcia (Wickens), Jed Kim (Schomaker), and Dr. Heike Hofstetter, facility director.



Recognition: Awards & Achievements

Faculty

Tim Bertram
2024 Vilas Mid-Career Investigator Award

2024 American Geophysical Union, Ascent Award

2024 Arnold and Mabel Beckman Foundation

Helen Blackwell
2024 Alexander M. Cruickshank Lecturer at the Gordon Research Conference on Chemistry and Biology of Peptides

Eszter Boros
Research Corporation for Science Advancement, 2024 Scialog Collaborative Team Awards

Research Corporation for Science Advancement, 2024 Scialog Fellow

A.J. Boydston
2024 D2P SEED Award

Thomas Brunold
2024 Taylor Teaching Award

Silvia Cavagnero
2025 Emily M. Gray Award

Josh Coon
ACS 2024 ANYL-Award in Chemical Instrumentation

Kyoung-Shin Choi
Elected to the American Academy of Arts and Science—2024

Sam Gellman
American Peptide Society, 2023 R. Bruce Merrifield Award

Xuhui Huang
Research Forward 2024 Award

Bob Hamers
2024 Hilldale Award

2024 Cool Science Image Award

M. Thomas Record, Jr.
Biophysical Society, 2024 Ignacio Tinoco Award of the Biophysical Society

Marcel Schreier
Research Corporation for Science Advancement, 2024 Scialog Fellow

Lloyd Smith
2025 Ralph N. Adams Award in Bioanalytical Chemistry

Shannon Stahl
Elected to National Academy of Science—2023

Ryan Stowe
Named Morgridge Fellow for 2024

Zoe Todd
2024 Scialog Fellow—Research Corporation for Science Advancement

Research Forward 2024 Award

Susanna Widicus Weaver
2024 National Academies—Chemical Sciences Roundtable

Research Forward 2024 Award

Tehshik Yoon
2024–25 Mid-Career Kellett Awardee

Martin Zanni
ACS 2024 Fellow

2024 Member of the Packard Fellowships for Science and Engineering Advisory Panel

Staff

Emily Bennin
2023 L&S University Staff Excellence Award

Amanda Buchberger
2024 Forward in Access Award

Pam Doolittle
2024 Forward in Access Award

2024 Taylor Teaching Award

Lea Gustin
2024 L&S Early Career Award

Erin Hale
2024 Departmental Staff Award

2024 University Staff Recognition Award

Agnes Lee
2024 Office of Academic and Career Success Outstanding Achievement Award

Jim Maynard
2024 Emmy Nomination

Katie McCullough
2024 L&S Early Career Advising Award

Student

Abayomi Awoyomi
2024 NOBCCHE Graduate Rising Star Award

Zehua Chen
2024 ACS PHYS Young Investigator Award

2024 ACS COMP Wiley Outstanding Postdoc Award

Christopher Dade
American Society for Microbiology 2024 Brad Fenwick Fellowship for the Advancement of Civic Science

Lauren Fields
2024 ACS Analytical Chemistry Graduate Fellowship

Catherine Getty
2024 NDSEG fellowship

Jed Kim
2024 ACS Division of Medicinal Chemistry Predoctoral Fellowship

Eric Kohn
2024 CAS Future Leader

Philip Lampkin
2024 Campuswide TA Award

Haocheng Liang
2-year NASA 2024 FINESST fellowship

Katelyn Michael
2024 12th Annual Young Chemist Award sponsored by Metrohm

Willa Mihalyi-Koch
2024 ACS Graduate Student and Postdoctoral Scholars Recognition Program

Ashley Ogorek
2024 ACS Division of Biological Chemistry Young Investigator Award

Sophia Vogelsang (Bergmann)
2024 Attendee at Ultrafast X-ray Summer School at the SLAC National Accelerator Laboratory

Yiwen Wang
2024 MolSSI Fellowship

Sam Wood
2024 Humboldt Research Fellowship

2024 NSF Award Winners:

Jackson W Wysocki, Amory Francis Griffin, Brian Foster, David E. Hardy, Mallory C. Wilson

2024 NSF Honorable Mentions: Olivia Maguire Duke, Catherine Getty, Matthew Fischer, Andrew J. Perciaccante, Herman Recendiz, Rodrigo Villanueva

Department of Chemistry earns regional MAGS recognition for DEI efforts

by Kimberly M. Hazen

The Bridge to the Doctorate Fellowship Program (Bridge Program) and initiatives to advance diversity, equity, and inclusion (DEI) have earned the University of Wisconsin–Madison’s Department of Chemistry the 2024 Award for Excellence and Innovation in Graduate Education from the Midwest Association of Graduate Schools (MAGS). The award recognizes and rewards specific excellence and innovation in graduate education, from admissions through degree completion. DEI initiatives within the Department of Chemistry and steering committee members **Dr. Desiree Bates**, Professor **Bob Hamers**, and Professor **Sam Pazicni** of the Department of Chemistry were nominated by **William J. Karpus**, Dean of the UW–Madison Graduate School.

The DEI steering committee created initiatives for recruiting, retention, and transition to a degree with one goal: to increase the diversity of students who complete a Ph.D. in chemical sciences. These initiatives include the Chemistry Opportunities (CHOPs) recruiting weekend, the Bridge program, and the Catalyst mentoring initiative. Before these efforts, the UW–Madison Department of Chemistry Ph.D. graduates numbered 149 with 6.7% coming from underrepresented minority groups. Just a few years later, individuals from these groups make up 14.5% of Ph.D. graduates.

CHOPs is a recruiting event that allows prospective students from a variety of backgrounds to explore the Ph.D. program at no expense. It is supported by Dow Chemical Corporation and Procter & Gamble (P&G).

P&G Senior Vice President Gerard Baillely says P&G has a long history of recruitment with the department and supporting these efforts makes sense. “We serve consumers all over the world with different backgrounds from different communities,” remarks Baillely. “It’s important that we have employees and talents who empathize with people from different backgrounds.”

PPG Industries-funded Catalyst supports incoming students in their transition to graduate studies and helps them settle into their new life in Madison.

The Bridge Program is a 22-month Research Master of Science degree program specifically designed to provide students with a range of experiences and mentorship. The program is funded by the generosity of PPG Industries, P&G, the UW–Madison Graduate School, and the UW–Madison College of Letters and Science.

Dr. Desiree Bates, who has been spearheading department diversity efforts for years, believes this award is co-owned by hardworking students in the program like Bridge Fellow **Shannon Brown**.

“Initially, attending graduate school was not on my radar,” Shannon explained. “My primary goals were to achieve a bachelor’s degree with as little debt as possible and join the workforce [...] the Bridge Program created the opportunity for me to examine if graduate school—a space I would otherwise have been unlikely to exist in—was the right place for me.”



Top: Dr. Desiree Bates accepts the 2024 Award for Excellence and Innovation in Graduate Education from the Midwest Association of Graduate Schools in April 2024. Bottom: Bridge Program Fellow Shannon Brown

New Faces, New Changes

Since January 2024:

New Faculty

Julian Cooper, Assistant Professor (Featured on pp. 21-22)

New Staff

Gabi Carosio, Instrumentation Scientist

Peter Jaeger, Chemistry Outreach Manager

Aaron Kluck, Financial Specialist

Bryan Wakefield, Director of Undergraduate Chemistry Research (not pictured)

Dylan Walsh, Scientist (not pictured)

Changes

Amanda Buchberger Jones, Associate Laboratory Director for Analytical Chemistry to Analytical Chemistry Lab Director

Cathy Clewett, Scientist to Assistant Director Magnetic Resonance (not pictured)

Pam Doolittle, Analytical Chemistry Lab Director to Undergraduate Program Director

Heike Hofstetter, Associate Director Magnetic Resonance to Director Magnetic Resonance

Asmaul Hogue, Research Associate to Scientist (not pictured)

Carolyn Karls, Financial Specialist to Research Administrator

Rie Takagi Fredrickson, Scientist to Scanning Electron Microscope Scientist

Blaise Thompson, Associate Instrumentation Technologist to Analytical Lab Director



Left to right: Pam Doolittle, Peter Jaeger, Aaron Kluck, Blaise Thompson, Gabi Carosio, Rie Takagi Fredrickson, Amanda Buchberger Jones, Carolyn Karls



Assistant Professor Julian Cooper

Julian Cooper joined the Department of Chemistry this past summer as an assistant professor to research and unlock new modes of chemical reactivity in materials.

The plan for the Cooper Group is to combine the tools of chemistry, materials science, and mechanics to develop new ways to make materials and alter the capabilities of existing materials. "At the fundamental level, we will advance new ways to think about chemical reactivity," Julian explains. "More broadly, this research will help address a variety of existing challenges in materials, including challenges in sustainability, energy storage, and materials performance." For now he says they're working on many different possibilities, "Right now, we're kind of spreading in different directions, hoping that something sticks." He says he is specifically interested in optimizing both the performance and recyclability of polymer materials, two qualities that generally run counter to each other. He says, "The stronger the material, the harder it is to recycle." Julian is investigating approaches to use chemistry and mechanical characterization techniques to bridge the difference.

ASSISTANT PROFESSOR JULIAN COOPER

Ph.D. in Chemistry from
**Massachusetts Institute
of Technology (MIT)**

B.S. in Chemistry from
Rice University

Retirements

Faculty

Mark Ediger, Professor

Clark Landis, Professor

Staff

Jeanne Hamers, Undergraduate
Program Director

Robert McClain, Analytical Lab Director

Cecilia Stodd, Research Administrator

Attendees at the "Supercool Symposium: Adventures in Liquids and Gases" pose with retiring professor, Mark Ediger in March 2024.



Julian's interest in science began at an early age through a childhood that was anything but ordinary. "I grew up all over the world," he explains. His dad, a geologist, worked for an oil and gas company and his family moved around a lot. He began school in Milan, Italy as a student in an Italian public school. "Initially it was hard," he says as he

"At the fundamental level, we will advance new ways to think about chemical reactivity."

—Assistant Professor Julian Cooper

explains the two stints in Italy, one from when he was 10 months old until four years old and one from when he was six until age 10. "I was lucky to have a teacher in first grade who studied in the US and had some proficiency in English to help me out but my mom and dad didn't speak Italian."

His early exposure to science was a periodic table placemat. While he was always curious about nature, his dad would talk often about rocks during childhood road trips. "I got tired of rocks," he says. "I'll be honest." And while he knew he didn't want to be a geologist, he thought it was "super cool to know how things worked." He said he studied the periodic table on the placemat

at the family table every morning from the time he was 10. By middle school, he understood how elements were organized.

Julian earned a Bachelor of Science degree in chemistry from Rice University in 2014 and a Ph.D. in chemistry from Massachusetts Institute of Technology (MIT) in 2019. Most recently, he has been conducting postdoctoral research at the University of Illinois at Urbana-Champaign, where he worked for Prof. Jeffrey Moore in a highly interdisciplinary lab applying chemistry in new ways to tackle pressing real-world challenges.

Now at UW-Madison, Julian is putting his understanding and training to work, getting his lab set up and enjoying being a first-time homeowner. "Between unpacking boxes in the lab and unpacking boxes at home, if I never see another box again for the rest of the year, I'll be okay," he laughs. "But things are getting off the ground," Julian explains. "We're not running on full cylinders yet, but we have run some experiments and have tested hypotheses."

With the rotation of graduate students this fall, Julian had a first-year student in his lab for a few weeks. He says he's excited to get his first cohort of students in the lab and get started. For now, he's working with an undergraduate student who he says "has been phenomenal."

Beyond research, Julian is a big fan of playing golf. As he settles into to exploring his new city, he's already hit the links at many of the courses around town.



Prof. Cooper hit the links on the Big Island (Hawaii) in December 2020. Courtesy: Julian Cooper



Chemistry Learning Center: Sparking student success

By Prior Turnmeyer-Clark

The Chemistry Learning Center (CLC) is far more than a tutoring hub—it's a space where dedicated educators transform student struggles into triumphs. At the core of this center is a team passionately committed to student success, fueled by a shared belief that every student has the potential to excel and feel at home in their academic journey.

Tracey Reitz, the CLC's director and an alum of UW-Madison herself, embodies this dedication. What began as a temporary position turned into a calling. "I thought it was just a job. I planned to stay for a year, but here I am, nine years later, and now the director. I absolutely love what we do here, and I'm incredibly passionate about it," she shares. This enthusiasm radiates throughout the CLC, shaping an environment where students are seen not just as learners, but as individuals with unique stories and potential.

"The CLC is more than just a learning center—it is a space where students can connect, build their confidence, and realize their potential."

—Shashank P.

Serving a diverse range of students, from first-generation college students to those navigating financial challenges, the CLC takes an individualized approach. Here, students find a safe space to explore and grow, free from the pressures of grading. "There's a different dynamic because we're not grading them. We get to focus on really teaching, and that's so rewarding," says Tracey. This approach is significant for

CLC students play Jeopardy as a review in the Learning Studio. Courtesy: Tracey Reitz

students who may feel out of place in a large university setting, creating a foundation of trust and belonging.

"The CLC is more than just a learning center—it is a space where students can connect, build their confidence, and realize their potential," says Shashank P. "It is essential in fostering academic success and personal development for many students at UW-Madison."

The CLC's collaborative and inclusive team culture amplifies this mission. "It's such a comfortable and supportive environment for learning," says Hasti G., a student at the center. "Every time I've gone to the CLC, I've always walked away having learned something new. It's the perfect place to fill in knowledge gaps and strengthen your understanding of key concepts." The CLC staff's main focus is to foster an environment where students feel confident asking questions and where learning feels natural and accessible.

With new funding, the CLC has expanded its reach, adding more staff to support students in the key areas of general and organic chemistry. They're also developing an online Canvas platform, allowing students across campus access to CLC resources. These innovations represent the CLC's ongoing commitment to broadening access and meeting students wherever they are on their academic path.

Since its inception in 1974, the CLC has been a lifeline for thousands of students, offering not just academic support but also a sense of community and encouragement. As Tracey puts it, "The CLC is all about the person—it's about the student." And through their passion, the CLC staff continues to make a difference, one student at a time.

The Newest Badger Chemists

Congratulations to our recent graduates.

Baccalaureate Bachelor of Science, Chemistry Major

December 2023

Zukun Chen
Dan Poellinger
Natalie Schuler

David Jia-Cheng Sun
Nathaniel Xiong

May 2024

Bahar Abtahi
Emily Adams
Sileen Alomari
Diego Arredondo
Emma Baumgardt ^H
Eviana Berthel
Jacob Bloecher ^H
Sarah Bulvan
Elise Burkhartzmeyer
Josephine (Josie) Colombe
Colin Crawford ^H
Bianca Czeslawski
Elliot Delfosse ^H
Mikaela Ann Hansen DeMartelaere
Amy Fang
Amory Griffin ^H
Jeongsoo Han
Josie Jauquet
Sarah Kapsner
Mahak Kathpalia

Sung June Kim
Annika Kline
Oliver Kuphal
Harrison (Harry) Lambert
Nolan Langer
Alexander Lemmenes
Sirawit Lertwiriyaipiti ^H
Katherine (Kate) McKay
Keegan Miller
Harithe Mohd Hanafi
Lillian Mostek
Carter Norton
SeongYoon (Yoon) Oh
Nicholas Papacosta
Molly Patridge
Muhammad Kasyful Azhim Bin
(Kasyful) Roslan
Jonathan Schimmels
Emily Schmitt ^H
Elizabeth Schnorrenberg



Chemistry majors at the May 2024 graduation celebration. Photo: Ilia Guzei

Bradley Allen Flannery Shepherd
Sarah Swineheart
Tom Tan
Victoria Tholkes
Javier (Javi) Valle Caffi
Rodrigo Villanueva Jr.
Hayoung Yi
Yi Yu
Christopher (Chris) Zhang
Atticus Zhang

^H Graduating with Comprehensive Honors
^H Graduating with Honors in the Liberal Arts
^H Graduating with Honors in the Major

August 2024

Derek Argall
Blake Dallmann
Soorya Davanagere
Maelia Dziedzic

Saul Hansen-LeBlanc
Ryan Lauer
Maxwell Norman

Graduate Master of Science

December 2023

Dairen Jean (McMahon)

May 2024

Ruojia Li (Boydston)
Evan Draxler (Choi)

Jazmyn (Mayeli) Vivaldo-Nikitovic
(McMahon)

August 2024

Aminata Diaby (Stahl)
Collin Oi (Hermans)
Jorge Rivera-Colon (Pazicni)

Ph.D.

December 2023

Austin Vincent Carr (Smith)
Novel Algorithms and Software for the Acquisition and Analysis of Mass Spectrometry-Based Proteomics Data

Hillary Dequina (Schomaker)
Progress Toward the Total Synthesis of Nogalamycin and Expanding the Scope of Heterocycles in DNA-Encoded Libraries

Catherine Elisabeth Earl (Hamers)
Reciprocal Redox of Biomolecules on Metal Oxide Nanomaterial Surfaces

Jonathan M. Ellis (Buller)
Biocatalytic Synthesis of γ -Hydroxy Amino Acids and Computational Exploration of Sequence-Activity Landscapes

Laura Dynan Elmendorf (Brunold)
Combined Spectroscopic and Computational Studies of Free and Enzyme-Bound B12 Species

Adam Michael Hilbrands (Choi)
Development of Bi-Based Photoelectrodes for Solar Fuel and Chemical Production

Louis V. Morris (Hamers)
Understanding the Reactivities and Mechanisms of Action of Organosilicons As Additives for Next-Generation Lithium-Ion Battery Electrolytes

Ashley Phetsanthad (Li)
Developing Mass Spectrometry-Based Strategies for the Enhanced Characterization of Biomolecules in the Nervous System

Thomas John Polaske (Blackwell)
*Discovery and Development of Small Molecule Probes for the Study of Quorum Sensing in the Bacterial Pathogen *Staphylococcus aureus**

Madeleine Grace Roberts (Burstyn)
Carbon Monoxide-Dependent DNA Binding of Heme-Containing Transcription Factors CooA and RcoM

Cody Alan Schilling (Boydston)
Towards Chemical Length-Scale Control in Additive Manufacturing: Innovations in Polymer Material Design and Technology

Chase Parker Schultz (Widicus Weaver)
Rotational Spectroscopy of Prebiotic Molecules

Karina Targos (Wickens)
New Strategies in Oxidative Bond Formation

Zhongrui Zhang (Tang)
Expanding the Horizon of Proteolysis Targeting Chimeras (PROTACs) in Rapid Platforms, CLIPTAC, and the Exploration of E3 Ligase Substrate Receptors

Min Zhu (Gong)
Guanidium-Rich Lipopeptide-Based Nanoparticles Efficiently Deliver Genome Editors in Skeletal Muscles and Retinal Pigment Epithelium

Photo: Ilia Guzei



Ph.D. recipients at the May 2024 graduation celebration. Photo: Ilia Guzei



Photo: Ilia Guzei

May 2024

Brett Daniel Akana-Schneider (Weix)

Expansion of Reductive Cross-Couplings: Reductive Arylation of Nitroarenes and Improved Methods for Nickel-Catalyzed Cross-Electrophile Coupling

Michelle Elizabeth Akana (Weix)

Computational Approaches to Improve Catalyst Design in Nickel-Catalyzed Cross-Electrophile Coupling

Hung H. Dang (Cavagnero)

Exploring Kinetic Controlled Protein Solubility Under Physiologically Relevant Conditions

Sean Richard Gitter (Boydston)

Polymer Design Enabled by Catalysis

Ruixian (Eric) Han (Rienstra)

Solid-State NMR Methods and Applications at High Magnetic Fields

Delaney Brenna Kilgour (Bertram)

Marine Reactive Trace Gases and Their Impacts on Atmospheric Chemistry in the Marine Boundary Layer

Joseph Yoojong Kim (Wright, E.)

Development and Application of Cryo-Electron Tomography Technologies for Neuronal Cell Biology

Tae Wook Kim (Gellman)

Study of Ligand-Receptor Interaction of the Parathyroid Hormone Receptor Type 1 and Its Intracellular Trafficking

Xin Yi Amber Lim (Fredrickson)

18-n+m Isomerism in Transition Metal-Main Group Intermetallics: Chemical Pressure-Directed Configurations of Electronically Viable Structures

Karli Ashton Lipinski (Hoskins)

Influence of Spliceosome Proteins on RNA Interactions in Pre-mRNA Splicing

Nathan Lee Loud (Weix)

High-Throughput Enabled Cross-Electrophile Couplings of Heteroaryl Electrophiles

Connor Robert Protter (Hamers)

Surface Interactions and Applications of Copper Sulfide

Vincent P. Rigoglioso (Boydston)

Assessing and Optimizing the Performance of Photoredox-Mediated Metal-Free Ring-Opening Metathesis Polymerization in Batch and Flow Reactors

Christopher Robert Roy (Jin)

Heterostructures and Hyperspectral Microscopy of Lead Halide Perovskite Semiconductors

Emily Zerull Schroeder (Schomaker)

Expanding the Scope of Intramolecular Silver-Catalyzed Nitrene Transfer: Enantioselective Aminations and Chemoselective Dearomatizations

William Thompson (Widicus Weaver)

Tracing Chemical Complexity From the Laboratory to the Cosmos

Alicia Marie Tripp (Hamers)

Surface Functionalization of 2D Nanomaterials

August 2024

Meghan Elise Campbell (Buller)

Stereoselective Biocatalytic C–C Bond Formation for the Generation of γ -Hydroxy Amino Acids and Exploration of Promiscuity-guided Engineering Methods for the Development of Generalist Biocatalysts

Alyah Faith Chmiel (Wickens)

Potent Photoreductants for Organic Synthesis

Mario A. Cribari (Martel)

Enzymatic Catalysis With Applications in Organic Synthesis and Plastic Waste Degradation

Kimberly Sue Deglopper (Stowe)

How Assessments Influence the Conceptual Ideas Students Invoke for Explaining Chemical Phenomena and Modeling and Characterizing Epistemic Ideas for Teaching and Learning Chemistry

Mareena Cindy Franke (Weix)

Selectivity, Scalability, and Sustainability in Cross-Electrophile Coupling Using Electrochemistry

Melissa Nicole Hall (Stahl)

Leveraging Heterogeneous Metal on Nitrogen-doped Carbon Materials for Aerobic Oxidation Catalysis: Fundamentals and Application to Diazo Compound Synthesis

Yun Hu (Schomaker)

Design, Synthesis, and Applications of Heterocyclooctynes and Small-Strained Rings: Advancing Bioorthogonal Chemistry and DNA-Encoded Libraries

Jacob Henry Jansen (Hermans)

Heterobimetallic Lewis Acid Catalyst Development for Polyesterification and Depolymerization

James Christopher Langford (Yang)

Accurate Quantum Descriptions of Proton and Electron Motion in Molecular Systems

Yejung Lee (Ediger)

Stability and Structure of Two-Component Vapor-Deposited Glasses of Organic Semiconductors

Matthew Steven Lish (Golden)

Development of a Quinazolinone-Focused, Mannich-Coupled, Domino Rearrangement and Its Utility in the Discovery and Optimization of Anti-Amoebic Scaffolds

Ashley Nicole Ogorek (Martell)

Design and Evolution of Biological Macromolecules for Applications in Proximity Labeling and Plastic Degradation

Katherine Anne Parrish (Goldsmith)

Investigating Chiral Light-Matter Interactions in Photonic Materials

John Gerrit Pavek (Smith)

Development of Methods to Improve the Efficiency of Proteoform Identification by Mass Spectrometry in Complex Systems

Edward Bay Pimentel (Martell)

Development of DNA-Based Tools for Enzyme-Mimicking Catalysis and Catalyst Discovery

Kyana M. Sanders (Fredrickson)

Designing Modular Intermetallic Compounds with Chemical Pressure: Intergrowth Assembly Principles Derived from the Entanglement of Interface Nuclei

Emma E. Santa (Blackwell)

*Investigating the Mechanisms of LuxR-Type Quorum Sensing Receptor Activation and Inhibition in the Opportunistic Pathogen *Pseudomonas aeruginosa**

Jason Michael Scheeler (Wright)

Spatially and Temporally Resolved Spectroscopy of Transition Metal Dichalcogenide Semiconductors

Cara Elizabeth Schwarz (Stowe)

Exploring Students' Conceptual and Epistemic Learning in Model-Centered Chemistry Courses

Jamorous Smith (Buller)

Leveraging the Promiscuity of PLP-Dependent Enzymes to Generate Useful Biological Tools

Julia Devorah Byron Smith (Gopalan)

Synthetic Methodologies to Tune Mixed Polymer Brush Morphology

Zhiming Su (Stahl)

Nickel-Catalyzed Cross-Electrophile Coupling: Methodology Development and Mechanistic Insights

Jonathan Samuel Van Buskirk (Fredrickson)

Identifying Solutions to Packing Frustrations in Complex Intermetallics

Zhongyi Wan (Schmidt)

Computational Modeling of Solid-phase Epitaxy in Polymorphic and Complex Oxides

Fengrui Wang (Lynn)

Design of Functional Soft Materials for Environmental Sensing and Antifouling Applications

Rui Wang (Jin)

Modular Electrochemical Synthesis and Resource Recovery Using Ion-Selective Redox Reservoirs

Eric Paul Weeda (Stahl)

Single-Step Aerobic Depolymerizations of Lignin to Oxidized Aromatics

Xin Yuan (Choi)

Mechanism and Control of Reductive Pathways in Electrochemical Biomass Upgrading

Zhijun Zhu (Li)

Deep Structural Omics: Enhancing Precision to Facilitate Characterization of Molecular Mechanism of Diseases

IGNITING A PASSION FOR RESEARCH

by Kimberly M. Hazen

Connecting principles in a textbook to real-world applications can mean the difference between the success and failure of a chemical experiment. It can also be the spark that ignites a passion for chemistry. For an undergraduate student allowed to conduct research in a lab, this experience can be life-changing.

Recent gifts from the William J. & Shirley A. Maeck Family Foundation allowed the department to expand research opportunities for undergraduate students through a unique program that gave them a designated lab space and a supervisor. The donation funded the hiring of postdoc **Ted McClain** who crafted a curriculum for a new Course-Based Undergraduate Research Experience designed to give undergraduate students authentic research experience, laboratory training, and a unique learning opportunity. "I was fortunate to have great chemistry professors who took an interest in my development and supported my pursuit of undergraduate research that ultimately led me to pursue a Ph.D. in organic chemistry," Ted explained. "Because of the tremendous impact that my undergraduate research experience had on my development and excitement for chemistry, I have always aspired to be a professor of chemistry."

The students he mentored—**Jewel Sherchok**, **Michael Rolfs**, and **Song Nhi Dang**—agree that the experience was extremely valuable to their undergraduate education. "The learning process is essentially saying, 'This may be a good path to take, so let's take it and see what happens!'", explains Michael Rolfs, whose research focused on the study of substituent effects in phenothiazine derivatives and their electrochemical reactivity towards the oxidative functionalization of alkenes. "That is the very core of science—to poke and prod until something



William "Bill" Maeck, BS '53



William J. & Shirley A. Maeck Family Foundation donation provides valuable experience for undergraduate students

Undergraduate Jewel Sherchok works in the new undergrad research space in the North Tower.

marvelous happens, or nothing at all, then write it down and continue forward."

William "Bill" Maeck understood this process of trial and error. After earning his undergraduate degree in chemistry from UW–Madison in 1953 where he worked under **Dr. Farrington Daniels**, Bill went on to receive a master's degree from the University of Idaho and work for the U.S. Atomic Energy Commission Laboratory, which later became the Idaho National Laboratory (INL). During his time at the INL, he took a keen interest in investing in the stock market. His methodical and serious mind served him as he evaluated different stocks to purchase or sell. He was once quoted as saying, "In analytical chemistry, you try to find a little bit of this and a little bit of that—I would do the same thing when deciding whether I wanted to buy a business." He knew the skills he learned in chemistry weren't very different from the skills that made him a successful investor.

For Jewel Sherchok, Bill's talents for investing and generosity allowed her to have an opportunity that she might not have had access to otherwise. She says the program and its mentorship guided her not only in her research but also in her personal and professional growth, "Through this research experience, I have not only enhanced my critical thinking skills but also honed my interpersonal and professional abilities through collaboration with my mentor and fellow researchers."

As a third-year undergraduate student, Song Nhi Dang used the experience to fine-tune her interest in chemistry.

"I have discovered my passion for chemistry," she explains. "In particular, I am extremely excited about the applications of organic chemistry to the development of new cosmetics." She said the experience allowed her a chance to dive deeper into her interests through research.

The program will continue in 2025 under **Bryan Wakefield**, the department's new director of undergraduate chemistry research. His goal for the program is to provide a high-quality research experience to as many undergraduate students as possible. "The undergraduate research space on the 7th floor of the North Tower is the ideal place to provide students who have not found a position in a faculty-led group with this opportunity," he explains. "Students can have their first research experience there and gain the skills they need to transition to other groups in the department or around campus." Bryan plans to further develop a program so that post-doctoral researchers and graduate students can propose research projects, recruit undergraduate students, and mentor them in the research. This model will allow undergraduate mentees to have an authentic research experience but it will also provide training to the mentors to help prepare them to lead their independent research groups in the future.

While Bill Maeck passed away in 2018, his legacy lives on through the support of research opportunities for undergraduate students. The students and the entire department are grateful for his foundation's generous support.

A scientific voice for clean energy policy

by Kimberly M. Hazen

The path to a chemistry Ph.D. for **Steve Feldgus '00** was not traditional, so it follows that the career that resulted from his work at UW has been anything but ordinary. In January 2024, Feldgus was named Principal Deputy Assistant Secretary for Land and Minerals Management for the U.S. Department of the Interior. Before his current role, Feldgus served on the House Natural Resources Committee for seven years, including as Deputy Staff Director under Chair Raúl M. Grijalva and Staff Director for the Subcommittee on Energy and Mineral Resources.

When asked what he'd like our current students to know about what they might do with a degree in chemistry he answered, "More than you could possibly imagine. It's not all industry and academia!"

At UW, Feldgus could have probably used his own pep talk. After working on gas-phase chemistry under Professor **James Weisshaar** for nearly four years, Feldgus took a summer detour through an

Alumnus Steve Feldgus takes an unconventional career path with the Department of the Interior

Advancement of Science (AAAS) Mass Media Fellowship and worked for NPR as a reporter in Greeley, Colorado. Whether the experience reframed his interests or not, Feldgus returned to school in the fall and was open to new opportunities. One of those opportunities came from a conversation with Professor **Clark Landis** about a stalled project involving computational chemistry. "It was clear to me that he's a really bright guy," explained Landis. "He just wasn't working on something that stimulated him." So Landis, with the support of Professor Weisshaar, pitched his project to Feldgus.

Landis said the opportunity reflects the climate of the department, "I think that the department is an unusually collegial place and we want people to have a good Ph.D. experience," he explained. "Change in research topic is accommodated without prejudice."

As luck would have it, a primarily computational project can move quickly. Feldgus proved that he was adept at computations and it took him very little time to get up to speed. After the "reboot," Feldgus finished his degree in under two years.

The work was the first of its kind. "It was a time when computers were becoming much more powerful in chemistry," explained Landis. "This was one of the very first demonstrations of using computers to understand the origins of selectivity in asymmetric catalysis."

After graduation and a short stint at teaching, Feldgus applied for and received an American Association for the AAAS Science & Technology Policy Fellowship. He credits his degree at UW for landing him the

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In Memoriam

1940s



Jacob John Menn, 101, d. August 23, 2024. His studies at UW–Madison were interrupted when he returned to the family farm to work during World War II. He resumed his studies after the war and graduated with a bachelor's degree in 1947.

1950s



James R. Jagler, 97, d. June 29, 2024. Following his honorable discharge from the Navy, he continued his education at the UW–Madison, graduating in 1950 with a bachelor's degree in chemistry. He returned to UW and received his master's in 1957.



Robert Landel, 98, d. September 10, 2024. Robert earned a Ph.D. in physical chemistry from UW–Madison in 1954 and studied under John D. Ferry.



Leo Harold Spinar, 94, d. January 5, 2024. Leo's education at UW–Madison was interrupted by 18 months of service in the Army Chemical Corps during the Korean War. He earned his Ph.D. in physical chemistry in 1953.

1960s



F. Jon Austin, 82, d. July 11, 2024. Jon graduated from the UW–Madison with a bachelor's degree in chemistry in 1964.



Robert Beckis, 78, d. September 5, 2024. Robert earned his bachelor's degree in chemistry in 1968.



Daniel Konowalow, 95, d. May 10, 2024. Daniel graduated with a Ph.D. in theoretical chemistry from UW–Madison in 1961. After working for DuPont Corporation for a few years, he returned to UW to serve as the associate director of the Theoretical Chemistry Institute.



Thomas Edward Lantz, 84, d. April 25, 2024. Thomas earned his Ph.D. from UW–Madison in 1969.



Thomas Spencer, Jr., 90, d. September 30, 2024. Thomas earned a Ph.D. in organic chemistry from UW–Madison in 1960. He was Professor Emeritus of Chemistry at Dartmouth College.



Herbert Winicov, 89, d. June 10, 2024. Herbert graduated from UW–Madison with a Ph.D. in chemistry in 1961.



Joyce Yagla Corey, 86, d. July 21, 2024. She earned her Ph.D. in chemistry at UW–Madison in 1964.



Howard Stephen Stoker, 84, d. March 30, 2024. He earned a Ph.D. in chemistry UW–Madison in 1963.



John Straughn, 76, d. September 7, 2024. After receiving a master's in chemistry at UW–Madison, he obtained a position with UW Facilities, Plant, and Maintenance in chemical safety for 26 years.



Eugene Ross Wagner, 86, d. February 23, 2024. He received his bachelor's and Ph.D. in chemistry from UW–Madison in 1964.



John P. Walsh, 81, d. August 24, 2024. He earned a masters in chemistry UW–Madison in 1965.



John Robert Wiseman, 88, d. July 30, 2024. He began his Ph.D. studies at UW–Madison in 1961 and subsequently followed his thesis adviser, Eugene Van Tamelen, to Stanford University in Palo Alto, California.



Howard Yeager, 80, d. June 2, 2024. He received a master's degree in chemistry from UW–Madison in 1967 and also taught at Wisconsin for one year.

1970s



Robert Charles Atkins (Bob), 80, d. August 20, 2024. Robert completed his Ph.D. in organic chemistry at the UW–Madison in 1971.



Joseph C Calabrese, 81, d. August 4th, 2024. He earned his Ph.D. from UW–Madison under the guidance of Dr. Lawrence Dahl in 1971. After moving to Italy for a postdoctoral fellowship, he returned to the Department of Chemistry as the staff crystallographer.



Walter Mark Douglas, 81, d. October 8, 2024. He earned a Ph.D. in chemistry from UW–Madison in 1970.



Philip August Helmke, 82, d. February 20, 2024. Philip earned a Ph.D. in analytical chemistry with a minor in geology at UW–Madison in 1971.



Murray Katcher, 79, d. July 13, 2024. Murray graduated from UW–Madison with a Ph.D. in inorganic chemistry in 1972. He earned his MD from UW–Madison and was a clinical professor of pediatrics and population health.



David Alan Krause, 74, d. August 23, 2024. David earned a Ph.D. in chemistry from UW–Madison in 1976.



Alan Edward Proctor, 76, d. July 11, 2024. Alan earned a Ph.D. in physical chemistry from the UW–Madison in 1975.



Ronald W. La Rochelle, 80, d. April 10, 2024. He earned a Ph.D. in organic chemistry from the UW–Madison in 1970.



Patrick David Spice, 74, d. February 24, 2024. He earned a master's degree in chemistry from UW–Madison in 1978.

1980s



Darrah Perry Chavey, 69, d. January 6, 2024. Darrah earned a Ph.D. in chemistry from UW–Madison in 1984.

2000s



Ryan West, 43, d. July 24, 2024, after a 3-year battle with cancer. Ryan earned his bachelor's degree in chemistry from UW–Madison in 2004 and a Ph.D. in chemical engineering from UW in 2009.



Professor Clark Landis with Steve Feldgus at the UW–Madison graduation in 2000. Courtesy: Clark Landis

opportunity to work for the Office of Senator Jon S. Corzine. His role involved helping with constituent concerns about policy that involved science or technology and he was called upon to give a scientific opinion on matters.

Before his current position, Feldgus served as Deputy Assistant Secretary for Land and Minerals Management for two and a half years. He also served on the House Natural Resources Committee for seven years, including as Deputy Staff Director under Chair Raúl M. Grijalva and Staff Director for the Subcommittee on Energy and Mineral Resources. Feldgus also served in a variety of other roles in the legislative and executive branches. As for his current position, Feldgus is grateful to continue the forward progress of the Interior Department. "Over the last three years, the Interior Department has made tremendous progress in protecting our public lands, cleaning up legacy pollution, and spurring a clean energy economy," states Feldgus.



YOUR GIFT IS A CATALYST.

Here's how your gift to the Department of Chemistry has made a difference.

Compiled by Emily Kitslaar

"I credit this recognition to the invaluable support from sponsors like you, which enables the UW-Madison Department of Chemistry to maintain its standing as one of the most competitive and successful programs in the country."

—Emily
2024 Cline Chemistry Graduate Student Support Award

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—Luke
2024 Dempsy Chemistry Scholarship

"I am committed to making meaningful contributions to the field of chemistry, and your generosity fuels my determination to achieve this goal."

—Jordan
2024 Department of Chemistry Scholarship

"I am deeply honored to receive this award in memorial of someone who was an outstanding scientist and a valued member of the UW-Madison chemistry community. What a special way to honor his legacy."

—Emma
2024 Harlan L. and Margaret L. Goering Organic Chemistry Fellowship

"Excelling at both academics and athletics is difficult and can sometimes make me question if I'm cut out for it, so to receive an award like this gives me reassurance that I'm on the right path."

—Hans
2024 Francis Craig Krauskopf Award

BE FEATURED ON OUR NEW ALUMNI WALL.

The Department of Chemistry has many great stories to tell. As an alum, you are part of these stories and a reason for our success!

Our new Featured Alumni Wall is located on the first-floor hallway in the Mathews Building. Connecting the Shain Tower to Mathews, Daniels, and the North Tower, this hallway is considered our "Main Street" and each year, thousands of prospective undergraduate students, families, graduate students, visiting professors, and others walk down this hallway. For them, these new alumni profiles illustrate a variety of career paths taken by alumni from rich and varied backgrounds. They spotlight the outcomes and the value of a chemistry degree and the success of our alumni.

If you'd like your story included, contact Kimberly Hazen at kmhazen@wisc.edu or follow this link: <https://forms.gle/9DKHxAFIL68Ku6jx8>





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The sun shines through snow-covered trees past a W crest banner after a snowfall on Bascom Hill at the University of Wisconsin-Madison on Jan. 11, 2024. (Photo by Althea Dotzour / UW-Madison)



**CONNECTION IS
THE CATALYST.**

Join us for these special events:

March 23, 2025 | Alumni & Friends Reception at ACS San Diego, CA

May 9, 2025 | Department of Chemistry Graduation Celebration & Reception

August 17, 2025 | Alumni & Friends Reception at ACS Washington, DC