No. 65 | 2023

# BADGER CHEMIST

**LOOKING BACK, MOVING FORWARD:**
CHEMISTRY THROUGH THE YEARS AT UW–MADISON

**GET TO KNOW THE NEW FACULTY:**
BOROS, TODD, SOLEY JOIN UW

University of Wisconsin–Madison Department of Chemistry | Est. 1953


*On the cover: The new North Tower provides state-of-the-art teaching laboratories and connected write-up rooms. Courtesy of James Ewing / JBSA for Ballinger.*

*On this page: Professor Helen Blackwell and graduate student Isabel Cannell in the Blackwell lab.*

# Departments



# Feature



## Department of Chemistry
UNIVERSITY OF WISCONSIN–MADISON


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BADGER CHEMIST

*A Newsletter from the Department of Chemistry of the University of Wisconsin*

MADISON, WISCONSIN — SUMMER, 1953

**Foreword By Our New Chairman**

Dear Former Chemistry Student,

Greetings to the several thousand men and women who have received degrees in chemistry at the University of Wisconsin. Most of you have known only two departmental chairmen—J. Howard Mathews—who was on the job continuously for 35 years.

This first year as the new chairman has been a happy one because all members of the departmental staff have been helpful and cooperative. Professor M. Leslie Hosh as associate chairman, Miss Berta Geerman as secretary and Mr. Harold A. Schimming as administrative assistant have been effective aides in administration and every one of the professors serves on at least two committees within the department. Educational policies are discussed fully by the professorial staff at the bimonthly luncheon meetings and important changes have been made in the curriculum. It is indeed fortunate, although there is not always agreement on all things, that there is nevertheless complete harmony.

We are fortunate also in our relations with the University's officers. President Edwin B. Fred and Dean Mark H. Ingraham. Encouragement and support from them, together with an atmosphere of mutual confidence, has made this first year of the departmental chairman a pleasant one. We are proud of the Department of Chemistry and its achievements. In addition to full teaching and research programs the staff members carry committee and lecturing assignments in the University, in Madison and in our national societies. They have accepted their responsibility to the community as well as to their Department. A partial list of these assignments is interesting. Professor Sorum is Chairman of Freshman Forum, and Professor Willard is on the committee to guide the senior course. Contemporary Trends. Associate Professor Dale teaches the introductory science course in the Integrated Liberal Studies program. Professor Mcloche is Chairman of the Committee of the Human Relations Committee of the University and for 25 years has been serving on the board of directors of the University Y.M.C.A. Professor Holt is a member of the Athletic Committee and Professor Schuette, president of the Wisconsin Academy of Sciences, Arts, and Letters, continues to be a guiding spirit in this 83-year-old organization by virtue of a life-time tenure on its Council, or governing board. He is also serving the museum of the State Historical Society of Wisconsin as a sort of curator-without-portfolio in that he is chairman of the Society's Philatelic Committee.

Currently there are in the department 34 professors, five of whom are members of the National Academy of Sciences, and 3 instructors, plus 38 teaching assistants, 42 research assistants and 26 fellows. The total number of graduate students is 168. A comparatively new development is the increase in postdoctoral fellows and project assistants supported largely by industrial grants and government research contracts.

The staff is now publishing the results of their researches in the scientific journals at the rate of about 100 papers a year. It was not always so, however, in that the 100th communication was not forthcoming until early in 1900! This and other interesting bits of information were uncovered some 20 years ago when department historian, Dr. Schuette, began the task of compiling a record of the scientific contributions by past members of the Department, and the seemingly hopeless one of securing a reprint of each. The success of the project in terms of "originals" found is reflected in the fact that photostating was required in only a few cases, one of which was the inaugural address to the Regents by Professor Ezra Slocum Carr in 1856, in the theme is that the natural sciences have a claim "to enlarged consideration in our systems of education."

The work of recording on file cards the publications of the staff and preserving a reprint of each was in time delegated to the departmental librarian. It has required 35 volumes to hold the record of our research form this record of our research activities. We suspect that ours is the only department of comparable age in the College of Letters and Science that has such a record.

In a recent conference with a faculty committee of a prominent University, your chairman had mixed feelings of pride and worry when he was asked to give advice on a list of men who had been suggested as possible candidates for the chairmanship of the chemistry department. Six members of our department were on the list.

Our chief worry at present is the decreasing enrollment of undergraduate students in chemistry. We are now feeling the effects of the low birth-rates of the 1930's, but chemistry and other subjects which require stiff mathematical preparation and arduous hours of study are suffering relatively more than the whole University. Jobs for chemists were never so plentiful and never so well paid, but the many representatives of industry who visit us to interview our seniors and graduate students about jobs are going to be even more disappointed next year than they were this year. The number of graduate students has kept up pretty well but the supply line at the freshman and sophomore level has dwindled so much that in the years to come a couple of graduate students will fill off ten. If your son or daughter or your neighbor's son or daughter has a special aptitude and interest in science, tell us about them and send them to us.

The selective service policies with reference to students have been working out very well. We trust that no drastic change will be made in this policy and that able students can continue to prepare themselves to serve in the best interests of their country.

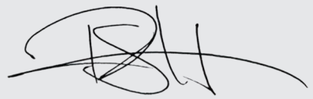
Another important problem is that of space. The new wing to be added to the northwest corner of the Chemistry Building along Charter Street is not for us—it is for the School of Pharmacy. We can be happy and scientifically productive in our present quarters, but the rickety wooden construction, and wavy floors of the central part of the Chemistry Building are a disgrace to any modern Chemistry Department. The demands for any kind of room in other departments of the University are so great that we will have to wait our turn for new

(continued on page 2, col. 1)

# 70 years
## of the Badger Chemist

1953 First published in 1953, the *Badger Chemist* was created to connect alumni of the Department of Chemistry. The "Foreword By Our New Chairman," written by Farrington Daniels began "Dear Former Chemistry Student, Greetings to the several thousand men and women who have received degrees in chemistry at the University of Wisconsin." Over the years, the magazine has been a key communication tool for thousands of alumni, friends, emeriti faculty, and others to stay informed on research developments, building progress, and other exciting updates from the department. As I take over as the ninth editor of this time-honored publication, I am grateful for the many alumni who have supported this publication over the years.

Regards,



Kimberly M. Hazen

SHARE YOUR NEWS and tell your #AfterChem career story by emailing connect@chem.wisc.edu.

# From the Chair's Office

Outlined in our mission is the goal "to conduct world-class, groundbreaking research in the chemical sciences while offering the highest quality of education." While we address specific challenges to achieve the goals of our mission, such as reorganizing our administrative structure, updating our physical spaces, or revitalizing our longstanding leadership in chemical education research, one thing is clear to me: our bright future is indebted to our spirit of collaboration.

Collaboration requires us to cast a wider net to include all students with the talent and desire for discovery. Programs such as Chemistry Opportunities (CHOPs)—require the buy-in and work of graduate students, faculty, and staff to succeed and build inclusion in our department.

Collaboration also means recognizing that instructional staff, administrative staff, scientists, and faculty are also committed to our mission and that governance and decision-making should reflect this shared commitment. This past year, the department took on strengthening faculty/staff collaboration by enabling staff to vote in departmental meetings.

We know that collaboration is key to ground-breaking, high-impact research. Outside the department, nearly 20 affiliate faculty are engaged to provide multidisciplinary experiences within the chemistry graduate program. We also collaborate with industry, as evidenced by the new Synthesis and Catalysis Center that is establishing a pre-competitive research program with major companies such as GSK, Corteva, and Eli Lilly.

Above all, collaboration with donors and their gifts drives all of our mission-focused activities. Thank you for contributing to the excellence of the Department of Chemistry!

# CHEMISTRY OF **COMMUNITY**


1

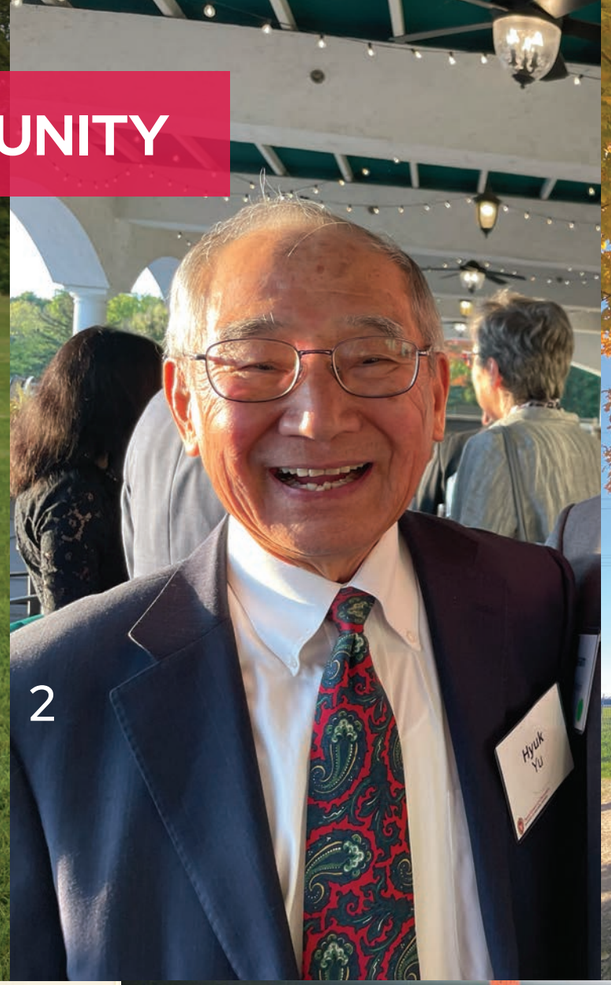

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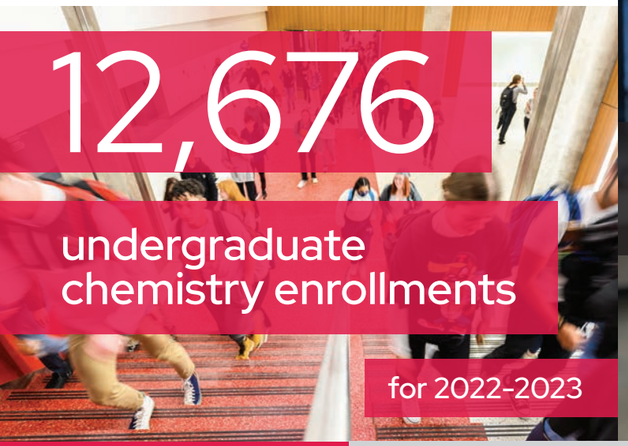
*Photo: Althea Dotzour / UW–Madison*

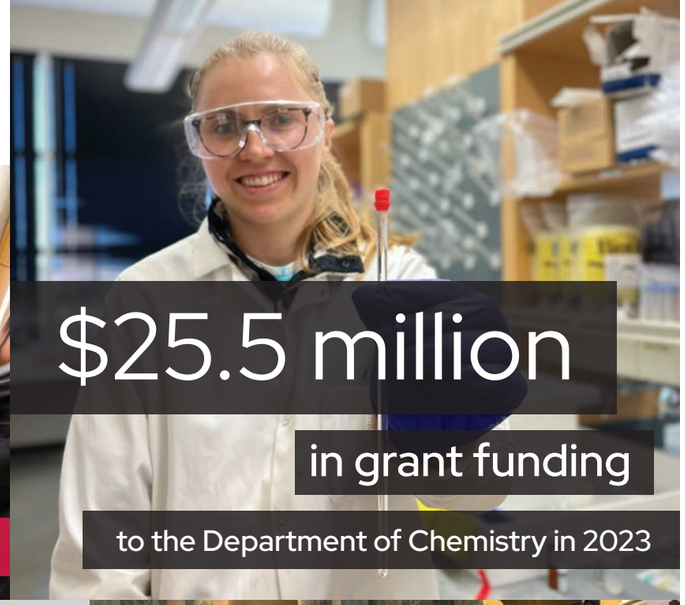
***1*** **Cameron Kaminsky** *is up to bat at the annual GSFLC-hosted Snout Out Picnic.* ***2*** *Emeritus Professor* **Hyuk Yu** *reconnects with colleagues at the 2023 Hirschfelder Award Banquet held at Maple Bluff Country Club.* ***3*** *Members of Catalyst, a peer-mentoring program (back left to right)* **Cristina Moscoso Cabrera**, **Miguel Betancourt Ponce**, **Gerardo Javier Quintana Cintron**, **Stephanie Oliveras Santos**, **La'Darious Quinn**, **Yareslie Cruz**, **Desiree Bates**, *and (front)* **Ethan Hartman** ***4*** *Graduate students (left to right)* **Ami Diaby**, **Shannon Brown**, **Surajudeen Omolabake**, **Drilon Etemi**, **Danica Gressel**, *and* **Aritri Biswas** *represent the department at NOBOCChE 2023.*

***5*** *Graduate students* **Minhua Cao** *and* **Cassie Doody** *pause to connect at the Women in Chemistry Coffee.* ***6*** *The Cavagnero group proudly shows off their 3D printouts of proteins.* ***7*** **Riku Hasimoto** *visits the chemistry glass shop from Tokyo Japan for a one-week training.* ***8*** *Undergraduate Chemistry Specialists* **Rosemary Wonnell** *and* **Maddy Henkel** *move into the Undergraduate Office in the newly renovated Daniels building.* ***9*** *Students take a break from studying to pose with UW–Madison Chancellor* **Jennifer Mnookin** *during the UW Regents' visit to Chemistry this year.* ***10*** **Troy Stich**, **Amanda Reig**, **Anne Bentley**, *and* **Michael Konopka** *reconnect at the Department of Chemistry reception at the Spring ACS meeting in Indianapolis.*

## By the Numbers



**12,676**
undergraduate chemistry enrollments
for 2022-2023



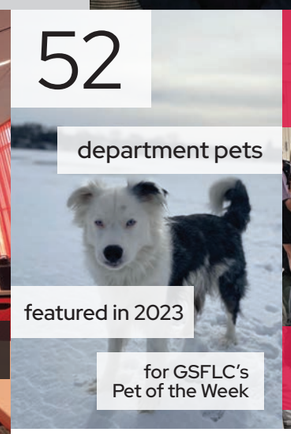
**$25.5 million**
in grant funding
to the Department of Chemistry in 2023

**83**
FACULTY-HOSTED SEMINAR PRESENTATIONS
given and planned for the 2023-2024 academic year

More than **130** alumni
reconnected with colleagues at ACS / Department of Chemistry receptions in 2023.

**143**
undergraduate students
conducted research in chemistry
in the 2022-2023 academic year.

**66**
new first-year graduate students
enrolled in 2023.



**52**
department pets
featured in 2023
for GSFLC's Pet of the Week

**25**
prospective graduate students
participated in our Chemistry Opportunities (CHOPs) weekend.

**273** peer-review articles
by chemistry and affiliate faculty during the 2022-2023 academic year.

**9** **NSF GRADUATE RESEARCH FELLOWS** through the 2023 Graduate Research Fellowship Program
***2*** *graduate students listed as honorable mentions*

# Centered *on the* Edge

## New way to make chemicals using electricity has environmental benefit

*by Will Cushman*

The world needs greener ways to make chemicals. In a new study, University of Wisconsin–Madison researchers demonstrate one potential path toward this goal by adapting hydrogen fuel cell technologies.

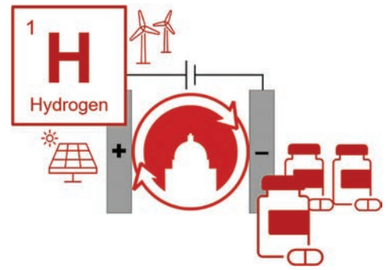
Working with scientists at the pharmaceutical maker Merck & Co., Inc., a group of UW–Madison chemists and engineers sought to develop a more sustainable method to manufacture ingredients needed to make many types of drugs.

"The process we are working with needs a green source of electrons," says **Shannon Stahl**, a professor in the UW–Madison Department of Chemistry who guided much of the research. The conventional process uses large quantities of zinc metal as the source of electrons, but handling zinc is complicated and generates large amounts of environmentally unfriendly waste.

The researchers found inspiration from hydrogen fuel cells, which use hydrogen gas as the source of electrons to generate electricity.

"We realized that fuel cell technology could be modified to make chemicals rather than electricity," says Stahl.

Hydrogen gas is an ideal choice in many ways, according to Stahl. It can be generated from renewable electricity, and it creates very little waste. Developing a hydrogen-based way to make pharmaceuticals aligns with renewed interest in a "hydrogen economy".




*This work introduces a technique for using hydrogen and electricity to create pharmaceuticals. Hydrogen can be made using renewable energy sources such as solar power, making the process more sustainable.*
***Credit: UW–Madison***

"This work is connected to a broader effort to create a hydrogen infrastructure that goes beyond fuel cells and energy production," says **Mathew Johnson**, a postdoctoral researcher in the chemistry department who led the study. "This work shows that hydrogen can be combined with electricity to make new drugs."

The researchers developed a system that uses a type of organic compound called a quinone to pull electrons away from hydrogen. An important feature of this process is that it works well in the absence of water. Fuel cells typically need water to operate effectively, but water can interfere with steps used to make the drug ingredients. The system then uses electricity to supercharge the electrons, giving them more energy than hydrogen could normally provide.

*Mathew Johnson*

*Professor Shannon Stahl*

The team, which included postdoctoral researcher **Jack Twilton**, chemistry professor **Daniel Weix** and chemical and biological engineering professor **Thatcher Root**, described their new system in a paper published Aug. 21 in the journal Nature. They show how it can be used to make dozens of important organic molecules, including a large batch of a pharmaceutical ingredient.

Stahl sees even bigger opportunities for this technology. "The chemical industry is a massive energy consumer, and there is a big push to decarbonize the industry," he says. "Renewable electricity can provide energy to produce chemicals with a much lower carbon footprint than burning fossil fuels."

*Financial support for the development of the mediate H2 anode was provided by the Center for Molecular Electrocatalysis, an Energy Frontier Research 10 Center, funded by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences and Merck Sharp & Dohme LLC, a subsidiary of Merck & Co., Inc., Rahway, NJ, USA. The development of Ni-catalyzed XEC reactions and their integration with the mediated H2 anode was supported by the NSF (PFI-RP 2122596). Spectroscopic instrumentation was partially supported by the NIH (1S10 OD020022-1) and the NSF (CHE-1048642).*

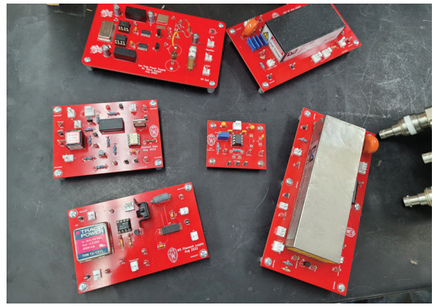
***Centered on the Edge****: They say life begins at the edge of your comfort zone, so we made our home there—our feet dangling off the ledge of what's possible and our eyes on the horizon of what's next. We're not just ready for change—we define it.*

# Bertram team wins Beckman Foundation funding for atmospheric monitoring

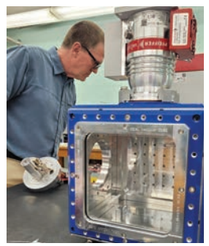
*by Kimberly M. Hazen*

Professor **Tim Bertram** and former UW–Madison Ph.D. student **Steve Kregel** are co-leading a team that received $890,000 from the Arnold and Mabel Beckman Foundation for mass spectrometry for atmospheric monitoring. The team will use the funding to develop a new compact, low-cost mass spectrometer for atmospheric monitoring of volatile organic compounds in the atmosphere. The final instruments will be used to assess air pollution throughout Wisconsin.

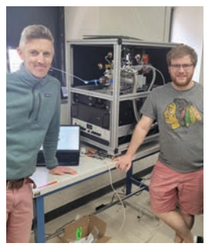
**"Beyond the development of new technology, the project has a significant collaborative component with other UW campuses and weaves into our existing chemical instrumentation undergraduate program in analytical chemistry," explains Bertram.**



*Custom circuit boards for the first version of the compact mass spectrometer.*



*Dr. Rob McClain works on the assembly of the modular mass spectrometer.*



*Professor Bertram (left) and Dr. Steve Kregel with a prototype miniature chemical ionization mass spectrometer.*

The team is a collaboration of Professor Steve Kregel, who began the project as a postdoc researcher, Professor Tim Bertram, and Laboratory Director **Rob McClain** of UW–Madison's Department of Chemistry; Professor Keith Beyer of the University of Wisconsin–LaCrosse, and Professor Patti Cleary of the University of Wisconsin–Eau Claire. Professor Kregel has joined Bradley University in Peoria, Illinois as an assistant professor, but remains a part of the project team.

The Beckman Foundation created the grant to underscore the "foundation's mission of supporting research breakthroughs in chemistry and the life sciences, and fostering the invention of methods, instruments, and materials that open new avenues of research and applications in these sciences and related disciplines." Three institutions were selected to receive a total of $3 million paid in yearly installments over three years. The grant will support prototype design development offering the most advanced mass spectrometry detection capabilities and sensitivity levels in lightweight, inexpensive, and easily operable systems for mobile monitoring.

"Our intent for this program is to support scientists, with a focus on undergraduates, to become inventors and innovators in this compelling area of research by building tools and instruments," explained Dr. Anne Hultgren, the Beckman Foundation's Executive Director. "If successful, the [miniaturized] prototype monitoring systems developed by our awardee teams could have a lasting impact on informing policy decisions on sources of pollution, improving indoor and outdoor air quality, and furthering the democratization of access to clean air around the world."

Professor Bertram also serves as part of the leadership team on a $430,000 EPA project to provide detailed, real-time information at the neighborhood level to address health disparities in Madison, Wisconsin. According to Bertram, "This would make Madison the most monitored community in Wisconsin concerning particulate matter." Once the city budget is amended to accept the EPA funding, the project will boost the city's air quality monitoring devices from two to 68.



# AJ Boydston named co-P.I. on MURI award

*Investigation will focus on spatially programmed material properties via designed mesostructures*

*Professor AJ Boydston (top center) and his research group.*

*by Kimberly M. Hazen*

Over the next five years, $7.5 million in funding will be shared among six principal investigators (P.I.s) on a Multidisciplinary University Research Initiative (MURI) award from the U.S. Department of Defense (DOD). For Professor **AJ Boydston** and his group, it means $1.25 million to work with the Office of Naval Research to develop directed assembly of mesoscale architectures in additive manufacturing. This project is just one of 31 research projects announced this year that will award $220 million to an extensive list of institutions. This highly competitive program only funds a small fraction of proposals each year, and it has a history of supporting research that has led to breakthroughs in several fields including information technology and materials science.

The Boydston Group is part of a six-P.I. team combining additive manufacturing with "bottom-up" directed assembly, using tailored nanoparticle building blocks and polymers. They will also be building new instruments to study the process and validate computational predictions. The goal of the project is to realize materials and structures with emergent thermal electromagnetic and optical properties that could be used in the cooling of high-power electronics, next-generation communication systems, or high-performance cameras.

The role of Professor Boydston's team falls in the molecular up through mesoscale realm. As background, Boydston explained that the ordering of length scales for chemists and practitioners in related fields is something like: molecular à nanoscale à mesoscale à macroscale. Boydston states, "The mesoscale is this hard-to-define in-between size that is larger than nanoscale but smaller than what we tend to interact with tangibly." His research group will contribute to this MURI by discovering and honing chemical approaches to build up from molecular to mesoscale. "We will leverage some nanoscale building blocks and learn what chemical reactivities can be used to control the ordering (literally the physical spacing and orientation) of nanoscale particles to create deliberate mesoscale structures," states Boydston.

The Boydston Group has expertise in integrating non-traditional chemical reactivities into additive manufacturing processes and even inventing new equipment platforms for additive manufacturing. However, Boydston explained that working as part of a larger MURI team will offer the advantage of focus for the group, "Now, we are going to be able to think about a vast chemical space without imposing any restrictions or filters with regard to equipment capabilities, because the broader team will be innovating on the equipment front."

Diversity in chemical reactivities will require a diversity of energy inputs (light, magnetic, thermal, mechanical, and electrical). Boydston's team plans to learn how to use a suite of energy inputs to direct specific, orthogonal chemical reactions at specific volumes in space.

Along with Professor Boydston, the MURI team includes John Hart and Rob Macfarlane of Massachusetts Institute of Technology (MIT); Randall Erb and Safa Jamali of Northeastern University; and Arthi Jayaraman of the University of Delaware. The team's expertise spans chemistry, materials science, simulation, machine learning, machine design, and characterization.

# Lab Notes

## Huang Research Group

The research in the Huang Research Group primarily focuses on elucidating biomolecular dynamics through the development of statistical-mechanics tools and machine-learning approaches, thereby bridging the gap between experiments and atomistic molecular dynamics simulations. With the aid of these tools, the group has successfully simulated essential conformational changes in RNA polymerases, which function as a molecular motor. These changes include forward translocation and backtracking along DNA, tasks that were long-considered highly challenging due to the large size (approximately half a million atoms) and the requirement for long timescales (a millisecond or longer).

2023 has been a remarkably busy year for the group. Firstly, they embarked on the development of new non-Markovian dynamic models rooted in the Generalized Master Equation (GME) framework. These GME models surpass the limitations of traditional Markovian models by explicitly incorporating the memory of dynamics, providing transformative tools to study protein dynamics. The group received a new 5-year NIH R01 grant to support this line of research. Secondly, the Huang Research Group has developed various new machine-learning approaches for molecular kinetics, including a Graph neural network approach, called GraphVAMPnets, to identify collective variables for the self-assembly, and the variational autoencoder method to efficiently group parallel kinetic pathways into distinct metastable path channels. Lastly, the group's collaborative efforts between simulation and experimentation have yielded valuable insights into how disease mutations disrupt the normal auto-inhibition of protein phosphatase 2A by redistributing its allosteric pathways. This line of research has recently secured NIH funding through a collaboration with the Xing group in UW–Madison's Oncology Department.

## Ediger Lab

Much of the recent work in the Ediger Lab has focused on vapor-deposited organic glasses, with potential applications in organic electronics. **Yejung Lee**, **Shinian Cheng**, and **Megan Tracy** have shown that it is possible to make ultrastable glasses of mixtures by co-deposition and even use co-deposition to create glasses in which the components are segregated on length scales up to 100 nm. **Mark Ediger** has worked with computer simulators in France to produce simulations that explain some features of ultrastable glasses. The group also continues to explore the deformation properties of polymer glasses, focusing on the role of segmental dynamics. **Pradip Kumar Bera** recently completed the first experiment in which the structural relaxation of a glass was measured during plastic flow.

The Ediger lab will disband in June 2024, with Mark's retirement. The "'Supercool' Symposium: Adventures in Liquids and Glasses" will be held in the department in March 2024, bringing together current lab members, former students, collaborators, and other interested scientists.

## Berry Group

Berry Group research focuses on discovering new chemistry of transition metal compounds, typically through complexes with metal-metal multiple bonds. The group makes use of unique physical characterization techniques including SQUID magnetometry and Mössbauer spectroscopy and uses a combination of synthetic, spectroscopic, and computational techniques to probe the chemistry of coordination complexes.

In 2021, the group published work on a new diruthenium catalyst for the ammonia oxidation reaction that can be utilized to harness energy from ammonia. This technology, important for the nitrogen economy, is a sustainable, green alternative to carbon fuel. Currently, the group is working on the synthesis, characterization, and reactivity of a second generation of catalysts to improve upon catalytic activity.

Another major research project in the group is with heterometallic extended metal atom chain (HEMAC) complexes that have the potential to be used as switches for molecular electronics. This project involves probing the fundamental chemistry of metal-metal multiple bonds and the synthesis of novel HEMAC complexes, which can act as metallic molecular wires and—unlike organic molecular wires—lead to interesting magnetic behavior.

## The Wright Group

Emeritus Professor **John Wright** and his former graduate student, **Peter Chen**, recently submitted their work "Optical Analogue of Multiple Quantum Coherence NMR" in the June 2023 issue of *Physics Today*. Peter, a faculty member at Spelman College since 1992, has had continuous funding from the NSF to develop multidimensional coherent gas phase molecular spectroscopy. The article is a summation of both John's and Peter's careers. Instead of creating multiple quantum state entanglements of nuclear spins, the optical analogue creates entanglements of rotational, vibrational, electronic, and valence core states. John retired in 2020 in order to have full-time devotion to the further development of this new methodology and he has collaborated with Light Conversion to create a prototype commercial laser system specifically designed for his NMR optical analogue. Continued research includes using this system to explore synthetic chemistry applications and this new technology has a great future. John and Professor **Martin Zanni** were recently invited to a special Nobel Symposium in Båstad, Sweden, to present research on Exploring Complex Molecular and Condensed Phase Processes and Functions by Multidimensional Spectroscopy from THz to X-rays.

John is indebted to many graduate students responsible for breakthroughs in his research program. **David Tallant**, John's first graduate student, developed Chemistry's first tunable laser that formed the foundation for the Wright Group's program. **Steve Lee**, **Murray Johnston**, and **David Moore** pioneered the first multidimensional coherent spectroscopy. **Dinh Nguyen**, **Jack Steehler**, and **Mike Riebe** created the first 3D laser system capable of coherent multidimensional spectroscopy. **Jim Hamilton** and Peter Chen pioneered the transformation to infrared vibrational excitation which formed the basis for an explosion of the methodology into new directions. **Wei Zhao** invented Doubly Vibrationally Enhanced spectroscopy. **Kent Meyer** led the group into ultrafast multidimensional spectroscopy and **Erin Boyle** discovered triple sum frequency spectroscopy. **Mark Rickard**, **Nathan Mathew**, and **Kate Kornau** discovered how to measure potential energy surfaces of reactions, while **Dan Kohler**, **Lena Yurs**, and **Steven Block** pioneered our entry into materials chemistry. John is also indebted to **Roger Carlson** who stands alone as the person who raised coherent multidimensional spectroscopy by developing the experimental and theoretical foundations for the technology described in a two-volume thesis that became the essential guidebook for the Wright group.

## Emeritus Professor Bassam Shakhashiri

Although **Dr. Shakhashiri** retired in August 2021, he continues his public engagement work including guest spots on Wisconsin Public Radio, workshops for Climate Science Concepts Fit Your Classroom, and the WISL Award for Communicating Ph.D. Research to the Public.

In October 2022, an interactive mural was unveiled in the Discovery Building on the UW–Madison campus, featuring Dr. Shakhashiri and other scientists. It features known historical and contemporary scientists all captured in the process of "doing" using vibrant, lively colors. Up close, the mural becomes interactive and educational with nine hidden QR codes that can be actively discovered while viewing.

In the fall of 2022, WARF created The Bassam Z. Shakhashiri Public Science Engagement Award, to be presented each year in recognition of a UW–Madison faculty and academic staff member who has shown excellence in engaging the public in their work in Science, Technology, Engineering, Arts, and Math (STEAM) research. The award honors Professor Shakhashiri's long-term commitment to science education and public engagement.

At the August 2023 ACS National meeting in San Francisco, California, a symposium, "Bassam Shakhashiri: A Leader in Science Education and Literacy" was held featuring 18 speakers including four ACS presidents, four ACS Priestley medalists, four National Medal of Science recipients, a Nobel Laureate, and the United States Director of Energy Under Secretary for Science and Innovation.

*An interactive mural unveiled in the Discovery Building celebrates the diversity of Wisconsin scientists.*


# Looking Back, *Moving Forward*

*Researched and written by Kimberly M. Hazen*

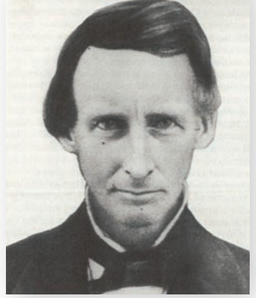
## Chemistry through the years at UW–Madison

*As the University of Wisconsin–Madison celebrates its 175th anniversary, we look back on 169 years of chemistry and 143 years as a department. So much has changed since the first chemistry class was taught by S. Pearl Lathrop in 1854. We continue to evolve, grow, and discover.*



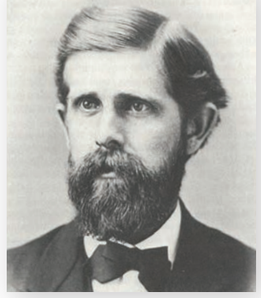
TODAY, THE DEPARTMENT OF CHEMISTRY is known for its outstanding teaching, research, and outreach programs as well as its collegial and collaborative atmosphere. The work of our department is supported by our exceptional faculty, instructors, lab directors, computational and instrumentation experts, and a multitude of staff. These essential members of our department order our supplies, pay our bills, support our grants, recruit our students, expedite our paychecks, facilitate our visas, train our teaching assistants, organize our publications, plan our events, arrange our travel, fill our stockrooms, keep our computers running, help our undergraduates, print our materials, receive our equipment, track our lost and found, maintain our safety, and clean our building.

Take a peek into our past and you'll find gritty, courageous leaders who built our program with curiosity, determination, and insight. Look closely at our department today and you'll find this same spirit that will steer the Department of Chemistry to continued success in the future.



## 1854

The first chemistry course, taught by **S. Pearl Lathrop**, meets in North Hall. As an instructor, Lathrop seeks "to expand the mind, moralize the heart … and to prepare youth for public as well as private action."



## 1880

The Department of Chemistry is formally established, and chaired by Professor **William Willard Daniells**. A growing need for space moved classes to University Hall, now Bascom Hall.

## 1884

**Martha Gunhild Week** receives a B.S. in the Natural Science Course. Today, a bequest in her name still provides scholarship support for women majoring in chemistry.

## 1895

**Louis Kahlenberg**, who joined the faculty in 1895 and later served as chair, becomes the first professor to develop a visible and ongoing research program.

## 1899

**Azariah Thomas Lincoln** receives the first doctorate in chemistry at UW–Madison under the supervision of Professor Louis Kahlenberg.


## 1902

UW–Madison chemistry students establish the professional fraternity, **Alpha Chi Sigma (ΑΧΣ)**. The organization now has collegiate and professional chapters throughout the United States consisting of both men and women and numbering more than 78,000 members.

## 1913

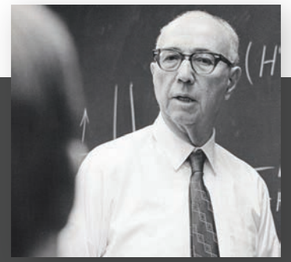
**Nellie Wakeman** becomes the first woman to receive a Ph.D. in chemistry at UW–Madison. Her advisor is Professor **Edward Kremers**, a pharmaceutical chemist.

## 1923

UW hosts Swedish chemist **Theodor "The" Svedberg**, a leading experimentalist who conceives the ultracentrifuge and holds the first National Symposium on Colloid Chemistry. The 98th ACS Colloid & Surface Science Symposium will be held in June 2024 at the University of Washington in Seattle.

## 1929

With an addition to the Chemistry Building (now known as Chamberlin Hall), the department's machine shop occupies a new designated space. The crew of the shop (picture left, 1977) moved into the Daniels sub-basement in 1967. The current team (picture right) represents the electronics, machine, and glass shops.



## 1937

Professor **Joseph O. Hirschfelder**, known as the founder of modern theoretical chemistry joins the faculty and later establishes the Theoretical Chemistry Institute. The internationally recognized Hirschfelder Prize is awarded annually in his honor.

## 1950

Professor **Paul Bender** oversees the Chemistry Instrument Center and later, as its director, establishes classes to teach students the use of the instruments for their research.

## 1953

The department hires its first dedicated glass technician, **Frank Peters**. Today, Distinguished Master Glassblower **Tracy Drier** directs the department's glass shop which provides scientific and research glassblowing services for chemistry faculty, students, and staff.

## 1962

The Mathews Building opens followed soon after by the Daniels Building in 1967. The two buildings are named for former department chairs **J. Howard Mathews** and **Farrington Daniels**.

## 1972

For his contribution to the understanding of the connection between chemical structure and catalytic activity of the active centre of the ribonuclease molecule, alumnus **Stanford Moore** (Ph.D. '38) is named a co-recipient of the Nobel Prize in Chemistry.

## 1980

With **Barry Trost** as chair, chemistry celebrates its 100th year as a department.


## 1983

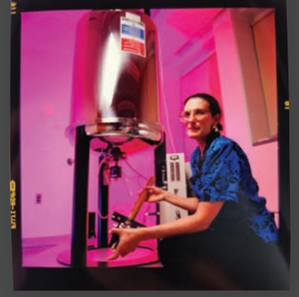
The **Institute for Chemical Education (ICE)** is formed to help science educators develop and share their ideas. Dr. **Bassam Shakhashiri** served as the first director of ICE.

## 1984

The department celebrates the **first Snout Out picnic** on September 15, 1984, at Westmorland Park, serving 500 pounds of meat, 150 pounds of potato salad, 90 pounds of baked beans, and four half-barrels of beer. This year's picnic (photo right) was held August 26 at Rennebohm Park.


## 1992

The **Graduate Student Faculty Liaison Committee (GSFLC)** is formed as a way to connect members of the department and facilitate effective communication. Today, the GSFLC is comprised of four subcommittees: wellness, community building, career development, and outreach.



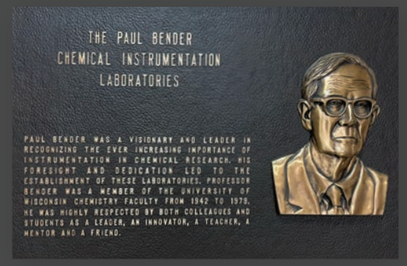
## 1995

Professor **Laura Lerner** becomes the first tenured female faculty member. Earning her Ph.D. in biomedical engineering from Johns Hopkins University, her background includes broad training in both engineering and biophysics.

## 2000

For his work on the discovery and development of conductive polymers, alumnus **Alan MacDiarmid** (Ph.D. '53) is named a co-recipient of the Nobel Prize in Chemistry.

The Shain Research Tower opens and is later named in honor of Professor **Irving Shain**, a former department chair and university chancellor.




## 2008

The **Paul Bender** Chemistry Instrumentation Center is named after a bequest from Paul and his wife **Margaret McLean Bender**, allowing the center to purchase and maintain state-of-the-art equipment.



## 2012

To draw diverse perspectives to the university, the department launches the **Chemistry Opportunities Program (CHOPs)**, a program to widen access to the chemistry graduate program at UW–Madison.



## 2017

Professor **Judith Burstyn** is chosen as the first female chair of the department.



## 2022

The **North Tower** opens after more than three years of construction. The new space includes new instructional laboratories with adjacent write-up rooms, flexible lecture rooms, an information commons, and a state-of-the-art Chemistry Learning Studio.

## 2023

DANIELS TOWER REOPENS

After extensive renovations for improved instructional labs, classrooms, and a new undergraduate office, the lower floors of the **Daniels Tower** reopen to students.



*A note of gratitude to Aaron J. Ihde's book **Chemistry as Viewed from Bascom's Hill, a History of the Chemistry Department at the University of Wisconsin in Madison**, the **University of Wisconsin-Madison Archives**, historical issues of the **Badger Chemist**, the **Badger 1949**, a centennial edition of the annual, and the many people who served as resources for this feature.*

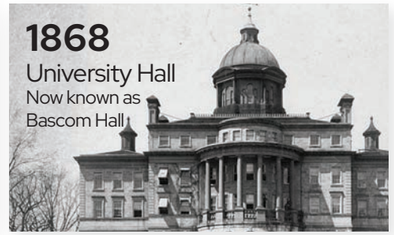
***PHOTO CREDITS: 1854** Courtesy Paul Boutwell Collection | **1880** Courtesy UW Department of Chemistry | **1884** Courtesy UW Archives | **1895** Courtesy UW Archives | **1899** Courtesy J.H. Mathews Collection | **1913** Courtesy the American Institute of the History of Pharmacy | **1923** Courtesy UW Department of Chemistry | **1929** Courtesy K.M. Hazen | **1937** Courtesy UW Department of Chemistry | **1950** Courtesy J.H. Mathews Collection | **1953** Courtesy Ilia Guzei | **1962** Courtesy UW Archives | **1983** Courtesy ICE | **1984** (L) Courtesy UW Department of Chemistry (R) GSFLC | **1995** Courtesy UW Archives | **2008** Courtesy K.M. Hazen | **2012** Courtesy Desiree Bates | **2017** Courtesy UW Department of Chemistry | **2022** Courtesy James Ewing / JBSA for Ballinger*

# The many spaces of chemistry at UW–Madison

*Over the years, chemistry has had many homes at the UW–Madison. From one classroom in North Hall to an entire complex occupying the block bounded by University Avenue, Johnson, Mills, and Charter Streets; the Department of Chemistry has a long history of outgrowing our space. Today, to anticipate needs, our planning process and department governance include considerations of space not only for today but long into the future.*

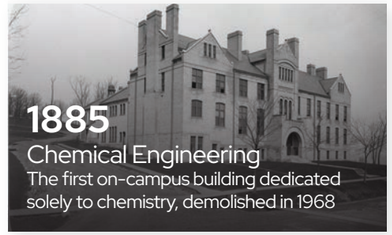
**1854**
North Hall


**1858**
South Hall



**1868**
University Hall
Now known as Bascom Hall

**1875**
Old Science Hall
Destroyed by fire in 1884



**1885**
Chemical Engineering
The first on-campus building dedicated solely to chemistry, demolished in 1968


**1905**
New Chemistry Building
Now known as Chamberlin Hall

**1913**
West Addition to Chemistry Building

**1929**
East Addition to Chemistry Building

**1962**
Department moves to Mathews Research Laboratory at Mills and Johnson Streets

**1967**
Farrington Daniels Chemistry Building
Adjoins Mathews Research Laboratory

**2000**
Shain Research Tower / Seminar Hall
Adjoins Mathews Research Laboratory

**2022**
North Tower
Adjoins Farrington Daniels Chemistry Building

**2023**
Farrington Daniels Chemistry Building
Renovations complete

***PHOTO CREDITS: 1854–1962** Courtesy UW Archives | **1967** Courtesy UW Department of Chemistry | **2000** Courtesy Nels Akerlund Photography | **2022–23** Courtesy James Ewing / JBSA for Ballinger*

## Gifts allow the CLC to grow, serve more students

*by Tracey Reitz*

Founded in 1974, and once located in a small green house where the Shain Research Tower now stands, the CLC has long been a cornerstone of academic excellence, providing a nurturing environment where students collaborate with instructors in small groups. In 2018, the department undertook an ambitious endeavor to design and renovate space in the Medical Sciences Center, doubling the square footage of the CLC and offering students a more comfortable and engaging learning space.

*The green house (left) served as an early CLC location. The house was demolished to make way for Shain Research Tower.*

**Read the full story online here:**

# Recognition: Awards & Achievements

## Faculty

**Tim Bertram**
American Geophysical Union's Atmospheric Sciences Ascent Award, 2023

**Eszter Boros**
Camille Dreyfus Teacher-Scholar

**Andy Buller**
2023 Sloan Research Fellow
Silvia Cavagnero

2022 Outstanding Mentoring Award from the Undergraduate Research Council

**Kyoung-Shin Choi**
Ho-Am Prize in Chemistry and Life Sciences (see p. 19)

2022 Kellet Mid-Career Award

**Randy Goldsmith**
Schmidt Science Polymaths, June 2022

**Ive Hermans**
Southwest Catalysis Society Award for Excellence in Applied Catalysis

2023 ACS Fellow

**Xuhui Huang**
2023 Biophysical Society Theory and Computation for Mid-Career Scientists Award

**Song Jin**
WARF Named Professorship, 2022

**Jeffrey Martell**
2023 Office of Naval Research Young Investigator Award

**Sam Pazicni**
Distinguished Faculty Postdoc Mentoring Award, 2022

**Jen Schomaker**
UW-Madison 2023 Vilas Associates Award

American Chemical Society Cope Scholar, 2022

Fellow in the American Association for the Advancement of Science, 2022

UW Madison Romnes Faculty Fellowship, 2022

**Bassam Shakhashiri**
2022 Alpha Chi Sigma Kuebler Award

2022 ACS Outstanding Service to the Division of Chemical Education Award

**Micheline Soley**
2023 Kavli Foundation Emerging Leader in Chemistry Award

**Shannon Stahl**
Elected to the American Academy of Arts and Sciences

ACS Award in Organometallic Chemistry

**Zach Wickens**
2022 Sloan Research Fellow

**Susanna Widicus Weaver**
2022 Illinois Wesleyan University Chemistry Alumni of the Year

**Yang Yang**
NSF Career Award

**Arun Yethiraj**
2022 ACS Physical Division Theoretical Chemistry Award

**Martin Zanni**
2022 Ellis R. Lippincott Award

## Staff

**Cheri Barta**
2022 University of Nebraska at Kearney Distinguished Alumna Award

**Desiree Bates**
2023 Chancellor's Award for Excellence in Service to the University

**Amanda Buchberger**
Chemistry Department Excellence Award for Academic Staff

**Dominic Colosi**
2021-2022 L&S University Staff Excellence Award

**Pam Doolittle**
2023 ACS Division of Analytical Chemistry J. Calvin Giddings Award for Excellence in Education

**Patrick Egan**
2021-2022 L&S University Staff Excellence Award

**Brian Esselman**
Letters & Science Academic Staff Mid-Career Award

**Lea Gustin**
Taylor Teaching Award, 2022-2023

**Kristi Heming**
Robert Alesch Award for UW Partners-in-Giving

**Liana Lamont**
Taylor Teaching Award, 2021-2022

**Steven Myers**
2022 University Staff Recognition Award

**Bob Shanks**
Chemistry Department Excellence Award for Academic Staff

**Cecilia Stodd**
2023 UW-Madison Elizabeth S. Pringle Award

**Martha Vestling**
2022 Al Yergey Mass Spectrometry Scientist Award

2021-2022 L&S Judith Craig Distinguished Service Award

## Student

**Meranda Masse**
2023 ACS Leadership Award in Mentoring

**Stephanie Oliveras Santos**
2023 ACS for Leadership Award in the Promotion of Diversity, Equity, Inclusion, and Respect

**Jairo Villalona**
Inducted into the Edward Alexander Bouchet Graduate Honor Society, 2023

**Phoenix Pham**, **Paul Schindler**, and **Ryan Strandberg** were elected into the 2023 Phi Beta Kappa Society.

**Michaela Barber**, **Maia N. Bates**, **Gerardo Javier Quintana Cintron**, **Zachary M. Faitz**, **Uriel Arturo Garcia**, **Angel Ibarra**, **Ryan P. McDonnell**, **Alana Rose Meyer**, and **Alyssa Katherine Olszewski** were named NSF Graduate Research Fellows.

## Other

**Department of Chemistry–North Tower**
Ballinger | Strang | Aro Eberle–Architects, Merit Award, 2023 Architectural Excellence Design Awards–Architecture, AIA Pennsylvania

2023 Engineering Excellence–Best of State American Council of Engineering Companies of Wisconsin


*Professor Kyoung-Shin Choi accepts the prestigious Ho-Am Prize at a ceremony on June 1, 2023, held in Seoul, South Korea.*

# Professor Kyoung-Shin Choi wins Samsung's 2023 Ho-Am Award

*by Kimberly M. Hazen*

Professor **Kyoung-Shin Choi** has been named the 2023 Samsung Ho-Am Prize Laureate in the category of Chemistry and Life Sciences. Professor Choi was awarded 300 million Korean Won (KRW) (approximately $228,400), a diploma, and a Ho-Am Prize medal at a ceremony held on June 1, 2023. Professor Choi was recognized for her work as "a world-renowned chemist in the field of energy science who has achieved remarkable progress in eco-friendly hydrogen production through research aimed at developing and understanding photoelectrodes and catalysts for the photoelectrochemical reaction of solar water splitting," according to an announcement from the foundation. Professor Choi has developed numerous electrochemical processes and electrodes that can be used to convert lignocellulosic biomass to biofuels and commodity chemicals and to treat seawater and wastewater for the protection of freshwater resources while recovering contaminants as valuable chemicals. Her work has a direct impact on creating a sustainable future.

Professor Choi joined the UW–Madison Department of Chemistry in 2012. She earned a B.S. in Food and Nutrition/Chemistry and an M.S. in Chemistry from Seoul National University; and a Ph.D. in Chemistry from Michigan State University. She served as a Postdoctoral Fellow at the University of California, Santa Barbara, and a Professor of Chemistry at Purdue University.

The Samsung Ho-Am Prize was established in 1990 by Kun-hee Lee, the late chairman of Samsung, with a vision to create a new corporate culture that carries on the "noble spirit of public service upheld by Byung-chull Lee, the founder of Samsung." The prize is awarded to individuals who have made significant contributions to academics, the arts, and social development, and who have furthered the welfare of humanity through distinguished accomplishments in their respective professional fields. Candidate nomination specifics require the candidate has earned "accomplishments and accumulated expertise which have contributed to society in their respective fields, and accumulated expertise that has been highly evaluated socially." The candidate must also have "distinguished contributions to the nation and humanity through a clearly creative mentality and spirit of service."

This year's laureates were selected through an evaluation process that spanned four months, with the participation of 46 judges composed of renowned scholars and experts from both domestic and international settings, as well as 45 overseas academic advisors.

In addition to Professor Choi's award in the category of chemistry and life science, this year the Ho-Am Foundation named laureates in the categories of physics and mathematics; engineering, medicine, arts, and community service. To date, a total of 170 recipients have received KRW 32.5 billion in prize money.

Notably, UW-Madison Department of Chemistry faculty member, Emeritus Professor **Hyuk Yu** earned the Ho-Am Award in 1997 for his work in the field of polymer dynamics on confined geometries in monolayers and thin films. Professor Yu's group extended techniques to oil/water interfaces, which was the first application of the method to liquid/liquid interfaces.

# New Faces, New Changes

Since January 2022:

## New Faculty

**Eszter Boros,** Associate Professor *(Featured on pp. 21–22)*
**Micheline Soley,** Assistant Professor *(Featured on pp. 25–26)*

**Zoe Todd,** Assistant Professor *(Featured on pp. 23–24)*

## New Staff

**Mary Beth Anzovino**, Associate Director of Organic Chem Labs
**Lauren Aria**, Assistant Glassblower
**Andrew Arndt**, Research Store Manager
**Jeff Bartz**, Scientist
**Austin Scott Bleskacek**, Laboratory Manager
**Beatriz Bolanos Lemire**, Human Resources Representative
**Rebecca Brown**, Chemistry Learning Center Specialist
**Rebecca Carlson**, Administrative Assistant
**Isabella Eliasen**, Administrative Assistant

**Jonathan Gapen,** Network Engineer
**Erin Grunewald,** Graduate Program Coordinator
**Hongqin (Tony) Guan,** Research Technician
**Haris Hadzic,** User Support Specialist
**Erin Hale,** Administrative Assistant
**Lynn Harrow,** Instructional Lab Specialist
**Kimberly Hazen,** Marketing and Communications Manager
**Spencer Heins,** Synthesis & Catalysis Center Director
**Madeline Henkel,** Undergraduate Services Specialist
**Andrew Hinz,** Undergraduate Program Manager
**Dillon Hofsommer,** Scientist
**Char Horsfall,** Assistant Department Administrator
**Christopher Hughes,** Chemistry Learning Center Instructor
**Francisca Jofre,** Graduate Program Director
**Carolyn Karls,** Financial Specialist
**Mickie Killian,** Chemistry Learning Center Instructor
**Kathryn Koenen,** Administrative Assistant
**Rebecca Moy,** Administrative and Events Professional
**Ashley Petersen,** Project Coordinator
**Laura Reade,** Administrative Assistant
**Tracey Reitz,** Chemistry Learning Center Director
**Carlos Saavedra Salazar,** Scientist
**Julia Saloni,** Chemistry Learning Center Instructor
**Sam Shields,** Instrument Maker
**McKenna Smith,** Scientist
**Mandi Simmons Thies,** Assistant to Department Chair
**Emma Weimerskirch,** Administrative Assistant
**Rosemary Wonnell,** Undergraduate Services Specialist

## Retirements

### Faculty

**Ned Sibert**
**Tom Record**

### Staff

**Arrietta Clauss,** Graduate Program Director
**Charlie Fry,** NMR Lab Director
**Kristi Heming,** Administrative Assistant
**Tony Jacob,** Chemistry Learning Center Director
**Jose Laboy,** Chemistry Learning Center Specialist
**Matt Sanders,** Executive Director






# Associate Professor Eszter Boros

*The Burstyn, Brunold, and Boros labs on an outing to the Henry Vilas Zoo*

*In June of this year, we officially welcomed Associate Professor **Eszter Boros** and her team to the Department of Chemistry. Here's more about her background, research, and what brought her to Madison.*

**ASSOCIATE PROFESSOR ESZTER BOROS**

Ph.D. in Chemistry from the **University of British Columbia**

M.S. and B.S. in Chemistry from the **University of Zurich**

### Why did you choose the University of Wisconsin-Madison?

The Department of Chemistry combines scientific excellence, drive, and a can-do attitude with collegiality and a genuine joy for chemistry. UW-Madison is an ideal environment for multidisciplinary research with chemistry as the central science. In addition to brilliant and inspiring faculty colleagues, students, and staff, core facilities, and administrative resources enable the study of ambitious, challenging, and high-risk-high-reward projects.

### Where did you work last and what made that position interesting?

I started my academic faculty career at Stony Brook University, where we established most of our now federally funded research projects. I am excited to progress our foundational and proof-of-concept work to the next level here at UW-Madison and have our program take flight!

**What's the focus of your research and what it could mean for the advancement of science or the general public?**

Our lab investigates the use of fundamental coordination chemistry to study the reactivity, structure, and photophysical properties of rare earth ions and early transition metals in water. We then apply this knowledge to synthesize and validate next-generation radiopharmaceuticals in preclinical mouse models of disease. We also study the behavior of non-endogenous metal ions in bacterial environments, hoping to inform the design of improved antibiotics that can overcome resistance mechanisms.

*"I didn't know that research could be a career, but I knew I wanted to learn more about science, so going to college to get a degree in chemistry seemed like the obvious choice."*

*—Associate Professor Eszter Boros*

**Tell us about your background. What made you pursue science and research? How has your experience shaped your research goals?**

I am a first-generation Ph.D. and grew up as the daughter of Hungarian immigrants in Switzerland. I am incredibly grateful to have grown up in a politically stable country with phenomenal educational resources, while Hungary experienced (and still is in) political turmoil after the fall of the Iron Curtain. As such, I never take anything for granted, yet I always strive to make the best of any situation I find myself in.

How did I end up in science? I always wanted to know how things worked at a microscopic (molecular) level, ever since I was little. Often, I would spend hours flipping through books on human physiology and biology, and peel apart leaves and flower petals in the garden. I didn't know that research could be a career, but I knew I wanted to learn more about science, so going to college to get a degree in chemistry seemed like the obvious choice. There, I learned about academic research, and that I could possibly spend my entire life learning about how the world worked... That seemed like the best thing, ever, and it turns out that it absolutely is!

**Tell us about your teaching philosophy and why you believe educating students is important.**

My teaching philosophy is to deliver content in a conversational, interactive format that is student-paced. I have developed curricula for two inorganic chemistry courses at Stony Brook and yet, due to the significant amount of student involvement of my lecturing style no two courses have been the same. My courses were focused on teaching concepts (over memorization) that were rooted in inorganic chemistry but broadly applicable to chemistry as a whole and should help students understand and connect concepts they learn in other courses.

**What else should we know about you?**

I am a mom to two little boys (ages one and three) and I like to be active (CrossFit, hiking, ice/roller skating). Being a mom and an athlete are definitely not diametrically opposed concepts to being an ambitious scientist and dedicated mentor.

**The team accompanying Associate Professor Boros to UW–Madison includes:**

**Dariusz Smilowicz**, postdoc
**Raphael Lengacher**, postdoc
**Axia Marlin**, postdoc
**Cormac Kelderman**, postdoc
**Jennifer Whetter**, Ph.D. student
**Minhua Cao**, Ph.D. student
**Owen Glaser**, Ph.D. student

*Associate Professor Boros with her two sons and husband*





# Assistant Professor Zoe Todd

*In August, Assistant Professor **Zoe Todd** joined the Department of Chemistry. Recently, Assistant Professor Todd shared her background, research, and her special love, Peter the Pony.*

**ASSISTANT PROFESSOR ZOE TODD**

A.M. in Astronomy and Ph.D. in Astronomy from **Harvard University**

B.S. in Biochemistry & Molecular Biology and Astronomy & Astrophysics from **Penn State University**

**Why did you choose the University of Wisconsin-Madison?**

I chose the University of Wisconsin-Madison because of the cutting-edge research, interdisciplinary focus, and teaching excellence. I'm really looking forward to interacting with others in the department and across campus!

**Where did you work last and what made that position interesting?**

I previously worked at the University of Washington as a Sagan Postdoctoral Fellow. There, I worked on topics related to astrobiology and the origins of life. I am fortunate enough to work on the fascinating questions involving our place in the universe, including if there is other life present elsewhere.

**What's the focus of your research and what it could mean for the advancement of science?**

I am interested in investigating the origins of life on Earth and understanding the implications for the possibility of life on other planets. Astrobiology is inherently interdisciplinary, relying on fields ranging from astronomy, physics, planetary science, chemistry, biology, geology, etc. My research utilizes an interdisciplinary approach to attempt to understand how the astronomical and planetary environments may allow for the chemical/biochemical origins and evolution of life. For example, I work on constraining favorable planetary environments that may provide the chemicals necessary for the origins of life. I also investigate prebiotic chemistry in

*Above: Peter the Pony accompanied Zoe Todd to Madison and has made the transition to his new home nearby in Oregon, Wisconsin.*

the laboratory to better understand the constraints on the planetary environment and the plausibility of the chemistry. I hope to work towards tracing out a continuous and plausible path for the origins of life: from the astronomical and planetary environments seeding the necessary feedstock chemicals, to the synthesis of the building blocks of life (e.g. ribonucleotides, amino acids, or alternatives), and finally to the development of the first self-replicating and functional protocells. By using a combined astronomy/chemistry approach in the planetary context, we may be able to make substantial progress in understanding the fundamental and intriguing question of if we are alone in the universe.

**Tell us about your background. What made you pursue science and research?**

I come from a very interdisciplinary background, spanning the fields of astrophysics to biochemistry. Originally as an undergraduate student, I planned on double majoring in these two fields, since I had an interest in both. I was fortunate enough to get a NASA-funded research position the summer before my freshman year working on the origins of life. This experience showed me that my two interests—in astronomy and biochemistry—

> *"It is very important to me that everyone feels respected and safe in their work environment since I believe this is when we are able to do our best thinking."*
>
> *—Assistant Professor Zoe Todd*

actually could be combined when working in the field of astrobiology. Ever since then, I've wanted to know how life started on our planet and what this implies for the possibility of life on other planets. These interests continue to shape my current research interests, and they undoubtedly will continue to in the future.

**What drives your desire to teach?**

Perhaps the most rewarding experience I have ever had is to teach students and to see the moment when something "clicks" or when they get the answer to a question they've wondered their entire lives. My experiences teaching inspire me to try to be a better communicator and a better scientist. Sharing my work and passion for science with others is immensely rewarding for me personally. My favorite moments in the classroom are when students can work together in small groups to solve problems or to discuss open-ended questions. In these moments, students are teaching me as much as I am teaching them!

**What can students expect from you in class or in the lab?**

Students can expect a respectful, kind, and inclusive environment in the classroom or in the lab, where they are intellectually challenged, granted the freedom to pursue ideas of interest, and given enough guidance to proceed. It is very important to me that everyone feels respected and safe in their work environment since I believe this is when we are able to do our best thinking. I hope to create an atmosphere where we are all learning from each other. In a field as broad and diverse as astrobiology, no one person can be an expert in everything. So, it's important that we all share our expertise and learn from each other.

**What most excites you about coming to UW–Madison?**

I'm very excited about the Wisconsin Center for Origins Research, where people from all across campus will come together to study the origins of life and astrobiology. UW-Madison has some of the world's experts in their respective fields, and I'm looking forward to learning from them and continuing to expand my knowledge. I truly believe that we will need every ounce of ingenuity and experience to tackle challenging problems like the origins of life. I'm also looking forward to a nice view of the lakes. :)

**And, you have a pony?**

I've been riding horses since I was four. Weekly lessons turned into leasing my first horse, which eventually turned into buying my own horse when I was about 11. When I was 15, my sister—who also rides and had her own horse—bought a $15 raffle ticket to win a baby pony. The raffle was to support a girl who needed a double lung transplant due to cystic fibrosis. And crazily enough, she won the baby pony (Peter)! We lived in Pennsylvania at the time and Peter was in Florida. Peter took a 20-hour drive to us as a tiny six-month-old pony. As I walked him off the trailer, I saw his little pony devil eyes and my first thought was—oh wow, he's going to be a handful!

My sister and I shared Peter during my time in high school and my first few years in college. When my sister graduated college and got a job elsewhere, she eventually took her horse with her but left Peter with me. He's been with me ever since, helped me stay sane throughout grad school, and even traveled to Seattle with me. Now in Madison, Peter is 15 years old and I can't call him a baby any longer. Although, in my head sometimes he's still the tiny six-month-old little terror that first came to us!

Peter's living in Oregon, Wisconsin, which is great farm country. He has a few horsey friends and he's loving the nice green grass! We get to ride on lots of trails along cornfields, hayfields, etc. We're both very happy here so far!





*Assistant Professor Soley plays classical guitar at the MIT Chapel in Cambridge, Massachusetts, near her hometown.*

# Assistant Professor Micheline Soley

*In August of last year, Assistant Professor **Micheline Soley** joined the Department of Chemistry. We recently sat down with Assistant Professor Soley to learn more about her research, her move to Madison, and her passion for classical guitar.*

**What was it that drew you to Madison?**

Of course, Madison is top-notch, not only in chemistry but in physics and quantum computing, so I knew that Madison would be a great place to work across disciplines. I also knew Madison was an excellent place to work since I have a family connection—my great uncle was a professor in the medical school and there is a bench dedicated to him at the edge of Picnic Point.

**Where did you work last and what made that position interesting?**

The last place that I worked was at the Yale Quantum Institute, where I was a postdoctoral fellow with Victor Batista, Steven Girvin, and A. Douglas Stone. Working at the Institute was especially exciting because it brought together researchers from different fields—physics, math, computer science, and chemistry—towards a common goal, the advancement of quantum computers. I am fascinated by research at the intersection of chemistry, physics, applied math, and computer science, and I love bringing that all to chemistry.

**ASSISTANT PROFESSOR MICHELINE SOLEY**

Ph.D. from **Harvard University**

**Yale Quantum Institute**
Postdoctoral Fellow

Fulbright Fellow at the
**Max-Born Institute** in Berlin Germany

B.S. in Chemistry and Music from
**Yale University**

**What's the focus right now of your research?**

My group has two main focuses. One is asking how to expand the range of molecular systems that can be studied with exact quantum dynamics through quantum computing and data science. This question is very important when we want to advance drug development, catalyst design, or how to make better sources of renewable energy. On the other hand, I'm also very interested in

how to use ultracold molecules and ultracold atoms to probe fundamental concepts in quantum mechanics, including how to realize quantum effects and their relationship to chemical reactivity using molecules cooled to almost absolute zero.

### How big is your team now?

Right now, we're a team of seven people: a Ph.D. student from chemistry, master's students from quantum computing and the physics program, undergrads from math and computer science, and even a high school student with a background in high-energy physics, which gives us another perspective. It's nice that the students get opportunities to work together and learn about different corners of science from each other.

### What made you pursue science and research? How has your experience shaped your research goals?

I was just thinking about how exactly this happened. I've always been very interested in understanding the nature of objects and the idea that there are actually atoms and molecules moving inside of our desks or in water sloshing around in a glass. I grew up outside of Boston in Lexington, Massachusetts where I was very lucky to have many educational resources growing up and even Lincoln Labs located in my hometown. In middle school, I had the opportunity to enter a lottery to attend a talk by a Nobel Prize winner in physics. I won the lottery, really in two ways. I won the actual lottery of learning from a Nobel winner who was working on ultracold atomic Bose–Einstein condensates, and I won the lottery of being inspired to start reading about physics and going on to learn about chemistry. And now, funny enough, I even work in that field of ultracold atoms and molecules. Although not a Nobel Prize winner, I still try to do outreach to inspire students and maybe give them a chance to get involved in science.

> *"I am fascinated by research at the intersection of chemistry, physics, applied math, and computer science."*
>
> *—Assistant Professor Micheline Soley*

### What can students expect from you in the lab or in your class?

Students can expect to have the chance to talk about new ideas and how the century-old concepts that we learn in class are still used in cutting-edge research today. I respect and believe in the idea that science is at its best when everyone is free and safe to share their own perspectives.

### When you're not in the lab, what do you enjoy doing?

I love playing classical guitar. I enjoy learning pieces from different parts of the world and accompanying myself singing on the guitar. In the past, I've been part of jazz big bands, jazz combos, and choruses. I haven't yet found one here, but there is a classical guitar program here, so I'm looking forward to that. Music and science are related on so many different levels. My chemistry work is all by-hand math, computer programming, and theory. There's also a theory of music to see how music is constructed on so many different levels, including chord analyses. When you're performing music, it's also like giving a seminar because like you're telling the story of your music, you're telling the story of your research.

*Assistant Professor Soley near her family home in Northern Patagonia, Chile on Lake Llanquihue.*

### And you just gave a big talk in San Francisco at the ACS meeting. Tell us about that.

That was the Kavli Foundation Lecture Series, which recognizes groundbreaking discoveries by scientists tackling many of the world's mounting challenges. The Emerging Leader Award is for a distinguished younger scientist regarded by their peers for significant contributions to an area of chemistry and multidisciplinary areas of chemistry. I won the award for harnessing the power of data and that was a really wonderful opportunity.

### We understand you're doing some community outreach. Tell us more.

My mother was actually born in Chile, and I am doing outreach with a Chilean connection. A Chilean high schooler founded a group called Girls in Quantum, which now has over 2000 high schoolers from 21 countries. The group is supported by the former chief technology officer of Cisco, Monique Morrow. I'm collaborating with the group and providing resources to get them hands-on experience with quantum computing. I'm working now to give the same experience to students in Chicago through the Chicago Quantum Exchange. I would like to introduce as many students as possible to quantum computing.



# The Newest Badger Chemists

## Congratulations to our recent graduates.

## Baccalaureate *Chemistry Major*

*The chemistry majors at the May 2023 graduation celebration*

### Fall 2022

Abdullah Kalid A. Alkarzai
Iris Bloede
Nathan Bradshaw
Xinpeng (Dale) Deng
Peter Erpelding (H)
Jeffrey Hilbelink
Connor Klaus
Pei Chi (Peggy) Lee
Xinyu (Jerry) Miao
Rachel Nelson
Alisha Parboteeah
Mingeun Park
Guy Pillon
Sierra Schwier
Olivia (Ollie) Sellman
Owen Sheehy
Robert (Rob) Taylor
Alexa Wasielewski

### May 2023

Peter Cismaru
Jaden Coles
Qwintin Drabek
Lauren Ehlers
Samuel (Sam) Gardner
John Hilgers
Thomas Hotvedt
Chenyao Huang
Xiaobao (Bruce) Huang
Hailey Huff
Anna Jansson (H)
Evan Jensen
Jason Johnson
Michael Jotterand
Bridget Knight
McKayla Knoebel
Caleb Koeller
Kathryn (Katie) Kothlow
Sumin Lee
Riley Lehman
Jason Lehrfeld
Morgan Lekschas
Ruojia Li (H)
Junyi Liu
Scott McInerney
Carter Ness
Sehyun Park (H)
Jared Pratt (H)
Ryan Quinn (H)
Thanadej (Dan) Rattanakornphan
Lauren Rault (H)
Corbyn Renner
Donald Richards
Matthew Rivard
Caroline Roycroft
Mamour Sam
Paul Schindler (H)
John (Jack) Steinbach
Ryan Strandberg
Marcus Tang Kai Heng
Xindi Tang (H)
Qiyuan (Tom) Tao
Natalie Taylor
Nathan (Nate) Truettner
Maxwell (Max) Unger (H)
Macy Vander Pas
John Vetterli
Emily Walker
Peter Waples
Noah Welke

### August 2023

Lucas Bartel
Josette Coulthurst
Nicholas King
Kyle Kirkendall-Jones
Dennis Kobuzi (H)
Berit Nagorsen
Cora Roost
Chien-Rung Shih
Zhengyi (Kevin) Tang
Ian Thurston
Devin Tomlin
Shuyi Zhang (H)
Niko Zoller

(H) Graduated with Comprehensive Honors
(H) Graduated with Honors in the Liberal Arts
(H) Graduated with Honors in the Major

## Graduate *Master of Science*

### December 2022

Ethan Nikolas Auleciems (Jin)
Emily C. Burgess (Blackwell)
Bethany J. McCarty (Tang)

### May 2023

Heather Joy Allaman (Cavagnero)
Ryan Hokule'A Hagmann (Hermans)
Michelle Harasimowicz (Hamers)
Houston Hartwell Smith (McMahon/Woods)
Danqing Wang (Li)

### August 2023

Kaitlyn M. Flynn (Stahl)
Anthony L. Sumlin (Boydston)

# Ph.D.

## December 2022

**Mary Katherine Andrews (Gellman)**
*Exploration in Foldamer Catalyzed Cross Aldol Reactions*

**Michael Mark Aristov (Berry)**
*Exploring and Visualizing the Nuances of Bonding in Bimetallic di-Molybdenum and Gold Complexes*

**Zachary Thomas Armstrong (Zanni)**
*Ultrafast Two-Dimensional White-Light Spectroscopy of Excitons in Disordered Environments*

**Miriam Magdalene Bohlmann Kunz (Zanni)**
*Ultrafast Pulse Shaping Applied to Multi-Dimensional Spectroscopy and Novel Microscopy Methods*

**Samuel B. Cahoon (Yoon)**
*Enantioselective Di-ϖ-Methane Rearrangements and Mechanism Guided Investigations into Photochemical Reactions*

**Matthew Ryan Dorris (Bolling/Smith)**
*Chemical Analyses of Polyphenol-Rich Fruit Juices*

**Levi T. Hogan (Goldsmith)**
*Single Nanoparticle Absorption Spectroscopy: Chemical Dynamics Using Optical Microresonators*

**Rachel Hutchinson (Cavagnero)**
*Critical Beginnings: Illuminating Structure, Dynamics, and Interactions During the Early Stages of Protein Life*

**Christopher McGee Jernigan (Bertram)**
*Atmospheric Fate of Sulfur Species Emitted to the Pristine Marine Environment*

**Mathew Robert Johnson (Stahl)**
*Flow Systems Integrating Heterogeneous Catalysts and Quinone Mediators Enable Power Generation and $H_2$-Promoted Electrosynthesis*

**Benjamin James Kasting (Ediger)**
*Investigation of Stable Glass Forming Ability and Secondary Relaxation Suppression in Systems with Previously Unexplored Dynamic Properties*

**Kyle Foster Sunden (Berry)**
*Yaq: Yet Another Acquisition; A Modular Approach to Spectroscopy Software and Instrumentation*

**Nhu Quynh Vu (Li)**
*Discovery and Quantification of Crustacean Neuropeptides Using Mass Spectrometry and Informatics Approaches*

## May 2023

**Ryan Timothy Allen (Zanni)**
*Ultrafast Dynamics of Carbon Nanotube Exciton Polaritons Revealed with Two-Dimensional Spectroscopy*

**Rachel Anne Bergin (Bertram)**
*Observation-Based Constraints on Composition & Total Surface Area of Atmospheric Aerosols: Implications for Regional Air Quality*

**Colleen Paige Chernowsky (Wickens)**
*Development of Selective and Deeply Reducing Systems with Electrochemistry and Photoredox Catalysis*

*Ph.D. recipients at the May 2023 graduation celebration*



**Daniel Graham Delafield (Li)**
*Standing in the Way of Profiling Depth: How the Selection of Chromatography and Mass Spectrometry Data Acquisition Limit Our View of the Proteome*

**Sidney Steven Dicke (Zanni)**
*Protein Secondary Structure Identification in Vitro and Ex Vivo Using 2D IR Spectroscopy: Kinetics and Imaging*

**Son Dong (Hermans)**
*Making Polymer Building Blocks from Natural Gas and Plastic Waste*

**Pristine Matisha Dorman (McMahon/Woods)**
*The Rotational Spectra and Analyses of Astrochemically Relevant Nitriles*

**Emily M. Kaufman (Brunold)**
*Progress Toward the Use of TSF and DOVE Spectroscopy to Probe Coupling Relationships in Complex Molecules*

**Jake Alexander Melby (Ge)**
*Novel Strategies to Address the Challenge of Sensitivity in Top-Down Proteomics*

**David Stephen Roberts (Jin)**
*Defining the Molecular Landscape of Low-Abundance Protein Biomarkers by Top-Down Proteomics and Nanotechnology*

**Cole Sagan (Garand)**
*High-Resolution Total Photoelectron Yield Spectroscopy Makes Model Systems of Polycyclic Aromatic Hydrocarbon Anion Resonances*

**Daniel Cristian Salgueiro (Weix)**
*Tuning Reactivity in $C(sp^3)$–$C(sp^2)$ Cross-Electrophile Coupling*

**Diana Jin Wang (Wickens)**
*Alkene Functionalization via a Dication Pool Strategy*

**Jonas Karl Widness (Weix)**
*Semiconductor Quantum Dots for Synthetic Photoredox Catalysis and Method Development for Cross Electrophile Coupling*

**Oliver Purdy Williams (Wickens)**
*"Hidden" Mechanisms in Photoredox Catalysis: Strategies to Promote Challenging Redox Events*

## August 2023

**Elizabeth Forbes Bayne (Ge)**
*Mass Spectrometry-Based Omics Technologies: The Enabling Force for Precision Medicine*

**Mahzad Dehghany (Schomaker)**
*Ring Expansions of Bicyclic Aziridines via Ylide Intermediates Toward Formation of Aminated Complex Molecules and Design, Synthesis, and Electrophysiological Evaluation of Ionophores and Ion Channels in Planar Bilayers*

**Kieran Michael Farrell (Zanni)**
*New Techniques and Technology Recover Old Capabilities and Improve the Sensitivity of Pulse-Shaping 2D IR*

**Matthew James Genzink (Yoon)**
*Total Synthesis of Pseudo-Dimeric Cyclobutane Natural Products via Brønsted Acid-Catalyzed Asymmetric [2+2] Photocycloadditions*

**Dung Le Golden (Stahl)**
*Radical Strategies for (Hetero) Benzylic $C(sp^3)$–H Functionalization and Cross Coupling*

**Peyton Mackinzie Higgins (Buller)**
*Substrate Multiplexed Screening Guides Development of Biocatalysts for Friedel-Crafts Alkylation of Aromatic Amino Acids*

**Dylan E. Holst (Wickens)**
*The Dication Pool Strategy for Diverse Alkene Functionalization*

**Michelle Marie Killian (Brunold)**
*Spectroscopic and Computational Investigation of Transition Metal Binding by the Human Immunological Protein Calprotectin and Characterization of Some Tris-Thioether Metal(II) Semiquinonate Complexes*

**Seoyoung Kim (Weix)**
*Development of Nickel-Catalyzed Cross-Electrophile Coupling of Aryl Chlorides and Triflates With Alkyl Halides*

**Veronica Katarzyna Krasecki (Goldsmith)**
*Lights, Camera, Molecules: Developing Fluorescence Methods to Investigate Chemical Reactions*

**Eli Jared Larson (Ge)**
*New Front-End Separation Approaches for Top-Down Proteomics*

**Yumin Lian (Schwartz)**
*Understanding and Controlling Fluoroscanning Variables Enables High-Resolution DNA Profiling*

**Marco Antonio Lopez (Stahl)**
*Expanding Benzylic C–H Diversification via C–H Chlorination/Functionalization Strategies*

**Grace Anne Lutovsky (Yoon)**
*Engaging Feedstock Chemicals in Photochemical Oxidation Reactions*

**Meranda Marie Masse (Cavagnero)**
*Protein Folding at Birth: Toward Understanding the Effect of the Ribosome on Nascent Protein Chains*

**Jericha Taylor Mill (Li)**
*Mass Spectrometry Techniques for Metabolomic Studies of Aging and Age-Related Diseases*

**Joshua R. Miller (Brunold)**
*Spectroscopic and Kinetic Analysis of Mammalian Cysteine Dioxygenase*

**Megan Renee Nieszala (Landis)**
*Practical Quench Labeling Techniques for Information-Rich Analysis of Olefin Polymerization Catalysts*

**Lydia J. Perkins (Buller)**
*Development of Cobalt Porphyrin Biocatalysis*

**Trenton McCaffrey Peters-Clarke (Coon)**
*Advancing Tandem Mass Spectrometry for Characterization of Complex Biopolymers*

**Gina Roesch (Garand)**
*Innovation in Mass Spectrometry Instrumentation for Applications in Cryogenic Ion Vibrational Spectroscopy*

**Richard Dominic Ross (Jin)**
*Structure-Property Relationships of Electrocatalysts for the Two-Electron Oxygen Reduction Reaction in Acidic and Neutral Media*

**Cesar Saucedo (Hamers)**
*Characterization of the Sub-Bandgap Photoelectron Emission Mechanism of Diamond into Vacuum and Water*

**Houston Hartwell Smith (McMahon/Woods)**
*Rotational and Structural Analyses of Astrochemically Relevant Molecules*

**Alexios Georgios Stamoulis (Stahl)**
*The Role of Organic Cocatalysts in Homogeneous and Heterogeneous Oxidations: Thermodynamic Principles and Mechanistic Insights*

**Patrick Timothy Sullivan (Feng)**
*Design and Characterization of Organic Redox Molecules for Energy Applications*

**Dylan Nicholas Tabang (Li)**
*Leveraging Mass Spectrometry to Probe Protein Post-Translational Modifications in Pancreatic Disease*

**Rachel Louise Tritt (Boydston)**
*Improving Control and Functionality of Photoredox-Mediated Metal-Free Ring-Opening Metathesis Polymerization*

**Cecilia Helen Vollbrecht (Goldsmith)**
*Development of Optical Microresonators for Single-Molecule Photothermal Spectroscopy*

**Danqing Wang (Li)**
*Development and Application of Mass Spectrometry Methods for Proteomic and Post-Translational Modification Analysis*

**Amelia Marie Wheaton (Berry)**
*When One Metal Is Not Enough: Synthetic, Spectroscopic, and Computational Investigations of Heterometallic Extended Metal Atom Chains*

**Ke Zhao (Blackwell)**
*Chemical and Biochemical Approaches to Investigate the Mechanisms of Quorum Sensing in Staphylococcus aureus*





***Courtesy of NASA.*** *The central region of the Chameleon I dark molecular cloud, which resides 630 light years away.*

# Katarina Yocum studies the chemistry of interstellar cloud "ices"

*by Caroline Cole*

**Katarina Yocum** graduated from the UW–Madison in January 2022. As a graduate research assistant for the NASA Goddard Space Flight Center through the Widicus Weaver Group, Yocum primarily studied developing new techniques to study cosmic ice chemistry.

The Widicus Weaver Group uses rotational spectroscopy, a data collection system many astrochemists use. However, Yocum's project had a slightly different focus within the field of astrochemistry.

"For my project, I would recreate conditions of an interstellar cloud. In interstellar clouds, there are 'ices' which are really important for the chemistry that happens there," Yocum said.

According to Yocum, the 'ices' are not just made of water in interstellar clouds—other chemicals include carbon dioxide, carbon monoxide, and methane. On Earth, we typically imagine these chemicals in gas form, but due to the extreme cold temperatures in the interstellar clouds, they can be in the solid phase.

"These ices provide a 'fast' formation pathway for more complex chemistry to happen," Yocum said. "That's why we find them so fascinating. We believe ices are the starting point of a lot of the different molecules that we detect in space."

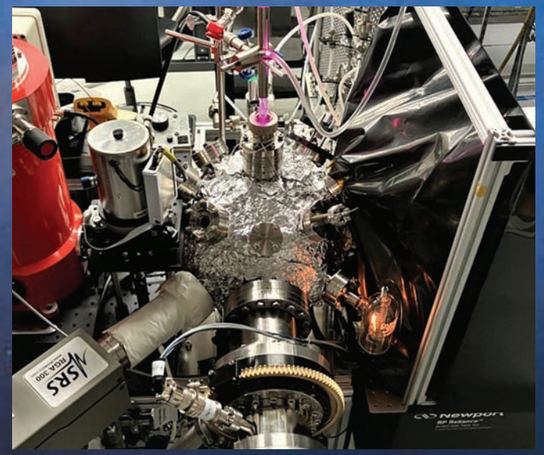
Yocum became interested in the field of astrochemistry after an internship studying cosmic ice chemistry at NASA during her undergraduate degree at Kutztown University of Pennsylvania.

"[The internship] answered a lot of the questions that I sit and think about day-to-day, such as 'how did life start on Earth?' and the different theories of how this looks scientifically," Yocum said.

After defending her thesis, she began her position as a NASA Postdoctoral Program (NPP) Fellow. She secured funding for two years to continue the ice chemistry work she studied with the Widicus Weaver Group.

*Dr. Katarina Yocum*

"My graduate work focused on developing the technique and looking at its limitations and capabilities," Yocum said. "Now we have a decent idea of what those limitations are, so we are focusing on the chemical studies rather than instrument development."




***Courtesy of Widicus Weaver Research Group.*** *The Sublimation Laboratory Ice Millimeter/submillimeter Experiment (SubLIME setup) is used to study the infrared spectra of interstellar ice analogs while monitoring the gas-phase chemistry above the ice using mass spectrometry and rotational spectroscopy. Dr. Yocum constructed, benchmarked, and conducted the initial science investigations using this instrument, the first of its kind.*

Specifically, Yocum's proposal covers two main areas. First, Yocum plans to examine prebiotic molecules such as glycine, a simple amino acid, and how these molecules physically transfer to the gas phase in interstellar clouds. Astrochemists continue to look for amino acids in interstellar space because that would tell researchers that prebiotic molecules are able to form at very early stages in star formation before planets develop. However, even after decades of research, astronomers have not confidently detected glycine, despite models showing that it can be formed in the interstellar medium. The second part of her proposal will study the detection limits of a new submillimeter spectroscopic technique to determine if it could be used to detect prebiotic molecules while on a flight mission spacecraft.

"When [our research group] came to UW, it was really exciting because it seemed like everyone was interested in astrochemistry," Yocum said. "That was nice because I felt encouraged by my committee and I felt that they were truly interested in my research."

# CHEMISTRY VISUALIZED

*by Katherine Parrish*

*"Metal Powders in Flames," a six-piece art display hangs in a Mathews Building hallway. These flame tests were set up and carried out by Jim Maynard and the photographs were taken by Jerry Jacobsen. They are six of a more than 80-piece collection.*

## Efforts by John and Betty Moore give chemistry art installations a new chapter.

*When Professor* **John Berry** *first came to UW-Madison to interview for a faculty position in 2005, he was struck by the art adorning the walls of the chemistry building. "It was really special to me… to see all these photos of flame tests, precipitations… I want to work in a department that is very proud of the fact that we do chemistry here, and we're going to show people what chemistry is all about."*

The artwork, commissioned by department members **John and Betty Moore** for the grand opening of the Shain Tower in 2003, currently consists of more than 80 framed photographs of chemical reactions and demonstrations. These pieces were proudly displayed on the walls of the first floor of the chemistry building until 2018 when they were taken down to prevent damage from construction activities. Thanks to the efforts of the Moores and Professor Berry, the art returned to the walls this past August, where it will continue to inspire generations of Badger Chemists.

Professor Moore joined the department in 1989 as chair of the General Chemistry Division and Director of the Institute for Chemical Education (ICE) and retired as W. T. Lippincott Professor of Chemistry in 2021. For thirteen years, he served as editor of the *Journal of Chemical Education* along with his wife Betty, who served as an associate editor. She worked for the chemistry department as program manager before retiring with her husband in 2021. The Moores' work developing new teaching technologies, advocating for accessibility, and disseminating cutting-edge pedagogy has made a profound and lasting impact on the science education community.

*John Moore, John Berry, and Betty Moore work in a storeroom to organize and label the chemical reaction and demonstration art collection.*

Professor Moore worked with the chemistry facilities committee throughout his time at UW-Madison and was involved in planning both the Shain and North Tower developments. In the early 2000s, renovations to the Daniels and Mathews buildings to accommodate the new Shain facility created a long corridor through all three buildings, affectionately referred to as 'Main Street.' This hallway posed a unique opportunity for the facilities committee. "There was a lot of traffic," said Professor Moore, "and there was a tremendous amount of empty wall space… and so we thought, we've got all these bare walls; we should do something meaningful." Mrs. Moore expressed what her thoughts were at the time: "We should teach with them!"

An ad-hoc committee was formed to determine how to make the space feel more welcoming. Committee members floated ideas about chemical imagery on the walls and monitors displaying recorded demonstrations, but it was only through the efforts of the Moores that these dreams were made a reality. Their experience producing educational media for ICE and the *Journal of Chemical Education* would prove useful. "It was something that we were already doing," Professor Moore explained, "making images and videos, and showing chemical reactions as a teaching tool." Work on the project began in February 2003. "It had to be done quickly," said Mrs. Moore, since they were planning to display the artwork at the grand opening of Shain in May.

> *"An image is static, but chemistry is dynamic, and that's why the series of photos . . . really gives you the sense of the dynamism."*
>
> *—John Berry*

The Moores enlisted the help of *Journal of Chemical Education* videographer **Jerry Jacobsen** and lecture demonstrator **Jim Maynard** to find experiments with both chemical and visual interest, ones that would be good candidates for art in the form of still images. "We looked at reactions with action, or color, or counterintuitive effects that could be visually perceived," shared Mr. Maynard. "I developed an eye for appealing reactions… visual imagery that was also chemistry." Part of the challenge was translating the evolution of a reaction over time into a series of still images. "We would select [stills] from the reactions that were filmed," Mrs. Moore explained, "because we understood what was happening and what it should show." The Moores collaborated on the captions that accompany each set of images, explaining the science behind them. Professor Berry expressed enthusiasm for the images in the series: "An image is static, but chemistry is dynamic, and that's why the series of photos if you go from one end to the other, that's what really gives you the sense of the dynamism." Indeed, the effect of seeing a reaction unfold before your eyes as you walk down a corridor is striking.

Even after all the demonstrations were planned, performed, and captured in photography, there was still more work to be done. Printing, framing, and hanging so many pieces was a logistical challenge, not to mention a costly one. "I think the grand total was probably around thirty thousand," said Professor Moore. The department

provided half the funds, while ICE covered the rest. The efforts of the entire group paid off and the project was completed in time for the grand opening of Shain Tower.

The photos were warmly received, as Mrs. Moore explained, "They are unique to our department...everyone appreciated them." However, the artwork made to celebrate the completion of one construction project had to be displaced for the start of another. Before the renovations of Mathews and Daniels began in 2019, the photos were taken down.

Two years ago, Professor Moore had hoped the artwork could be returned to the walls of the chemistry building. Until that could happen, the pieces were stored in an ICE storeroom. The process of re-hanging the artwork began on August 3, 2023, and was completed a week later. "It's nice to see them all up again," remarked Professor Moore.

On the first floor of Mathews, just off of 'Main Street,' you will find a series of brilliantly colored images titled, "Metal Powders in Flames." More photos of flame tests, precipitation reactions, and other curious chemical demonstrations, are now on display throughout the hallways on floors 3–8 of the Daniels building. While most of the artwork portrays the art of chemistry, one series examines the chemistry of art. Emeritus Professor of Chemistry **Don Gaines**, an avid amateur photographer, donated a set of five photographs he produced in his darkroom at home. This series, which can be found on the fifth floor of Daniels, demonstrates the effect of five different chemical development techniques on the same exposure. Each series highlights not just the beauty of chemistry, but also the inspiration and creativity that underpins science communication and exploration.

The vibrant images that once again adorn the walls of the chemistry building are testaments to the Moores' dedication to science education and the UW–Madison community. These pieces invite the viewer to consider the intersections between science and art, education and expression, humanity, and the world we inhabit. As this artwork continues to inspire and intrigue, it will remain a lasting tribute to the Moores. Professor Berry conveyed his hope that "former students, alumni... will recognize these photos, and I think they will be glad to see that they're still here. They're in new homes, but they're still brightening up the halls of the department."



# YOUR GIFT IS A CATALYST.

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

*Compiled by Emily Kitslaar*

"Your continued dedication and support to the UW-Madison Department of Chemistry has played a major role in its success and it is an inspiration to me and many students who are pursuing their academic and career goals in this field."

***–Marcus Kai Heng Tang,***
*2023 ACS DIC Undergraduate Award in Inorganic Chemistry*

"Receiving this fellowship feels like a culmination of my efforts and something I can be proud of earning."

***–Melissa Hall,***
*Dennis Evans Fellowship*

"Receiving this scholarship has been a source of inspiration, motivating and reminding me to work harder and strive for excellence."

***–Diana Morales Mijares,***
*Department of Chemistry Scholarship*

"It does encourage me to achieve, succeed and understand the power of 'paying it forward'. Receiving this scholarship has only made me stronger, and it helps me reassure myself that I'm on the right track."

***–Soorya Davanagere,***
*Eugene and Patricia Kreger Herscher Scholarship*

"It is through awards like this that students are reminded of their talents and accomplishments and feel supported in such a large community like the UW-Madison campus."

***–Kamryn Dembny,***
*Francis Craig Krauskopf Memorial Scholarship*

"This award has given me confidence in my research abilities, and I have decided to apply for post-doctoral researcher positions."

***–Kimberly DeGlopper,***
*2023 Gary B. and Janice L. Aspelin Excellence in Research Award–Chem Ed.*

"You play an invaluable role in our progress, and I am humbled in recognition."

***–Daniel Graham Delafield,***
*2023 Gary R. Parr Memorial Award*

"Because of your kind support, I will be able to use the Gary R. Parr Memorial Award funds to attend the American Society for Mass Spectrometry conference this summer in Houston, Texas to share the culmination of my thesis work and learn from other researchers in the mass spectrometry community."

***–Eli J. Larson,***
*2023 Gary R. Parr Memorial Award*

"I feel extremely grateful to feel secure in my financial future so I can spend time focusing on academic pursuits and taking advantage of the resources, organizations, and research opportunities UW-Madison has to offer. "

***–Hunter Potter,***
*John and Elizabeth Moore Award for Excellence in General Chemistry*

"Your contribution has been instrumental in helping me pursue my dreams, and I hope that one day I can inspire and support others in the same way."

***–Kate Zhao,***
*Ralph F. Hirschmann–Daniel H. Rich Fellowship in Bio-organic Chemistry*

"I am grateful for your belief in my potential."

***–Eshani Goonetilleke,***
*2023 Robert C. and Kathleen H. Ryan Graduate Student Award*

"Your contributions truly have a profound impact on the department and make it one of the best places in the world to study chemistry."

***–Sean Gitter,***
*Robert C. Doban Mentorship Award*

"Your investment in my education has made a significant impact on my life, and I am committed to using the knowledge and skills gained from my education to make a positive difference in the world."

***–Seungwoo Noh,***
*Walter W. and Young-Ja C. Toy Scholarship for Fall 2023*

"With the funding afforded by this fellowship, I am excited to engage in several months of uninterrupted research and attend conferences this summer."

***–Benjamin K. Chi,***
*2023 William B. Dickinson Fellowship in Organic Chemistry*

"With your generous award, I am able to strategically use the money to purchase chemicals and instruments that are necessary for my research."

***–Zhiming Su,***
*William B. Dickinson Fellowship in Organic Chemistry*

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*UW mascot Bucky Badger and members of the UW Spirit Squad perform for the crowd during the UW Homecoming Parade.* ***(Photo by Bryce Richter / UW–Madison)***