BADGER CHEMIST

University of Wisconsin–Madison Department of Chemistry
Established 1953, No. 64 2021

Two leaders in outreach & Chemistry Education retire, leaving legacies for a new faculty team

ALSO INSIDE:

- Department research
- Meet our new Department chair
- A new building opens this Spring

Department of Chemistry
UNIVERSITY OF WISCONSIN–MADISON

Letter from the Chair

Greetings Badger Chemists!

I became chair in July 2021 – it already has been exciting and challenging. I am grateful for former Chair Judith N. Burstyn, who advanced the organizational structure of our Department and put us in a strong position for future growth.

Department Chair Clark Landis

Each chair brings a set of priorities. One of my key goals is to increase collaborative research with industry and other groups. Through such collaborations, we connect our research with applications that benefit society – a genuine expression of the Wisconsin Idea. Collaborations with researchers outside of academia prepare students for their careers, because multifaceted industrial research enables students to envision a broader set of roles they can play. Collaborations open new revenue streams for supporting basic research and student training, enable students to access specialized facilities and technologies in private industry, and provide companies with access to unique equipment and emerging technologies that exist only at the University. I am excited to explore where these partnerships can take our research and education programs.

My other key priorities as Department chair include:

- Increasing research space and completing the new building project
- Recruiting new, more diverse faculty
- Focusing on equity and diversity in all of our practices, especially teaching and hiring
- Completing the Department reorganization that was initiated by Judith N. Burstyn

I look forward to sharing our progress with you in the future and hope you'll reach out if you have questions or ideas.

Sincerely,

Clark R. Landis
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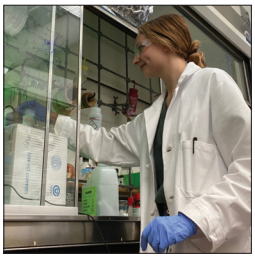

ON THE COVER: (on left) Prof. John Moore works with undergraduate student Jiayu Wang during a chemistry class discussion section in 2016. (on right) Bucky helps Prof. Bassam Shakhashiri perform an experiment during the second of two 50th anniversary shows of "Once Upon a Christmas Cheery in the Lab of Shakhashiri" to a sellout audience in 2019. (Photos by Jeff Miller | UW–Madison)

Congratulations New Badger Chemists!

This year we celebrated graduating students online. View Celebrating Student Success 2021 at BadgerChemistNews.chem.wisc.edu

Bachelor's Degrees

FALL 2020

- Jake Ryan Alexander
- Sammy Ausman * ** ***
- Jacqueline Alyce Biernat
- Nicole Ann Fossum
- Tessa Rose Hellenbrand
- Austin Mitchell Hunt
- Eunyoung Jang
- Taylor Ann Klungness
- Alexander Jake Knopf
- Andrew Lee
- Weiting Lyu
- Virginia Baker Mathu ***
- Shawn Patrick McLaughlin
- McKayla Marie Olig
- Ian Radspinner
- Thomas Clifford Rollo
- Muhammad Isha Faizin Bin Saifullizam
- Morgan Schmitz
- Chance Lee Wilkinson-Johnson
- Andy Yan
- Zinan Yu ***
- Keer Zhao * ***
- Yuchen Zhao

SPRING 2021

- Cristina Joan Bahaveolos
- Brenna Bartels ***
- Emily Grace Benson *
- Grace Carlson ***
- Erin Chen
- Jingxiang Cheng
- Jacob M. Dahl
- Maja Isabella Eaton
- Owen Erpelding ***
- Benjamin Ryan Feingold * **
- Stephanie Frost
- Yuanzuo Gao ***
- Han Geng ***
- Anna Gerosolina
- Morgan Kate Gugger ***
- Lydia Jean Hoffman
- Derek Holik
- Ismael Ali Jaffri
- Mason Alexander Job
- Bridget Kaiser
- Madeline Kakacek
- Jared Alexander Klein
- Jack Gordon Knoke
- Rachel Ann Knutson **
- Rebecca Christine Kressuk
- Michael Richard Kuehne Jr.
- Maija Lee
- Ethan Leung
- John Michael Lilek
- Yueai Lin *
- Marina Minic
- Jonah Charles Nelson
- Edward M. Paulsen
- Corey Nathaniel Pedersen ** ***
- James Pfister
- Morgan Leah Richter
- Anuchit Rupanya * ***
- Dylan Monroe Snider ***
- Chester M. Sosnowski
- Jingxuan Tang *
- Marko Tupanjac **
- Blake Palmer, Waples
- Linnea Elizabeth Wust

SUMMER 2021

- Sheila Ngoc Anh Duong
- Zachary James Ehmer
- Zachariah Georgakakis
- Dave Kaiman ***
- Turner Michael Luke
- Robert Sapienza
- Brendan Ivar Steinmetz
- Alfred Shiergetya Sunaryo

* Honors in the Major ** Honors in the Liberal Arts *** Graduation with Distinction
Names missing from the list may appear in the 2020 or 2022 issues of Badger Chemist.

MASTER'S DEGREES

- Alina Dao (Nathanson)
- Anthony DiBernardo (Tang)
- Xiao Dong (Yoon)
- Froylan Omar Fernandez Candelaria (Burstyn)
- Gillian Good (Martell)
- Jiabao Guo (Li)
- Connor Huntwork (Hermans)
- Joshua Kreisel (Martell)
- Ethan Licht (Schomaker)
- Victoria Longley (Weix)
- Brandon Mehlenbacher (Goldsmith)
- Matthew Rossler (Yoon)
- Correy Vigil (Bertram)
- Keyu Zeng (Fredrickson)

DOCTORAL DEGREES

Manar Alherech (Stahl) Valorization of an Oxidative Lignin Depolymerization Stream with Centrifugal Partition Chromatography

Jaya Borgatta (Hamers) Understanding the influence of Cu-based nanoparticle properties on interactions with plant systems and disease suppression

Brian Cary (Gellman) Functional and structural studies of family B G protein-coupled receptors

Melissa Cendejas (Hermans) Investigation of Active Site Structure and Formation on Boron-Based Oxidative Dehydrogenation Catalysts

Sijie Chen (Stahl) Copper-Catalyzed Benzylic C(sp3)–H Cross Couplings: Methodology Development and Applications in Medicinal Chemistry

Yusi Cui (Li) Development and Application of Isobaric Labeling, ERLIC Separation, and Chemoproteomics Methods for Bioanalytical Research

Rebeca Fernandez (Brunold) Structural, Spectroscopic, and Kinetic Investigation of Cysteamine Dioxygenase

Alex Foote (Goldsmith) Time-resolved Multirotational Fluorescence Anisotropy Measurements of Single Molecules to Characterize Conformational Subpopulations of Solution-Phase Intrinsically Disordered Proteins

Isabel Foreman-Ortiz (Pedersen) Nanoparticle impact on membrane properties and embedded ion channels

Kevin Garcia (Weix) Greener Approaches to Cross-Coupling

Christopher Gravatt (Yoon) New Strategies for [2+2] Photocycloadditions of Aliphatic Alkenes

Elizabeth Greenhalgh (Brunold) Spectroscopic and Computational Investigations of Cobalamin Containing Enzymes

Matthew Hautzinger (Jin) Structure-Property Relationships of Halide Perovskite Semiconductors

Austin Henke (Hamers) Redox Reactions at Solid-Liquid Interfaces and Implications for Sustainability

Casey Howdieshell (Garand) Linear Digital Ion Trap Mass Spectrometry and its Application for Cryogenic Ion Spectroscopy

Aurora Janes (Schmidt) Computational Modeling for Heterogeneous Catalysis of Aerobic Oxidation and Electrocatalytic Oxygen Reduction

Zachary Jones (Hamers) Optical Characterization of Fluorescent Diamond Nanoparticles in Complex Environments

Adam Klemen (Gellman) Potential Foldamers Based on an ortho-Terphenyl Amino Acid

Samantha Knott (Ge) Development of Mass Spectrometry Based Proteomic Approaches for the Study of Diseased Tissues

Caitlin Kozack (Stahl) Method Development and Mechanistic Investigation of Palladium-Catalyzed Allylic Oxidation Reactions of Terminal Alkenes

Kate Kurgan (Gellman) Towards Crystallization of Single-Pass Transmembrane Domains

Xinyi Li (Schmidt) Simulate the nucleation of electrolytes with explicit solvents via two approaches

Zihui Li (Li) Advancing Quantitative Proteomics and Protein Post-translational Modification Analyses by Multi-Dimensional Mass Spectrometric Approaches

Dongyue Liang (Cui) Computational Studies at Nanomaterial-Biological Interfaces

Ann Lindberg (Choi) Development of Electrode Materials for (Photo)electrochemical Reactions

Lei Liu (Gellman) Exploration of Activity Profiles for Nylon-3 Polymers as Antimicrobial Peptide Mimics

Ann Lindberg (Choi) Development of Electrode Materials for (Photo)electrochemical Reactions

Erdong Lu (Fredrickson) Atomic Packing in Action: Chemical Pressure Directed Intergrowth in Chimney Ladders, Ternary Phosphides and Polar Intermetallics

Brock Lynde (Boydston) Challenges, Successes, and Opportunities in Investigating Novel Strategies for Polymer Synthesis

William McDermott (Hermans) Development of Boron-based Catalysts for the Selective Oxidation of Light Alkanes to Olefins

Robert Millikin (Smith) Algorithms for the Interpretation of Mass Spectra in Quantitative and Qualitative Proteomics

Jordan Nutting (Stahl) Overpotential in Organic Synthesis: Implications in Electrochemical Synthesis and Aerobic Catalysis

Vanessa Orr (McMahon and Woods) Rotational and Vibrational Spectroscopy and Structure Determination of Organic Molecules of Astrochemical Relevance

Marshall Padilla (Mecozzi) New Liquid Biomaterials for Nanoemulsion-mediated Drug Delivery

Sungho Park (Berry) Tailoring Metal-Based SOMOs for Pnictogen Reactivity

Andjela Radmilovic (Choi) Development of New Ternary Metal Oxide Photoelectrodes for Use in a Photoelectrochemical Cell

Jessica Roberts (Schomaker) Computational Modeling to Explore the Influence of Sterics, Electronics, and Non-Covalent Interactions on Reactivity

Zachary Rolfs (Smith) Novel Strategies for Identifying Endogenous Peptides and Determining Protein Turn-over Rates

Chase Salazar (Stahl) Mechanistic Insights Support Efficient Pd Catalysts for Oxidative C–H Arylation with O2

Daniel SantaLucia (Berry) Investigations of the Electronic Structures of Multimetallic Iron-Chalcogenide Clusters and Five-Coordinate Cobalt Complexes

Matthew Styles (Blackwell) Towards a mechanistic understanding quorum sensing agonism and antagonism: biophysical and biochemical investigations of LuxR-type receptor:ligand complexes

Aristidis Vasilopoulos (Stahl) Transition Metal-Catalyzed Oxidative Cross Coupling for Synthesis and Functionalization of Diverse Molecules

Michael Vermeuel (Bertram) The Influence of Complex Meteorology and Surface Heterogeneity on Oxidation in the Troposphere

Tingting Weng (Schmidt) Computational Modeling of the Stability and Reactivity of Zeolitic Imidazolate Frameworks

Korbin West (Blackwell) The development of chemical tools to study cell-cell communication and virulence in Gram-positive bacteria

Yuzhou Zhao (Jin) Stacking and Twisting of Layered Materials Enabled by Screw Dislocations and Non-Euclidean Surfaces

Yanyu Zhu (Weisshaar) Single-Cell Detection of Antimicrobial Peptide's Attack on Live E. coli by Super-Resolution Fluorescence Microscopy

Burstyn leaves lasting legacy

First female Department chair implements change despite obstacles

By Caroline Cole
Department Communications

Photo by Tatum Lyles Flick

Former Department Chair Prof. Judith N. Burstyn stands in a Buckyball model in the Shain Tower Lobby.

Prof. Judith N. Burstyn, the University of Wisconsin-Madison Department of Chemistry's first female Department chair and a member of the UW–Madison chemistry community for more than 30 years, finished her landmark term in June.

In addition to challenging low female representation in the chemistry field and in the Department, two major obstacles presented themselves during Burstyn's term. While undertaking her ambitious project of reorganizing the Department's structure, the Chemistry building complex flooded in February 2019. Then, the onset of the COVID-19 pandemic forced colleges across the country, including UW–Madison, to adapt to online instruction. Despite these challenges, Burstyn used her decisive qualities to advance the Department through difficult times.

"My attitude to adversity is to never let a crisis go to waste: crises can be opportunities for learning and growth," Burstyn said.

The flood had operational impacts that were difficult to navigate, in part because the organizational structure was not well defined. Although she had initiated the transition toward a more resilient structure, the reorganization process was barely beginning at the time of the flood, Burstyn said. Department leadership had started conversations with consultants, but no structural changes had been implemented in time to benefit the Department during the crisis. However, these new arrangements, which included distributed leadership and clear-cut responsibilities for faculty and staff, were finalized prior to the Department's second tribulation: the COVID-19 pandemic.

"I believe that if the pandemic happened before our reorganization, we would've been in a state of disaster," Burstyn said. "We were able to manage the issues associated with COVID-19 because the reorganization helped everyone understand who was responsible for what tasks and act much more effectively."

Burstyn acknowledges the insight of prior Department leaders in helping her understand how the Department functioned and in planting the seeds for the reorganization project.

Burstyn credits former Chair Prof. Bob McMahon with mapping out the Department's existing organizational structure and former Chair Prof. Jim Weisshaar for speaking with her about the organizational challenges facing the Department. She also appreciates Executive Director Matt Sanders, for sharing his understanding of the ins and outs of Department operations, including some processes that were not functioning at full efficiency, Burstyn said. Though she credits her colleagues' persistence through many challenges, Burstyn perceived that small adjustments were insufficient to meet the increasing demands on Department operations. Burstyn's can-do attitude and leadership style remedied these issues efficiently through the reorganization.

> "My attitude to adversity is 'Never let a crisis go to waste:' crises can be opportunities for learning and growth."
>
> **Judith N. Burstyn**
> Former Chair, Department of Chemistry

STORY CONTINUES ONLINE ››
BADGERCHEMISTNEWS.CHEM.WISC.EDU

Landis becomes Department chair

Grateful for legacy of past chair, ready to take on new challenges

By Meranda Masse
Department Communications &
Graduate Student (Cavagnero)

Prof. Clark Landis has taken over as chair of the Department of Chemistry, a position previously held by Prof. Judith N. Burstyn.

Landis has a few goals he would like to pursue, including:

- Increasing collaborative research with industry and other groups
- Increasing research space and completing the new building project
- Recruiting new, more diverse faculty
- Focusing on equity and diversity in all of our practices, especially teaching and hiring
- Completing the Department reorganization that was initiated by Burstyn

Another goal is to revise budgeting for the Department, and different entities within it. Increasing research dollars, size and complexity of the department organization and compliance needs require an updated budget model. He is optimistic that the new model can be established during his tenure as chair.

Landis also plans to lead the Department in becoming more diverse, equitable and inclusive.

"From the chair position I can model some of this," Landis explained. "More importantly, I can bring people together and say that we need to have a discussion."

He continued to say that in the next five to 10 years, there will be a lot of professors retiring, which means the Department will need to hire more faculty. Landis believes that this is a great opportunity for the Department to add diversity to the faculty.

Landis reminisced on his years in the Department, commenting on how he appreciates the close relationships he has with his colleagues, and likes that the facilities are top-notch. He looks forward to the next few years.

Photo by Tatum Lyles Flick

Newly elected Department Chair Clark Landis stands at Monona Terrace.

"Coming out of an 18-month pandemic and going into a new building, there's a lot to be excited about," Landis said.

Landis began his term in the summer. He expects that Burstyn's policy changes will have lasting benefits. Burstyn looks forward to seeing how the Department will thrive under Landis' leadership.

"Clark has been particularly innovative over many years in his ways of thinking and quite a visionary," Burstyn said. "I am optimistic that the Department is moving in a positive direction."

Landis grew up in the Midwest, obtaining his bachelor's degree at the University of Illinois and his Ph.D. at the University of Chicago.

He then worked in industry for a few years before pursuing his love of academic research at UC Boulder, and later moving to the University of Wisconsin–Madison.

Landis has been with the Department for more than 30 years and said that serving as Department chair would be his final act as a faculty member before retiring.

Landis plans to serve as chair for three years, the established term.

Department welcomes Prof. Xuhui Huang

By Meranda Masse
Department Communications &
Graduate Student (Cavagnero)

Submitted by Prof. Xuhui Huang

The Huang group attends the Hirschfelder banquet. Pictured, from left are: Mingyi Xue, Eshani Chrisana Goonetilleke, Prof. Xuhui Huang, Yunrui Qiu, Andrew Yik and Bojun Liu.

Prof. Xuhui Huang, who arrived in Madison over the summer, is the newest faculty member added to the Department. His group is primarily focused on Theoretical Chemistry and Molecular Biophysics, particularly looking at the interface of the two fields.

His group walks this line by elucidating conformational changes in biomolecules through the development of new methods based on statistical mechanics. He mentioned that this knowledge can help bridge the gap between experiments and molecular dynamics simulations.

His group has contributed to the field in many ways. A few examples are: the elucidation of functional conformational changes of RNA Polymerases, the elucidation of dynamics for molecular recognition and self-assembly, and the development of new Integral Equation Theories for Solvation.

Huang will not only bring a breadth of knowledge to the Department, but also enthusiasm for science and collaboration. He comes to the Department with more than 100 papers as an independent PI.

Huang prides himself on his mentorship style, and stated that he likes to train students to become effective independent researchers.

"I am excited to join the Department of Chemistry and Theoretical Chemistry Institute at UW–Madison, and honored to be appointed as the Hirschfelder Chair in Theoretical Chemistry," Huang said. "I look forward to all the opportunities for collaborations and to working with a number of very talented scientists."

He brought some students from Hong Kong University of Science and Technology (HKUST) with him, and they are all very excited for the research opportunities that UW–Madison has to offer.

Huang earned a Ph.D. from Columbia University in 2006, followed by postdoctoral research at Stanford University with Prof. Michael Levitt and Vijay Pande. Huang then became an assistant professor at HKUST in 2010, and was promoted to full professor in 2019.

Huang has won many awards, the most recent being the Pople Medal from the Asia-Pacific Association of Theoretical and Computational Chemists in 2021.

Congratulations Retirees!

Jerry Bell
Bruce Goldade
Tom Ladell
Betty Moore
John Moore
Kendall Schneider
Bassam Shakhashiri
Claude Woods
James Zernicke

Welcome New Staff!

Christina Bahaveolos
Laboratory Technician

Amber Bartz
Electronics Technician

Amanda Buchberger
Analytical Assistant
Lab Director

Luke Carroll
Financial Specialist

Farzaneh Chalyavi (Zanni)
Editor & Lab Manager

Tzu-Ling Chen
(Goldsmith) Scientist

Gustavo Cruz Diaz
(Widicus Weaver)
Assistant Scientist

Irena Garic
Administrative Assistant

Erin Grunewald
Undergraduate Chemistry Specialist

Caleb Harris (Berry)
Assistant Scientist

Xuhui Huang
Professor

James (Jim) Leu
IT Manager

Kent Meyer (Wright)
Assistant Scientist

Tristan Rholl
Research Store Manager

Aaron Smith
Inventory Control
Coordinator
Shipping/Receiving

Jackie Trate
Instructional Innovator

Alicia Walker
Administrative Assistant

Jeremy Weaver
Instructor & Curriculum Coordinator

Josef Wilkinson
Laboratory Technician

Jia Zhou
Instructor & Resource Specialist

Retiring faculty legacies set stage for ChemEd colleagues

By Tatum Lyles Flick
Marketing & Communications Manager

For many years, the Department of Chemistry at UW–Madison has been a key place for Chemistry Education, with teaching, outreach, and dissemination of Chemistry Education materials second to none.

In 2021, two chemists who changed the face of Chemistry Education, Prof. John Moore and Prof. Bassam Shakhashiri, retired, leaving the program to two newer faculty members, Prof. Ryan Stowe and Prof. Sam Pazicni.

"When I was being recruited, every interaction I had with staff and faculty in our Department made it clear that chemists at UW–Madison care deeply about creating meaningful spaces for students to engage in doing chemistry," Stowe said, adding that Department members were clearly passionate about Chemistry Education.

The field has changed a lot since Moore and Shakhashiri started working to engage and inspire students, but what drives them and the new professors remains the same.

"Teaching is a human experience," Pazicni explained. "It's about the interactions you have with others and the inspiration that you can provide in others to learn our discipline and learn how it affects our world and our society."

Since joining the Department, Stowe and Pazicni have learned a lot from their mentors, Shakhashiri and Moore, and forged key relationships with Department instructors.

"You just have to look around to Bassam's amazing contributions to workshops, to lectures across the world to understand how many lives he has touched by his

Prof. Ryan Stowe

Prof. Sam Pazicni

demonstration shows and his passion, not only for chemistry, but to inspire others," Pazicni said. "I hope I never forget that – that teaching is about that as much as it is about the science of learning."

Moore has also been a champion of outreach, offering access to practical information and demonstrations to help teachers and leading a summer program that inspired children to be excited about chemistry.

"John is passionate about free access to high quality educational materials and has dedicated substantial effort toward creation of interactive, Open Educational Resources (some of which are used at UW–Madison)," Stowe explained.

Read the full Q&As with Stowe and Pazicni, and learn more about their work, at BadgerChemistNews.chem.wisc.edu. Check out the following stories on Shakhashiri's and Moore's legacies in Chemistry Education.

Chemistry Education through the years:
Reflecting on Prof. John W. Moore's retirement and impact

By Caroline Cole
Department Communications

Prof. John W. Moore, the W. T. Lippincott Professor of Chemistry at UW–Madison, retired from the Department at the end of Spring 2021. His wife, Program Manager Betty Moore, who retired at the same time, made major contributions to the Department and to John's professional career.

John's career is marked by a plethora of academic and teaching achievements, including state, national and international awards, editing the leading publication in his field, publishing 114 papers, organizing 116 workshops and symposia, co-authoring several college textbooks and publishing an online OER interactive learning system.

As a chemistry educator, John's accomplishments span three main sectors. The first, which began in 1965, involved finding new and effective ways to use emerging technology in teaching. The second was his outreach efforts, such as creating accessible materials for other chemistry educators to use. The third involved national and international leadership, such as his 13-year editorship of the Journal of Chemical Education.

"Most of the things I have done over the years as a chemistry educator were designed to improve student learning," John said. "To do that, you need to have a good idea of what students are thinking and doing."

John brought 24 years of successfully supporting student learning when he joined the Department of Chemistry in 1989 as the chair of the General Chemistry Division and the director of the Institute for Chemical Education (ICE). In the former role, John led the Department's NSF-sponsored New Traditions curriculum project, which brought more active-learning methods to the undergraduate curriculum. In his ICE directorship, John expanded the Institute's activities to include kits and publications that continue to be distributed throughout the world, increased the number of themes that guided its summer Chemistry Camps and developed new summer workshops for college, high school, middle school and early elementary school teachers.

In the late 1990s, John led the development of a new program for teachers of kindergarten through second grade that incorporated science into their classrooms seamlessly. To do this, he reached out to elementary school teachers and learned about what students were doing in their classrooms. Then, the teachers and Institute staff developed hands-on and safe learning materials that intermingled science, reading, writing and art to enhance the schools' curriculums. The students' regular teachers were thus able to become their science teachers as well.

"We included not just science, but also reading, writing and art. The projects that students worked on were now based on a science exploration, but students had to read something about it and write something about it," John said.

Throughout his numerous positions, obstacles have presented themselves, but he has introduced new solutions to overcome them.

For instance, when the pandemic interfered with the summer 2020 session of the ICE Chemistry Camps, John, Betty and Institute for Chemical Education staffer Isabelle Tigges-Green decided to create new formats for the activities so children could do projects in their kitchens with minimal supervision from their parents.

"We wanted to make the camp available to as many people as possible, and interest as many children and parents in science as we could," John said.

John's involvement with students to improve learning also applied to undergraduates, graduate students, postdoctoral fellows and visiting faculty. One example is his long-term participation in restructuring the Chemistry 109 course. In 2000, John collaborated with Prof. Judith N. Burstyn and two postdoctoral fellows to completely revise the Department's flagship course for first-year students. Carrying on a process initiated by the New Traditions curriculum project, John met weekly with a group of students—one from each of 16 discussion-laboratory sections of this 360-student course. By learning about how students experienced Chemistry 109, John continually adapted the course to better meet students' needs. This culminated in 2014 when several students volunteered to work on undergraduate research with John. This working group restructured the course to introduce more group-based learning, convert one lecture session to an active learning session and offer online materials to enhance student discussions. Evaluation of learning outcomes showed that the upgraded version of Chemistry 109 was more effective at teaching students. The undergraduate researchers not only contributed to the project, but also learned from John about Chemistry Education.

John's leadership in Chemistry Education is exemplified by his editorship of the Journal of Chemical Education. As an associate editor, Betty helped John make the Journal more accessible to teachers of all kinds—especially high school teachers. Early in his 13 years as editor, the Journal celebrated its 75th anniversary with the Perspectives series of articles in which experts in many subfields of chemistry, some of them Nobel Prize winners, provided summaries of research and prospectuses for future developments. John introduced a monthly column specifically dedicated to chemistry education research and added many other monthly features to the Journal's repertoire. He re-organized how the journal was produced, reducing time to publication and providing for digitization

of all articles — back to the Journal's origin in 1924. In his last year as editor, John built connections with the American Chemical Society (ACS) that led to the Journal's current status as a publication of the ACS.

John's passion for group collaboration, active learning and leveraging numerous voices in decision-making is also evidenced in the construction project for the new Chemistry building, where he was able to put to good use his many years of teaching experience.

John and the Chemistry Facilities Committee worked with the building's design team to create a building with a cutting-edge focus on learning. The emphasis is on group learning and interactive lectures, not on traditional teaching models with no student collaboration. Each laboratory has an associated write-up room where students can interact with teaching assistants and other students to discuss and interpret lab results. What would have traditionally been a lecture room with unmovable furniture became a Learning Studio—a space designed for 160 students to work in groups of eight on problems that develop their chemistry knowledge. The lecture rooms have movable chairs and extra space per student so that they can work in small groups. Numerous other spaces allow for students to interact with each other, with teaching assistants and with faculty.

John's career has been devoted to creating, evaluating and disseminating better tools and processes by which students can learn chemistry and he hopes that after his departure, the Department will maintain and enhance its position as a leader among chemistry programs nationwide.

"The Department has a tradition of excellence in chemistry education," John said. "I expect and hope that this tradition will continue to strengthen every year with both the Chemistry Education research faculty and all of the new staff who have joined us in the last decade."

Learn more about John's career, research and accomplishments at BadgerChemistNews.chem.wisc.edu.

Photo by Jeff Miller | UW–Madison

Prof. John Moore works with undergraduate Jiayu Wang during a class discussion section in 2016.

Tireless advocate for science literacy retires

By Terry Devitt
University Communications

Bassam Shakhashiri, the kinetic and tireless science educator and 81-year-old University of Wisconsin–Madison chemistry professor who for more than 50 years charmed and amazed audiences with the wonders of science, has retired. His steadfast advocacy for science literacy was a clarion call to scientists and politicians alike.

Best known for his colorful (and sometimes loud) public demonstrations of chemical phenomena, Shakhashiri played to packed houses from Washington to Silicon Valley. His annual program, "Once Upon a Christmas Cheery in the Lab of Shakhashiri," was a staple in Madison, on public television, and — while serving in the late 1980s as an assistant director of the National Science Foundation (NSF) — in the halls of Congress and venues such as the Smithsonian National Air and Space Museum and the National Academy of Sciences.

The goal was always the same: to convey to audiences — by power of demonstration — the value of science to society and the absolute necessity of broad science literacy for understanding everything from human health to climate change.

"Science is a way of looking at the world," Shakhashiri said. "Science literacy is the appreciation of science without a deep understanding of chemistry, physics, biology or any other science. It's an attitude."

Shakhashiri emigrated from Lebanon to the United States at the age of 17 with his parents and two sisters. He joined the UW–Madison Chemistry faculty in 1970, arriving on campus one week after the Sterling Hall bombing.

Channeling a desire to reinvigorate the college learning experience, he became the founding director of the UW System Undergraduate Teaching Improvement Council in 1977. In 1983, he founded the UW–Madison Institute for Chemical Education (ICE), a nationally recognized center that provides support, tools and inspiration for science educators. ICE has been a leader in helping revitalize science curricula in the nation's schools.

"I wanted to help put Wisconsin on the map in science education," Shakhashiri recalled in an interview in an aerie of an office overlooking Lake Mendota. "Wisconsin was very attractive to me. I learned the meaning of the Wisconsin Idea. I feel it in my bones. I cherish the freedom of scholarly work and public service."

In 1984, Shakhashiri accepted an appointment to serve as NSF assistant director for science and engineering education. He immediately set out to rebuild a program whose budgets were, for all practical purposes, zeroed out by the Reagan administration, leaving only $16 million in 1981 for graduate fellowships that had already been awarded.

With the support of scientists, an energetic flair, and a knack for getting the ear and sympathy of Congressional leaders, budgets for science education at NSF surged to the $230 million mark by 1990. However, around that time, Shakhashiri was forced from the agency, in large measure because his success at rekindling Congressional support for science education was viewed by some as a detraction from the agency's research mission, he said.

In some quarters, 20 percent of the NSF budget pie was too much: "I wanted to make the pie bigger," recalled Shakhashiri. "I always advocated for the agency."

Today, NSF's science education budgets stand at more than $900 million. In 2007, the National Science Board, which oversees NSF, conferred on Shakhashiri its Public Service Award, an act viewed by some as vindication for the Wisconsin chemistry professor and his uncompromising advocacy.

Returning to Madison, Shakhashiri established himself as a preeminent scholar in science education, over time giving more than 1,500 invited presentations in the United States and around the world.

Photo by Bryce Richter | UW–Madison

Prof. Bassam Shakhashiri shares a chemical demonstration to help others understand the value of science to society.

With collaborators, Shakhashiri authored a five-volume series of chemistry demonstration handbooks, published by UW Press and described as "classics, used year in and year out" by teachers and others to illustrate meaningful lessons in science. The books remain "the best such tools for teachers in any language ever written," extolled Cornell chemistry professor and Nobel Laureate Roald Hoffmann.

In 2001, Shakhashiri was named the first William T. Evjue Distinguished Chair for the Wisconsin Idea, a position he held for 20 years.

"He is a force of nature who is now a legend, especially for his Christmas lectures," said Sean B. Carroll, a UW–Madison emeritus professor of genetics who serves as vice president for science education at the Howard Hughes Medical Institute. "His cleverness, his boundless enthusiasm, and his showmanship no doubt inspired many future scientists and teachers."

To Shakhashiri, "science is fun." He wears the mantra like a uniform, invariably sporting it on a big blue button or a cardinal tee shirt. He is known to dispense the buttons — to everyone from kindergartners to cab drivers — at so much as a smile. Before the COVID-19

pandemic, Shakhashiri and his students could be seen tooling around Wisconsin and beyond in a "Science is Fun" box truck, fostering learning and curiosity in schools, shopping malls and community centers.

"I saw Bassam's demonstrations first perhaps 50 years ago, and loved them," said Hoffmann, a theoretician by trade, whose play about the nature of discovery, "Oxygen," was co-authored with UW alumnus Carl Djerassi and produced in Madison with a memorable assist from Shakhashiri. "The public demonstrations in the play were not done in any other production," recalls Hoffmann, clearly touched by the painstaking effort Shakhashiri poured into the play.

In 2002, Shakhashiri established the Wisconsin Initiative for Science Literacy (WISL), a program he will continue to lead. As its name implies, WISL 's mission is to promote literacy among the public in science, mathematics and technology "to attract future generations to careers in research, teaching and public service," and to help UW–Madison graduate students master the communication skills required to effectively share their research with non-experts.

In 2012, Shakhashiri served as president of the American Chemical Society, one of the world's largest scientific organizations with 155,000 members in 150 countries.

"You can't pigeonhole Bassam," said Cora Marrett, the UW–Madison emeritus sociology professor who followed Bassam to leadership roles at NSF, including twice as acting director and a tour leading the agency's education efforts, the same role Shakhashiri defined more than 30 years ago.

Among his accomplishments at NSF, she notes, was being an early advocate for inclusion in science, reaching out to underrepresented populations, including women and people of color.

"It was an emphasis he retained over the years," Marrett said. "It was a deep commitment" to help enable untapped pools of talent to contribute to the enterprise of discovery and, ultimately, society.

Shakhashiri's retirement marks the end of some of the Wisconsin chemist's public engagement activities, including his famous Christmas program, but he said his commitment to public service in the interest of broad science education and literacy is unwavering. "I will continue to live the Wisconsin Idea."

A Q&A with Bassam Shakhashiri

By Terry Devitt
University Communications

University of Wisconsin—Madison chemistry Prof. Bassam Shakhashiri sat down recently to reflect on his more than 50 years as a science educator, as he faces retirement.

Q: You are passionate about sharing science with students and the public. What sparked that passion and when did you decide science, and Chemistry Education in particular, was your calling?

A: In my general chemistry courses I wanted students to both learn course content and to connect science to societal progress and problems. I realized that technical training is crucial, but that my role extends to educating students and others to be responsible in their behavior to protect the environment and to always work for the common good. I was influenced in particular by Rachel Carson, Gaylord Nelson, and my father, who was a public health physician. My mother's community work in Lebanon and in the US was a great influence.

Q: Getting scientists and researchers to better engage with students and the public can be a heavy lift. Is the glaring need for more robust science literacy getting scientists motivated to address the challenge?

A: Science and society have what is essentially a social contract that enables great intellectual achievements but comes with mutual expectations of benefiting the human condition and protecting our planet. The grand challenges facing society require technical solutions and public participation. Faculty are more than classroom teachers, researchers and technical trainers. We all do what we do because it interests us, it satisfies our curiosity, we enjoy it. However, we have a responsibility to humanity as a whole. We excel in research and in the classroom, but we must enhance our public engagement efforts to influence societal attitudes and behavior. In a free and civil society people must be virtuous as well as technically skilled.

Q: Given events of the past year, what are your thoughts on the current state of public science literacy? Are there things to be hopeful about science and its relationship to society?

A: Science literacy is an attitude. Relationships are complex and with advances in science the need for connecting science to society requires more care, respect, and trust. I remain confident that scientists will devote a portion of their intellect to effectively connecting with non-scientists.

Q: When you were at the National Science Foundation, there was tension between the education and the research communities when it came to funding. Have we gotten past that?

A: I and others say there is one community committed to advancing knowledge and to serving society. Bureaucratic squabbles can deter progress, but visionary programs for the common good (usually) prevail.

Q: Looking back on 50-plus years of public service in science education, what have been the most memorable and rewarding aspects of your professional life?

A: I am fortunate to have seen smiles and heard voices from so many around the world. Reaching kids of all ages through the Christmas Lecture is deeply meaningful. My work in Washington was made unnecessarily difficult by shortsightedness, but I am pleased and satisfied that I affected the lives of researchers and the general public. My Wisconsin tenured appointment made it all possible.

Grad student creates free library of 3-D chemistry molecules

By Caroline Cole
Department Communications

When the COVID-19 pandemic forced UW–Madison's in-person instruction online in 2020, undergraduate and graduate research students encountered a massive obstacle in their learning: How would they perform their research if they were unable to go into their labs ?

Michael Aristov, a 5th-year graduate student in the Berry lab in the Department of Chemistry, pivoted to another one of his interests when the pandemic impeded his research. He decided to build augmented reality models to aid chemistry education.

Using his knowledge in computational chemistry to construct the molecules and with a secondary program called Chimera, which helps visualize chemistry orbitals, Aristov began building 3-D models of chemical structures and molecules. He used the program Blender, a free 3-D modeling software that can create animations, and decided to house the models on Sketchfab, a browser-based platform that allows users to store 3-D models and animations for free.

The library currently consists of about 196 models, and more 3-D structures are in the process of being proofed, Aristov said.

The project kickstarted after Aristov considered how many undergraduate Chemistry students use smartphones, offering the opportunity to leverage 3-D technology that will eventually allow students to see chemical structures in augmented reality. In other words, students can easily load the 3-D models through Sketchfab, which works well for use on course websites, Aristov said.

The augmented reality models are a helpful substitution for physical models and wedge-and-dash drawings, Aristov said. The first few models were basic molecules to emphasize that chemical structures can bend and twist, but after learning more about 3-D modeling, Aristov created more complicated molecules such as those with double bonds.

Before these models, Aristov had no experience with Blender and learned about the program primarily from YouTube tutorials, he said.

"It was a massive learning curve," Aristov said. "The more you do something the more comfortable you get with it, and now I'm quite familiar with Blender and proud of some of the things I can make."

After learning more about each program, Aristov presented his models to chemistry instructors, including Prof. John W. Moore, Dr. Brian Esselman, and Dr. Stephen Block. Due to Sketchfab's ability to export the models and embed code, which allows a 3-D model to appear after inserting HTML code into an online text, Moore's online open-access general chemistry textbook used the models.

"We did not want links in the textbook, where a student would click [the link] and it would open in a new tab or a new window, because that breaks the flow of student learning," Aristov said.

Aristov credits Moore with getting the ball rolling on the models, as he guided him on which models were important to include in the textbook.

"I thought that [the models] were great because there are certain kinds of things that we want to show that you cannot do with 2D images," Moore said. "Even if you build a physical model with balls and sticks, you cannot do certain things because the physical world does not allow you to. For example, you can't superimpose two molecular models, but you can superimpose two images of molecular models to see whether they are the same."

Prof. John Berry, Aristov's advisor, also offered his support and enthusiasm for the shift in focus during the pandemic.

"This project was purely Michael's invention, and it's a perfect blend of his chemistry expertise with his interest in 3-D modeling," Berry said.

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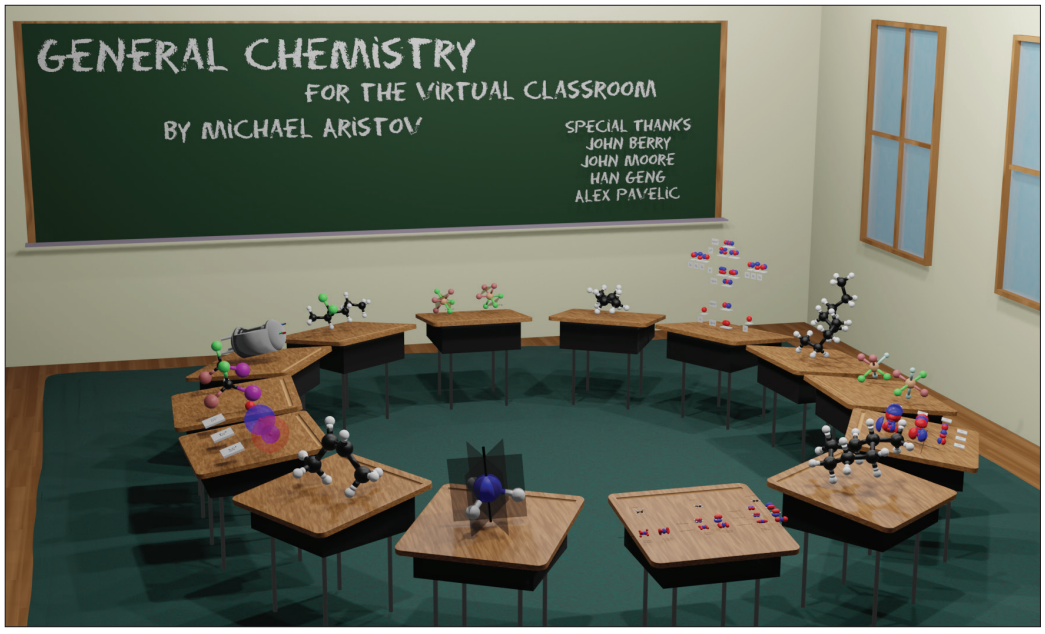

Illustration of 3-D chemical models in a classroom.

Original artwork by Michael Aristov

Annual Mole Day created by Badger Chemist

By Mason Braasch
Department Communications

Almost any student who has taken a chemistry course-whether it be in high school, college, or elsewhere- will have a story about how they celebrated Mole Day with their class. Few know, however, that the creation of the day has ties to the University of Wisconsin–Madison.

Every October 23 from 6:02 a.m. to 6:02 p.m. chemists and chemistry students from around the world unite in celebration of Mole Day, an unofficial holiday that teaches the concept of Avogadro's Number. The National Mole Day Foundation explains that Avogadro's Number (6.02×10^{23}), "is a basic measuring unit in chemistry" where "for a given molecule, one mole is a mass (in grams) whose number is equal to the molar mass of the molecule." While the concept is taught in every basic chemistry course, it is an essential aspect of the science, thus warranting its very own holiday!

As part of National Chemistry Week, the American Chemical Society and the National Mole Day Foundation, as well as high schools from around the globe, engage people with chemistry and foster an interest in the science. Complete with a different theme each year (past themes have included AniMole Kingdom, Molar Eclipse and Rock N' Mole), resources for teachers and students, fun activities such as the Molympics, and even merchandise, Mole Day is an essential part of connecting communities with the field of chemistry — and it was created by a UW–Madison alumnus.

Maurice Lee Oehler received his M.S. in chemistry from UW–Madison in 1961, under the advisement of Prof. Howard E. Zimmerman. He then went on to teach chemistry at Prairie du Chien High School, where the idea for Mole Day was born. On May 15, 1991, Oehler established the National Mole Day Foundation, which helps to engage chemistry students world-wide, create enthusiasm surrounding chemistry, and answer inquiries from students, chemistry teachers, college professors, retired chemists and anyone interested in the field. Since its creation in 1991, the National Mole Day Foundation has amassed more than 3,000 "mole-due" paying members.

Oehler passed away in January of 2020, but his legacy lives on in the continued passion for chemistry that is exhibited every year on October 23.

Bassam Z. Shakhashiri, an emeritus professor at the UW–Madison Department of Chemistry, was the president of the American Chemical Society (ACS) in 2012. He reflected on his involvement with ACS and their annual Mole Day celebrations, recalling how the scientific demonstrations, costumes and experiments are fun and lighthearted ways to generate curiosity for important topics.

"What's important when we teach chemistry is to have students learn the fundamentals, but also learn how to connect chemistry to society," said Shakhashiri, "The more that we talk about chemistry in a responsible manner, the better. We celebrate Mole Day as a way to connect our science to the general public."

Shakhashiri also emphasized that although Mole Day is filled with lighthearted activities, the reason we celebrate is to remember the very important chemical concept of Avogadro's Number.

"When I was teaching general chemistry, I would always say something about Mole Day. I would try to be humorous, but also affirm that it was so important to know what Avogadro's Number was and why it was useful in chemistry," Shakhashiri recalled, "It provides an opening for doing all kinds of things that relate to important concepts in chemistry."

This year, The National Mole Day Foundation has established the theme as HaMOLEton, which pays homage to the historical Broadway hit, "Hamilton." Combining chemistry and history, this October 23 was one to remember.

Thirty years ago, Maurice Lee Oehler created Mole Day to share his passion for chemistry with students and help them appreciate science as he did. Today, the unofficial holiday is celebrated around the world — an accomplishment that some may call unbelieva-mole.

Submitted by Bassam Shakhashiri

Bassam Shakhashiri enjoys Mole Day with students through the annual American Chemical Society celebration.

Department launches Faculty Research Mentorship Program

By Mason Braasch
Department Communications

Community is an important aspect of any Department, especially in an age of virtual interactions. Recently, the Department of Chemistry took strides to strengthen mentorship relationships, engage in conversations, and initiate peer learning with a new mentor training program.

Using a model by the Center for Improvement of Mentored Experiences in Research (CIMER), members of the UW–Madison chemistry community constructed a program in which core faculty members of the Department engaged in case studies, breakout group discussions, and even homework that explored peer learning and mentor training.

Dr. Cheri Barta, one of the facilitators, explained that the ultimate goal of the program was to "generate awareness about mentoring, to talk about the best practices that could be implemented, and to create a support network for mentoring so faculty could rely on each other."

The program aims to develop deeper and more meaningful mentorship relationships and to teach ways to utilize these relationships in order to benefit the Department and mentees.

"I hoped we would normalize our discussions among faculty, staff and students about how to be better mentors and integrate that into how to be better scientists and engineers" said Prof. AJ Boydston, the co-chair for Climate, Diversity, Equity and Inclusion steering committee who helped to facilitate the new program.

Department alumna, Dr. Ann M. Caviani Pease, who donated funds to develop the program, said she was inspired by conversations about scientific, evidence-based approaches to improve the Department and by preparation done by former Department Chair Judith N. Burstyn to ensure the program's effectiveness.

Dr. Cheri Barta

Prof. AJ Boydston

Dr. Ann Pease

"I was certain Judith had really accessed and spoken with enough individuals, whose focus was diversity, equity, inclusion and improving circumstances, and they were skilled in what needed to be done," Pease said, "I had full faith that Judith would put the money to good use."

The first session took place in October 2020 as a virtual event. Facilitators and faculty who participated were satisfied with the session and excited for the impact it will have on the Department.

"I was really happy to see that many of the participants said that there were actionable items coming out of the workshop, whether that was changing existing policies in the group or creating value statements," Boydston said. "Having more discussions with faculty and collaborators about mentoring students and postdocs equips them with the ability to take action almost immediately."

The sessions helped faculty creatively approach peer relationships, and have opened the door to opportunities to develop deeper and more meaningful connections. In Organic Path meetings, for example, attendees have a "mentoring moment" at the beginning of meetings, in which they discuss a mentoring or science issue.

"It's been really great to see that those conversations have been initiated, where we weren't seeing conversations about mentoring before the program," Barta said. "It has been nice to see the faculty come together, share their experiences and think more deeply about mentorship."

Going forward, facilitators say that they hope that the sessions will continue to foster meaningful conversations, as well as dive into other topics of interest. Dr. Cara Jenkins, who worked alongside Boydston and Barta on the program, says that she hopes to include members from other departments in the future. Additionally, Barta said that including more conversations about diversity and inclusion are on the list of additions for upcoming sessions.

In order to sustain the conversations and impacts of the program, Boydston, Barta and Jenkins, along with Dr. Andrew Greenburg, another facilitator of the program, have been holding office hours where faculty can drop in with questions or challenges.

"We want to find the healthiest, most supportive way to help everybody improve," Boydston said.

As the sessions continue to evolve, the focus on connections, mentorship, and peer learning will continue.

"I just think it's a really great program, and I think that it has the potential to really make a difference in the quality of mentorship at the University as a whole," Jenkins said. "I hope that all the faculty members in all the Departments take the opportunity to do this training."

Exciting discovery made from incorrect hypothesis

By Meranda M. Masse
Department Communications &
Graduate Student (Cavagnero)

A hypothesis can be a scientist's best-educated guess about how an experiment might turn out or why they got specific results. Sometimes, they're not far off from the truth. Other times, they're wrong. Being wrong isn't always a bad thing. Often, it means that the researchers get to discover something new and exciting. This exact scenario happened when the Burstyn and Buller labs decided to work together on a project.

"You get alternative perspectives, and that's why collaborations can be so beneficial," said Brian Weaver, a graduate student in the Burstyn group.

In addition to being part of a healthy diet, proteins are responsible for many complex chemical reactions in our body's cells and even in bacterial cells. Sometimes these proteins have metals in them that help facilitate these reactions. While the Burstyn group aims to understand how these metals can help, the Buller group makes new proteins that can perform specific chemical reactions. By combining their knowledge, the Buller and Burstyn groups wanted to make bacterial cells that would incorporate cobalt metal into their proteins.

By putting cobalt metal into proteins, bacterial cells can make specific products that would otherwise produce lots of wasteful and potentially hazardous chemicals in a lab. Performing the reactions in cells makes the chemical reactions better for the planet and more efficient.

As Prof. Andrew Buller said, "This is how life does chemistry, and the transformations it pulls off are wild!"

> "This is how life does chemistry, and the transformations it pulls off are wild!"
>
> **Andrew Buller**
> Professor of Chemistry

Too much cobalt can kill cells, which makes trying to incorporate the metal into proteins a challenging task. The two groups thought that they could evolve cells to withstand high concentrations of cobalt metal.

Weaver and graduate student Lydia Perkins from the Buller group were paired up and asked to perform these experiments. Interestingly, after evolving these new cells, the pair realized that their initial thoughts were incorrect about how cells can incorporate cobalt into their proteins. Instead of seeing more proteins with cobalt metal in them, the researchers found out that the cells made to survive in high concentrations of cobalt did the opposite.

"When we evolved them, it turned out that they were worse at incorporating cobalt. [The cells were] good at surviving in cobalt, but bad at putting it into [their proteins]," Perkins explained.

When Perkins and Weaver went back to the drawing board, they decided to run some controls. Controls can tell researchers how something they are changing in an experiment compares to their system without that specific change.

Thanks to the control experiments, the two groups soon realized that there was no need to evolve the cells in the first place. As it turns out, at high concentrations of cobalt metal, bacterial cells could survive by putting cobalt into their proteins- which is precisely what the researchers wanted in the first place.

"We had a misconception on how this needed to work. That's really what Brian and Lydia figured out," Prof. Judith N. Burstyn commented.

While the two groups' initial hypothesis was wrong, through careful research and collaboration, they reached their final goal of putting cobalt metal into proteins. Thanks to their work, incorporating cobalt metal into proteins is now accessible to many other researchers- leaving the possibilities for future exploration endless.

Photo by Julia M. Fraser

Lydia Perkins (Buller group), Prof. Judith Burstyn, Prof. Andrew Buller and Brian Weaver (Burstyn group) collaborated on a project through which they learned that bacterial cells could survive by putting cobalt into their proteins.

Wickens Lab explores new method to make aziridines

By Aadhishre Kasat
Department Communication and
Student Researcher (Buller)

The Wickens lab primarily focuses on developing novel strategies for combating long-standing synthesis challenges in organic chemistry. This past year, they took the challenge of developing a new method to synthesize aziridines by leveraging electrochemistry.

Aziridines are three-membered nitrogen-containing cyclic molecules. The ring strain associated with them makes them highly reactive substrates in ring-opening reactions and, therefore, an attractive precursor for the synthesis of several nitrogen-containing compounds. However, the same ring strain makes these molecules highly unstable and, thus, challenging to synthesize. In the past, scientists have used highly reactive reagents to make the synthesis of these strained molecules possible.

"Previously, aziridines were synthesized by preparing reactive nitrogen-containing reagents that were well-suited to react with carbon-carbon double bonds," said Zachary Wickens, assistant professor in the Department of Chemistry. "However, this approach limits the array of groups that can be attached to the nitrogen atom, and therefore limits the aziridines that we can access. This is because there are only a small number of nitrogen groups that can be successfully turned into the highly reactive species required for this approach."

The Wickens lab approached the challenge of aziridine synthesis from a different perspective. Instead of trying to find ways to make nitrogen groups reactive, they used electrochemistry to activate the carbon-carbon double bonds, which can then react with a variety of amines to synthesize a larger variety of aziridines than ever possible before.

"Using this approach, we have been able to synthesize aziridine derivatives in one step that previously would have been a huge challenge to prepare," said Wickens. "This development has a lot of potential applications in medicinal chemistry and pharmaceutical development because nitrogen-containing compounds are commonly found in biologically active molecules."

The Wickens lab's work goes beyond developing a new route for aziridine synthesis. What they really developed is a different way to transform molecules that hadn't been considered before. Their development of this novel reaction will help build a new platform for medicinal chemistry and lay the foundation for many different reactions that will stem from the principles on which their research is based.

Photo by Casey Winter

Electrochemical aziridination reaction

Widicus Weaver Lab finds new methods for prebiotic chemistry

By Tatum Lyles Flick
Marketing & Communications Manager

Over the past year, the Widicus Weaver group kept busy under the constraints of COVID-19, by finding new ways to approach research on prebiotic astrochemistry. The group focused on calculations, modeling, and computational work while evaluating the setup of their laboratory experiments.

Photo by Colton Mansavage

Prof. Susanna Widicus Weaver

One success from working outside of the lab was a paper co-authored by graduate students Hayley A. Bunn and Chase Schultz from the Widicus Weaver lab and a graduate student from the Bertram lab, Christopher Jernigan. Jernigan taught Bunn to use modeling software the Bertram lab uses for atmospheric chemistry, which led to collaborations and to identifying molecules that would have otherwise been missed as potential products in the experiment.

"We're trying to make aminomethanol, the direct precursor to glycine in the interstellar medium, but it's so reactive we can't keep it around long enough to collect a spectrum," explained Prof. Susanna Widicus Weaver. "We may have made it in our mixture, but according to the models, it reacts away so fast we would never detect it. Now we have this piece of evidence that can guide us on what to try next."

The group now uses these models to study chemical systems to predict what might happen.

The lab is also working on a collaboration with a cometary chemist and an ice chemist with the NASA Goddard Space Flight Center. Most people study samples of simulated interstellar ice with mass spectrometry to determine what forms in the ice.

"We're looking at what molecules are released from interstellar ice using rotational spectroscopy, just like you would do with a telescope" Widicus Weaver said. "No one has ever done this experiment this way before."

Graduate student Katarina Yocum published a proof of concept paper two years ago and recently a second paper with the first big set of results from this experiment.

"We like to tell people we make comets in the lab," Widicus Weaver said. "It's such a different way to think about that experiment and people are really excited about these results."

Photo by Sam Hall

The view from the DC-8 research aircraft as it flies through the marine boundary layer, the portion of the atmosphere close to the ocean's surface where the ocean affects processes like cloud formation.

Bertram group finds ocean life helps produce clouds, but existing clouds keep new ones at bay

By Eric Hamilton
University Communications

Stand on the ocean's shore and take a big whiff of the salt spray and you'll smell the unmistakably pungent scent of the sea. That ripe, almost rotting smell? That's sulfur.

Marine plankton breathe more than 20 million tons of sulfur into the air every year, mostly in the form of dimethyl sulfide (DMS). In the air, this chemical can transform into sulfuric acid, which helps produce clouds by giving a site for water droplets to form. Over the scale of the world's oceans, this process affects the entire climate.

But new research from the University of Wisconsin–Madison, the National Oceanic and Atmospheric Administration (NOAA) and others reveals that more than one-third of the DMS emitted from the sea can never help new clouds form because it is lost to the clouds themselves. The new findings significantly alter the prevailing understanding of how marine life influences clouds and may change the way scientists predict how cloud formation responds to changes in the oceans.

Prof. Tim Bertram

By reflecting sunlight back into space and controlling rainfall, clouds play significant roles in the global climate. Accurately predicting their formation is essential to understanding the effects of climate change.

"It turns out that this story of cloud formation was really incomplete," said Prof. Tim Bertram, senior author of the new report. "Over the last three or four years, we've been questioning parts of that story, both through laboratory experiments and with large-scale field experiments. Now we can better connect the dots between what's emitted from the ocean and how you form these particulates that encourage cloud formation."

Dr. Gordon Novak

With collaborators from 13 other institutions, Gordon Novak, formerly a graduate student in the Bertram group and now a research scientist at NOAA, constructed the analysis published in the Proceedings of the National Academy of Sciences.

A few years ago, this group of collaborators, led by Patrick Veres at NOAA, discovered that on its way to becoming sulfuric acid, DMS first turns into a molecule known as HPMTF, which had never been identified before. For the new study, the team used NASA-owned, instrument-laden aircraft to capture detailed measurements of these chemicals over the open ocean both inside of clouds and under sunny skies.

"This is a massive DC-8 aircraft. It's a flying laboratory," Bertram said. "Essentially all of the seats have been removed, and very precise chemical instrumentation has been put in that allows the team to measure, at very low concentrations, both the emitted molecules in the atmosphere and all of the chemical intermediates."

From the flight data, the team discovered that HPMTF readily dissolves into the water droplets of existing clouds, which permanently removes that sulfur from the cloud nucleation process. In cloud-free areas, more HPMTF survives to become sulfuric acid and help form new clouds.

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Single-molecule measurements give insight into how pacemaker ion channels interact with cAMP

By Meranda Masse
Department Communications &
Graduate Student (Cavagnero)

If you've ever been on an amusement park ride, been scared suddenly, or maybe even had to address a large crowd when you were nervous; you've likely felt your heart start to thump faster even though you weren't exerting a lot of energy. What happened was a certain chemical compound called cyclic adenosine monophosphate (cAMP) activated pacemaker ion channels, which caused an increase in electrical activity that led to your heart beating faster.

Ion channels are found in many different cells throughout the body and can control many different types of bodily functions, such as muscle contractions. Some examples of where these channels can be found are within the nervous system, and within the heart. Within the heart and brain specifically, there are pacemaker ion channels. Pacemaker ion channels are responsible for delivering electrical currents to these areas. In this way they are similar to pacemaker devices, which deliver electrical pulses, but rely on a biochemical pathway rather than a physical one.

For many years, researchers have tried to study how these channels are activated by the chemical compound cAMP. Unfortunately, their efforts have yielded opposing results, with some suggesting that the binding is cooperative (meaning that when one cAMP binds it affects the binding of the second cAMP), and others suggesting that binding is noncooperative (binding of one cAMP is not affected by the binding of another cAMP). The discrepancies of these results are likely due to the nature of bulk measurements and their inability to resolve complex mixtures with multiple interconverting species.

Goldsmith described Zero Mode Waveguides as a way to specifically observe an individual in a crowd, while still seeing how the crowd can affect them and their actions.

So, to answer this question, single-molecule measurements are a must.

A key difference between single-molecule and bulk measurements is the type of information they can yield. In the case of single-molecule measurements, unsurprisingly, individual molecules are observed. This is different from bulk measurements because in bulk, there will be lots of molecules that may be doing entirely different things, which all become averaged together to obtain a final measurement. Another key difference is that single molecule measurements require very small concentrations, whereas bulk measurements can be performed at higher concentrations.

To explore how pacemaker ion channels are activated by cAMP, a team consisting of lead graduate student David White, Prof. Randall Goldsmith, and Prof. Baron Chanda, decided to team up and look at pacemaker ion channels and how they interact with cAMP at the single-molecule level. Their work was recently published in Nature (Vol 595, pp 606–610 (2021)).

In general, single-molecule measurements require that anything fluorescently labeled be at a very low concentration. In the body, cAMP is in relatively high concentrations when compared to the pacemaker ion channels that it interacts with. At these concentrations, it is very difficult to perform single-molecule measurements. Thankfully, the team knew of a technology that could alleviate this issue called Zero Mode Waveguides.

Prof. Randall Goldsmith

Goldsmith described Zero Mode Waveguides as a way to specifically observe an individual in a crowd, while still seeing how the crowd can affect them and their actions. Using this method, the group could study how physiologically relevant concentrations of cAMP interact with pacemaker ion channels, allowing for much more accurate studies of their interactions with one another.

Specifically, Zero Mode Waveguides are tiny holes (often around 150 nm) that focus light to an exceedingly small volume, far beyond the theoretical limit attainable by using optical lenses.

By limiting the zone of excitation, this method is able to monitor single binding events even at a much higher concentration because the freely diffusing labels in the solution do not contribute to background noise.

STORY CONTINUES ONLINE ››

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Lab makes 3-D enzyme mimicking architectures using full pallet of synthetic chemistry

By Aadhishre Kasat
Department Communications &
Student Researcher (Buller)

The Martell group's research focuses on making artificial enzymes and artificial receptors by combining biomolecules with synthetic molecules.

"We synthetically modify individual DNA arms by using functional groups that are not found in naturally occurring amino acids and cofactors, therefore broadening the scope of our reactivity," said Prof. Jeffrey Martell. "We then rely on complementary base-pairing for the arms to self-assemble into a 3-D cage, such that the attached functional groups are displayed into a central cavity."

Martell's approach of creating artificial enzymes using DNA scaffolds is sophisticated. Based on collision theory, for a successful reaction to occur, the reactants colliding must possess a minimum energy and be oriented in a manner favorable for the reaction to occur. The movement of the catalysts and reagents in a typical synthetic chemistry reaction is largely administered by diffusion. While we can tweak factors such as heat and concentration to increase the total number of collisions, there will still be many collisions that will not result in a successful reaction.

According to Martell, enzymes are one step forward. Enzymes are 3-D structures where the catalytic activity is sequestered in the internal cavity of the structure, where the functional groups are already arranged in a conformation most favorable for reaction to occur. Since enzymes are closed structures, the substrate can enter only in a specific manner such that it is oriented *perfectly* for the reaction to occur. This isn't to say that diffusion doesn't occur in biological systems; it does. This just means that reactions occur more efficiently in enzymes because of their specific 3-D structure, yielding much faster reaction rates.

By making 3-D enzyme mimicking architectures using the full palette of synthetic chemistry, the Martell lab is exploiting not just the expanded reactivity offered by synthetic chemistry but also the specificity offered by enzymatic structures, resulting in reactions with incredibly high rates.

The strength and the challenge of the project are the same — the 3-D enzyme mimicking structure.

"While this structure offers benefits of biocatalysis, even the smallest of changes in conformation can drastically affect activity," Martell said. "It is really challenging to ensure that the DNA scaffold folds in a manner such that the synthetic molecules are organized in the most favorable manner."

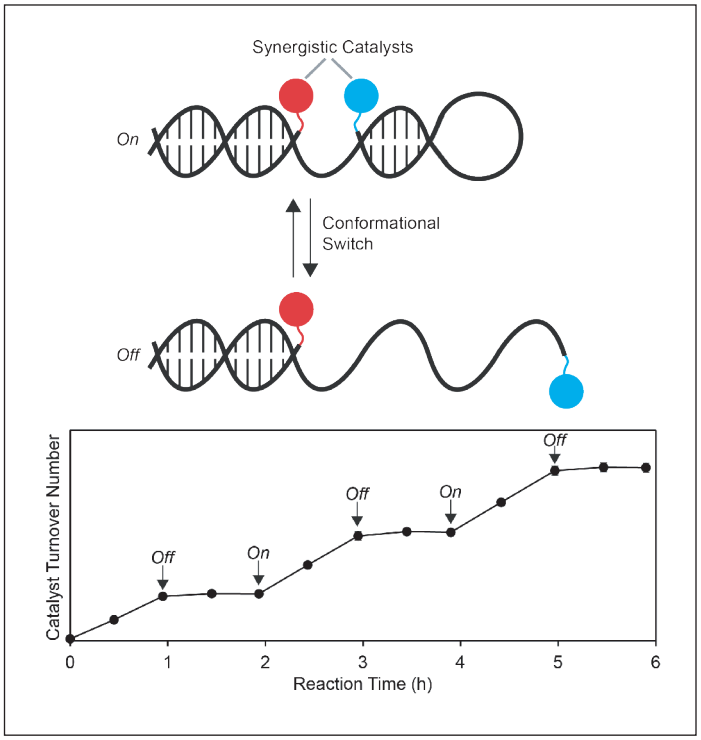
Even with challenges, the Martell lab has had success. A recently submitted paper spearheaded by fourth-year graduate student Edward Pimentel showed that DNA scaffolds can be used to accelerate chemical reactions.

Prof. Jeffrey Martell

Edward Pimentel

"Edward attached two co-catalysts on the same side of the DNA helix to perform an alcohol oxidation reaction and showed that when DNA is used as a scaffold, the reaction occurs much faster than when it isn't," explained Martell.

As seen in the figure, Pimentel completely switched the reaction off by altering the conformation of the DNA scaffold. This is very interesting because of its applications in sensing and targeted therapeutics.



Graduate researcher Edward Pimentel showed that changing the conformation of the DNA scaffold, thereby increasing the distance between the co-catalysts, and inhibiting their interaction, resulted in the reaction completely shutting off.

New building scheduled to open for Spring

By Tatum Lyles Flick
Marketing & Communications Manager

The new Department of Chemistry tower, which was supposed to open in the Fall of 2021, is now scheduled to open for classes in the Spring of 2022, according to the Facilities Committee. As part of a $133 million upgrade to the building complex, the tower is poised to serve the rapidly increasing number of undergraduate students at UW–Madison.

"New fire codes posed some problems that delayed the opening of the new building," said Department Chair Clark Landis. "We have every expectation that these problems will be surmounted and that the building will be open for the Spring semester."

The new building will support the undergraduate program with new collaborative-learning spaces, an information commons (library) geared to online information services, lecture rooms that encourage group work as well as presentations, state-of-the-art laboratories with adjacent write-up rooms and facilities to support undergraduate research and an advanced synthesis course.

Photo by John Moore

Write-up rooms with adjoining labs offer students a place to reflect on, discuss and better understand the chemical reactions behind experiments. Pictured above, the write-up room has seating arranged for group work; an organic lab is in the background.

Photo by John Moore

The UW–Madison Department of Chemistry's new tower is scheduled to open in time for the Spring 2022 semester.

Chemistry graduate students use virtual zine to bridge gap between arts and science

Photo submitted by Philip Lampkin

The Benzine editorial board includes top row from left: Danica Gressel (Fredrickson), Philip Lampkin (Gellman) and Sophya Alamudun (Choi), bottom row from left: Robin Morgenstern (Pazicni), Jairo Villalona (Buller) and Ray Czerwinski (Goldsmith).

By Aadhishre Kasat
Department Communications

Although art and science are often viewed as unrelated ventures, over the years their coexistence has been realized as more compatible than immiscible. Graduate students from the Department of Chemistry, through their recently established art and literary magazine, are advocating for this interdisciplinary approach and the benefits it renders. The Benzine, besides being a great pun, is a platform for the Chemistry community to share their art, build a sense of community and alleviate stress.

The idea of the zine was first brought to fruition by Philip Lampkin, a graduate student in the Gellman group.

"I've always been a strong believer in the pursuit and development of all of one's passions," Lampkin said. "This belief was further cemented when I started graduate school. Through conversations with my colleagues, I realized all the brilliant chemists around me contained within them significant artistic abilities I would've never imagined."

Lampkin soon shared this idea with others, who are now on the editorial board: Danica Gressel (Fredrickson), Robin Morgenstern (Pazicni), Ray Czerwinski (Goldsmith), Jairo Villalona (Buller), and Sophya Alamudun (Choi).

Embracing the interdisciplinarity nature of science and art has positively influenced both the chemist and artist within members of the Chemistry community.

"There's definitely still a stereotype that scientists can't be artists and vice versa," said Ray Czerwinski, a graduate student in the Goldsmith group. "As a musician and a writer, I've always felt a strong connection to the arts, but I kept it separate from science. While working on the zine, I realized that by nurturing my creativity, I am polishing skills that will help me find success as a scientist. The Benzine is a small part of the growing movement to celebrate the intersection of those creativities, and I think that's an important message for scientists anywhere."

While working on the zine, board members realized that by developing their artistic skills, they are also enhancing their science communication skills.

"I have been able to better assess the effectiveness of my figures and analogies and understand the importance of storytelling in science," said Jairo Villalona, a graduate student in the Buller group.

The Benzine has materialized as a creative outlet for many board members and has positively impacted their mental health.

"Previously, when I hit a wall in my research, it was very easy to feel burnt out, but working on the zine keeps me grounded and makes me feel like I have something important to contribute to when my research isn't going well," said Sophya Alamudun, a graduate student in the Choi group.

By distributing The Benzine, board members were able to extend the community they built into the Department and instill values of inclusivity and diversity. After the release of the first publication, they received many messages from readers expressing their gratitude for the zine.

STORY CONTINUES ONLINE ››

BADGERCHEMISTNEWS.CHEM.WISC.EDU

Postdoc uses social media to share STEM resources

By Mason Braasch
Department Communications

@stempowerment_resources

Stephanie Santos-Diaz, an advocate for diversity, equity and inclusion in higher education, and a postdoc at the Department of Chemistry, recently started an Instagram account that is intended to be an empowering resource for underrepresented populations in the STEM field. Six months after her first post in October 2020, the STEMpowerment Instagram page has gained more than 200 followers, and has shared over 40 posts. Santos-Diaz explained that the Instagram page is a way to acknowledge her community and help them to overcome potential barriers.

"I'm Latinx. I'm a woman in STEM," Santos-Diaz said. "So, I really want to give back to my community and help them out. That's what STEMpowerment Resources is specifically for. Anyone can follow and can benefit from it, but it's specifically for those populations."

On the page, Santos-Diaz shares announcements for conferences, scholarships, and networking opportunities, as well as motivational materials such as quotes from people within the community. Her hope is that her followers use these resources to explore the different opportunities offered in STEM and break free from the normal way to do things.

"I feel like a lot of us are fed this narrative about which trajectories are best for us. People tell us, 'You finish your bachelor's degree and then you go to grad school, get your masters or Ph.D., and then you get a job or get a postdoc, and get a job in academia or industry.' So, it's very limited," Santos-Diaz said, "I want people to know that there are ways to get involved in other different disciplines, there are ways to explore other things."

In the future, Santos-Diaz hopes to continue sharing important resources and opportunities, while transforming the space into a STEM Empowerment Coaching page. Her goal of starting a business was her inspiration for the Instagram page, and she hopes that the work she has done to build it and her database of resources will help her to achieve this goal.

Stephanie Santos-Diaz
STEMpowerment artwork

Those who would like to follow along, or who are looking for opportunities within the STEM field, can follow the STEMpowerment Resources page on Instagram, @stempowerment_resources

Badger Chemists build strong community

Photo by Cassie Doody

The winners of the annual Snout Out softball tournament are (front row, from left): Clark Landis, John Berry, Becky Schultz, Faysal Ibrahim, Carly Masonheimer, Troy Vulpis, Natalia Soja, Levi Hogan; (second row, from left) Tony Meza, Zach Bennett, Kaine Suansing, (third row, from left) Allwin McDonald, Rachel Hutchinson, Lydia Perkins, Sidney Dicke, Trenton Peters-Clarke, Brian Weaver, Riley Kelch and Prasanth Kumar.

Photo by a Nice Passerby

In 2020-2021, Department members found lots of creative ways to maintain their sense of collaboration and community. They attended book clubs and virtual coffee discussions, and enjoyed Madison's warm weather for summer lunches.

Bertram, Bain receive Taylor Excellence in Teaching Awards

By Meranda Masse
Department Communications &
Graduate Student (Cavagnero)

The Department of Chemistry chose two recipients for the James W. Taylor Excellence Teaching Award – Prof. Timothy Bertram and senior instructional technology specialist Dr. Rachel Bain.

Bertram began teaching at UW–Madison in 2015, and said that his teaching philosophy entails teaching at a pace that students can learn from and using examples that they care about. Bertram said that some of his favorite memories teaching are in small group discussions during office hours, where he saw concepts crystallize for his students as they made connections between topics.

Prof. Tim Bertram

When asked about how the pandemic has altered his teaching approach, he mainly commented on how bringing the classroom to a virtual setting is critical.

"I have attempted to recreate the classroom environment using a tablet to hand write my lecture notes," he said, explaining that this allows for the students to be more engaged in the material, and also allows them to look back on notes from previous lectures.

Dr. Rachel Bain

While Bain is not a teacher in the typical sense, she plays a vital role in making teaching possible for her colleagues by serving in instructional technology. When instruction switched to mostly remote, Bain said how inspiring it was to see, "a great team effort toward making teaching and learning chemistry better."

Bain has a "helping philosophy," where she said how important it is to meet everyone where they are and come up with the best technological solution for their needs. She added that she is happiest working behind the scenes, but this award means a lot.

Also recognized were recipients of the Outstanding Chemistry Teaching Assistant Awards- Ray Czerwinski, Meghan Campbell, Kimberly DeGlopper, Madison Fellows, Matt Genzink, Matt Hautzinger, Amber Lim, Jericha Mill, Houston Smith and Natalia Spitha.

Doolittle earns Distinguished Faculty Associate promotion

By Mason Braasch
Department Communications

Dr. Pam Doolittle has been promoted to Distinguished Faculty Associate by performing at a level of proficiency, gaining extensive experience, knowledge, and skills, and providing guidance and training to peers and other staff.

Doolittle started her journey at UW–Madison, earning a Ph.D. under R. Claude Woods. Since 1998, she has served as the Analytical Lab Director in charge of Chem 115, 116, 327 and 329.

"She transformed our UW–Madison analytical curriculum, bringing state-of-the-art research from our Department to the students in our undergraduate analytical classes," said former Department Chair Judith N. Burstyn. "She contributed curricular materials for the Open Education Resource (OER), the Analytical Sciences Digital Library, and she has written in and presented for the major venues of the field."

Doolittle worked hard to earn this promotion, however, she says that she would not be where she is today without the support of her teaching staff and her peers.

"I have worked on building my CV and reputation for years to earn the Department's support for this distinction," Doolittle said. "I published papers, presented at conferences, and got involved in promoting active learning at a national level. None of these things happened just because of me, but because of a team of people."

Doolittle thanks: Woods, John Wright, John Schrag, Matt Sanders, and Lloyd Smith, as well as lab directors, TAs and FAs.

"Folks I work with hear me say often, 'It takes teamwork to make the dream work!' and this was definitely true for creating the program we have today," said Doolittle.

Recently, Doolittle led the largest in-person instructional effort on the entire UW–Madison campus. Her continued dedication to the Department and her willingness to continue instruction in troubling times indicates why she earned this promotion.

Dr. Pam Doolittle

"I have worked in chemistry in one form or another for over 30 years and have spent my entire professional career in the service of the Department and University," she said, "It has been one of the great privileges of my life to work alongside its members, and engage the students taking courses in the program."

Undergrad researcher earns award to attend ACS Atlanta

Photo submitted by Christian Gomez

Christian Gomez attends the ACS Meeting & Expo in Atlanta, GA, by winning an ACS Bridge Travel and Career/Professional Development Award.

By Tatum Lyles Flick
Marketing & Communications Manager

Christian Gomez, an undergraduate researcher with the Martell group, received an ACS Bridge Travel and Career/Professional Development Award, which helped him attend his first scientific conference – the ACS Meeting & Expo in Atlanta.

The award supports underrepresented undergraduate and graduate students by funding conference attendance and career and professional development.

"The award gave me the opportunity to represent both University of Wisconsin–Madison and the Martell group," Gomez said. "The ACS Fall 2021 Meeting was a great way to talk to other professors and students about current research, while exchanging and learning about new ideas in different fields of chemistry."

"I'm so glad Christian was able to attend the ACS Atlanta meeting," said Prof. Jeffrey Martell. "This was a fantastic opportunity for him to learn about new areas of chemistry, meet scientists from all over the world, and gain experience explaining his research."

The Martell develops enzyme-mimicking catalysts, and Gomez studies ways to create DNA-based sensors for detection of small molecules or proteins.

"The presentations at the ACS conference offered a wide range of topics that helped me expand my knowledge beyond my current area of research," he said, adding that he enjoyed the talks and attending in-person poster presentations, where he could have one-on-one conversations with presenters.

"The travel award has offered a glimpse into professional presentations and I hope to give my own poster presentation next year at the 2022 ACS Fall meeting," Gomez concluded.

Graduate students win Department of Defense Fellowship

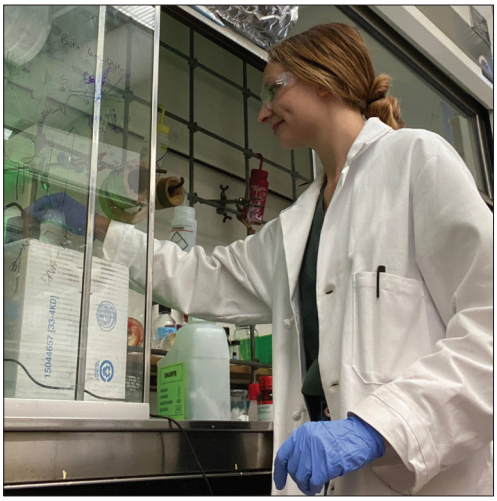
By Tatum Lyles Flick
Marketing & Communications Manager

Chemistry graduate students Christopher Dade (Forest) and Ashley Ogorek (Martell) have been selected for Department of Defense's National Defense Science and Engineering Graduate (NDSEG) fellowships, which for three years offer a monthly stipend, travel budget, health insurance and pay tuition and fees.

Only 159 fellows were selected out of 7,942 applicants.

"This fellowship will enable me to pursue research full time for the last three years of my graduate career," said Ogorek, who is part of the Martell group. "I am also excited to become part of a community of top scientists across the country."

Ogorek detects protein-protein interactions through DNA and antibody



Ashley Ogorek, a graduate student in the Martell Lab, recently won a National Defense Science and Engineering Graduate fellowship.

switchable catalysis. She hopes her research can reveal more about proteomics, therapeutics, and disease diagnostics.

"My research is focused on identifying inhibitors of a protein in the bacteria *Pseudomonas aeruginosa* that processes the subunits of both the type 4 pilus and type 2 secretion systems," Dade said. "Our goal is not only to better understand the structure, function, and mechanism of integral membrane aspartic acid proteases but also to potentially develop new leads for targeting virulence in drug-resistant pathogens."

Dade was excited and honored to earn the three-year fellowship.

"Because the fellowship funds graduate students and not the research, I also see it as a validation of my goal to become a publicly engaged scientist, working to establish the role scientists can play rebuilding connections and trust between citizens and their land-grant universities," he said.

Department of Chemistry Awards

ALUMNI

Bullock, R. Morris (Casey) - ACS Award, Organometallic

Cooke, Lloyd Miller (Meloche) - UW Athletic Hall of Fame, 2021

FACULTY & STAFF

Bain, Rachel - Taylor Excellence in Teaching Award

Bertram, Tim - Taylor Excellence in Teaching Award

Chemistry Instrument Center Academic Staff: Cathy Clewett, Charlie Fry, Ilia Guzei, Heike Hofstetter, Bob Shanks, and Martha Vestling - Departmental Academic Staff Excellence Group Award

Doolittle, Pam - Academic Staff Mid-Career L&S Excellence award and Distinguished Faculty Associate title

Gustin, Léa - 2020 Dept Academic Staff Excellence Award

Huang, Xuhui - Pople Medal, APATCC

Lemire, Beatriz - University Staff Recognition Award

Nathanson, Gilbert - GSFLC Mentorship Award

Pazicni, Sam - GSFLC Mentorship Award & Distinguished Faculty Postdoc Mentoring Award

Reitz, Tracey (CLC) - 2021 Letters & Science Academic Staff Early Career Award

Schomaker, Jennifer - UW Romnes Faculty Fellowship Award, elected fellow of Royal Society of Chemistry, ACS Arthur C. Cope Scholars Award

Shakhashiri, Bassam - Timm Award for Excellence in Teaching Chem from NEACT

Wickens, Zachary - NSF Award

Willadsen, Marc - 2021 University Staff Award

Zanni, Martin - Plyler Prize for Molecular Spectroscopy & Dynamics

GRADUATE STUDENTS

Aguirre-Figueroa, Guadalupe (Blackwell) - Pei Wang Fellowship

Akana, Michelle (Weix) - PPG Summer Fellowship

Alamudun, Sophya (Choi) - Pei Wang Fellowship

Bates, Jason (Stahl) - GSFLC Mentorship Award

Bird, Jennifer E. (Ph.D. 2021) WISL Award for Rural Cancer Disparities and Communication Needs

Bishop, Camille (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Vapor deposition rate modifies order in highly structured glasses*

Borgatta, Jaya (Hamers) - McCoy Memorial Scholarship

Bratburd, Jennifer R. (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Host-microbiome interactions impacting pathogen and mutualist colonization within defensive symbioses*

Britton Acevedo, Shaneen (Cavagnero) - Pei Wang Fellowship

Brown, Kyle (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Novel Proteomic Approaches to Characterize Endogenous Membrane Proteins*

Bruns, David (Stahl) - Slifkin Award

Buck, Kevin (Ge) - Pei Wang Fellowship

Buxton Henke, Katie (Smith) - Hartl Research Award – Analytical

Campbell, Meghan (Buller) - Kellogg TA Award

Chen, Sijie (Stahl) - Casey Research Award – Organic

Chernowsky, Colleen (Wickens) - Dickinson Fellowship in Organic

Czerwinski, Rachel (Goldsmith, Shakhashiri) - Kellogg TA Award

Deglopper, Kimberly (Stowe) - Kellogg TA Award

Dehghany, Mahzad (Schomaker) - Dickinson Fellowship in Organic

DeLaney, Kellen (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Mass Spectrometry Methods and Applications for Functional Characterization of the Crustacean Neuropeptidome*

Deshaye, Megan (Stowe) - Pei Wang Fellowship

Ehehalt, Lauren (Weix) - Pei Wang Fellowship

Evans, Taylor A. (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Development of antimony-containing catalysts and semiconductors for (photo)electrochemical fuel production*

Fan, Dacheng (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Investigating the O-GlcNAc cycling enzymes: substrate recognition, enzymatic activity, and biological functions*

Fellows, Madison (McMahon) - Kellogg TA Award

Fernandez, Rebeca (Ph.D. 2021, Brunold) - Harold Hay Fellowship, GSFLC Mentorship Award, and WISL Award for *Structural, Spectroscopic, and Kinetic Investigation of Cysteamine Dioxygenase*

Garnier, Bridget (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Faulting in southern Guatemala and implications for the North America – forearc – Caribbean triple junction*

Genzink, Matthew (Yoon) - Kellogg TA Award

Gibadullin, Ruslan (Gellman) - Mirviss Mentorship Award and Hirschmann-Rich Fellowship in Bio-Organic

Greenhalgh, Elizabeth (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Spectroscopic and Computational Investigations of the Cobalamin Containing Enzymes EutT, CblC, PceA, and QueG*

Gui, Yue (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Phase Transitions in Molecular Solids: Understanding Polymorphic Transformation and Crystal Nucleation, and Engineering Amorphous Drugs for Global Health*

Hang, Yun (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *New Light on Earth's Energy Budget and Its Implication for Solar Energy Potential*

Hansen, Christina - (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Structured Aggregation of Germline Determinants in Danionin Embryonic Development*

Hautzinger, Matthew (Jin) - Kellogg TA Award

Herzog, Joshua M. (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Quantitative Temperature & Formaldehyde Concentration Imaging for High-Pressure Turbulent Fuel Jet Ignition*

Hogan, Levi (Goldsmith, Shakhashiri) - Carlson Graduate Award

Holst, Dylan (Wickens) - Dickinson Fellowship in Organic

Hu, Bob (Schomaker) - Dickinson Fellowship in Organic

Janicki, Tesia (Schmidt) - GSFLC Mentorship Award

Jarois, Dean (Gellman) - National Science Foundation Graduate Research Fellowship

Jones, Zack (Hamers) - Carlson Graduate Award

Lane Starr, Nicole M. (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *The Role of Oxylipins at the Intersection of Rhinovirus Infection and Asthma*

Laudadio, Elizabeth (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Chemical Transformations of Lithium Cobalt Oxide Nanoparticles in Model Environmental Systems*

Li, Zihui (Li) - Harold Hay Fellowship

Lian, Yumin (Schwartz) - Anderson Grad Student Support Fund

Lim, Amber (Fredrickson) - Kellogg TA Award

Linke, Vanessa (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Linking Mass Spectrometry and Genetics for Studying the Various Biological Roles of Lipids*

Lumley, Margaret (Ph.D. 2020) WISL Award for Communicating Ph.D. Research to the Public for *Development of Electrode Materials for Electrochemical Desalination and Solar Water Splitting*

Lyu, Xiuliang - GSFLC Mentorship Award

Martinez, Jesse (Stahl) - Pei Wang Fellowship

McDonald, Allwin (Buller, Shakhashiri) - Hartl Research Award – ChemBio and GSFLC Mentorship Award

McKetney, Justin (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Advancing Mass Spectrometry-based Proteomic Analysis Strategies for the Investigation of Human Health and Disease*

Mill, Jericha (Li) - Kellogg TA Award

Miller, Rachel (Smith) - Parr Memorial Award

Millikin, Rob (Smith) - Hirschmann-Rich Fellowship in Bio-Organic

Morrow, Christopher S. (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Finding the bottleneck in brain rejuvenation: mechanisms underlying neural stem cell quiescence exit*

Muley, Sachin (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Structure-property correlations in metallic glass and amorphous carbon films*

Mustafi, Mainak (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Dynamics of EF-Tu/ternary complex in live E. coli using superresolution imaging*

Nicastri, Kate (Schomaker) - Morton Research Award, Mentee: Jared Pratt

Niu, Jiani (Gellman) - PPG Mentoring Award

Niu, Mengyao (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Whisper with Lipids: Fungal Oxylipins in Development and Host Interactions in Aspergillus fumigatus*

Opotowsky, Arrielle C. (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Spent Nuclear Fuel Attribution using Statistical Methods: Impacts of Information Reduction on Prediction Performance"*

Ortiz Ledón, Cesar Alfonso (Hamers) - GSFLC Mentorship Award

Pan, Feng (Goldsmith) - Reddy Award in P-Chem

Pattabiraman, Dinesh (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Impact of Inverter Control on the Dynamic Performance of Power Systems with High Penetration of Inverter-based Resources*

Peters-Clarke, Trenton (Coon) - Morton Research Award, Mentee: Qiuwen Quan

Petti, Megan (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Development of Novel Surface Sensitive and Surface Specific Two-Dimensional Spectroscopies*

Pike, Kyndal (Smith) - Pei Wang Fellowship

Plachinski, Elyse (Yoon) - Pei Wang Fellowship

Polaske, Tom (Blackwell) - PPG Summer Fellowship

Quinn, La'Darious (Lynn) - Pei Wang Fellowship

Roberts, David (Jin) - Parr Memorial Award

Rolfs, Zach (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Novel Strategies for Identifying Endogenous Peptides and Determining Protein Turnover Rates*

Ryan, Matthew (Zanni) - Pei Wang Fellowship

Sagan, Cole (Garand) - GSFLC Mentorship Award

Salazar, Chase (Stahl) - Casey Research Award – Inorganic

SantaLucia, Daniel (Berry) - Bender Memorial Award

Schaffer, Leah (Ph.D. 2020) WISL Award for Communicating Ph.D. Research to the Public for *Integrated Proteomic Strategies for Proteoform Discovery*

Schilling, Cody (Boydston) - PPG Summer Fellowship

Schlais, David (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Modeling and Designing Secure Tightly-Coupled Accelerators in CPUs*

Sdao, Sophia (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Cyclin-dependent kinases 1 and 2 control-cell metabolism and insulin secretion*

Serrano, Lia (Coon) - Pei Wang Fellowship

Sherman, Summer (Garand) - Daniels Ethical Leadership Award

Smith, Houston (McMahon) - Kellogg TA Award

Spitha, Natalia (Wright) - Kellogg TA Award

Steffel, Catherine N. (Ph.D. 2021) - WISL Award for Communicating Ph.D. Research to the Public for *Quantitative Ultrasound Imaging Parameters for Evaluation of Carotid Atherosclerotic Plaque*

Styles, Matt (Blackwell) - Harold Hay Fellowship

Sullivan, Patrick (Feng) - PPG Summer Fellowship

Tritt, Rachel (Boydston) - Goering Organic Fellowship

Tucholski, Trisha (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Defining the Human Heart Proteoform Landscape with Top-down Proteomics*

Vasilopoulos, Aristidis (Stahl) - Bender Memorial Award

Villalona, Jairo (Buller) - IGEN poster competition, first place

Walsh, Shannon (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Effects of age and mechanical loading on articular cartilage metabolism and corresponding consequences for tissue health*

Wegner, Kyle (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *A Glitch in the Matrix: Exploring the Role of Prostatic Collagen in Lower Urinary Tract Dysfunction*

West, Korbin (Blackwell) - Harold Hay Fellowship

Yang, Hanming (Cavagnero) - Reddy Award in P-Chem

Yang, Maixee (Li) - Pei Wang Fellowship

York, Jordan (Blackwell) - Pei Wang Fellowship

Zdanovskaia, Maria (McMahon) - Berk Research Award

Zhao, Xianyuan (Nathanson) - Hartl Research Award – Physical

Zhao, Yuzhou (Jin) - Hartl Research Award – Materials

Zhu, Yanyu (Ph.D. 2020) - WISL Award for Communicating Ph.D. Research to the Public for *Single-Cell Detection of Antimicrobial Peptide's Attack on Live E. coli by Super-Resolution Fluorescence Microscopy*

UNDERGRADUATE STUDENTS

Adkins, Taylor (Esselman) - 2021 Hilldale Fellow, Week Scholarship, Firminhac Scholarship and Paulick Scholarship

Alkhunaizi, Hassan (Martell) - 2021 Hilldale Fellow

Allen, Anna (Guzman-Luna, Fuchs, Cavagnero) - Chem Undergrad Research Symposium Award

Argall, Tristan (Hoskins) - 2021 Hilldale Fellow

Aschenbrener, Cole (Brunold) - 2021 Hilldale Fellow

Boeckenstedt, Bella - Krauskopf Memorial Award

Chavarria, Iris - Ackerman East High Scholarship

Chen, Xi (Hutchinson, Zhou, Cavagnero) - Chem Undergrad Research Symposium Award

Coil-Ott, Raven - Student Support in Chemistry

Coulthurst, Josette - Bender Scholarship

Darien, Jacob - Student Support in Chemistry

Davis, Kurt - ACS-Hach Land Grant Scholarship

Dobson, Olivia - Moore Award for Excellence – 109

Dufek, Deseree (Kleman, Gellman) - Chem Undergrad Research Symposium Award

England, Kevin (Dang, Li, Guzman-Luna, Cavagnero) - Chem Undergrad Research Symposium Honorable Mention

Geng, Han - ACS Inorganic division undergrad award for graduating senior

Guadarrama, Arturo - Ackerman East High Scholarship

Gugger, Morgan - WI ACS Local Section Undergraduate Award for Excellence - Analytical/Materials

Harkner, Cade - Student Support in Chemistry

Henry, Jacob - Panek Scholarship and Ackerman Scholarship

Ibrahim, Nora - Krauskopf Award

Ishikuri, Takahiro - WI ACS Local Section Undergraduate Award for Excellence - at Large

Jansson, Anna - Reiner Scholarship and Tong Scholarship

Jensen, Evan - Dempsky Scholarship

Juntunen, Nicholas (Brunold) - 2021 Hilldale Fellow and WI ACS Local Section Undergraduate Award for Excellence - Inorganic

Kasat, Aadhishre (Buller) - 2021 Hilldale Fellow, Brouse Scholarship and Firminhac Scholarship

Langholz, William (Record) - 2021 Hilldale Fellow

Lehman, Riley - Dempsky Scholarship

Li, Renxi (Gallagher) - Taylor Scholarship and 2021 Hilldale Fellow

Li, Ruojia - Dempsky Scholarship

Luo, Lora - Herscher Scholarship and Firminhac Scholarship

Luo, Zaneta - Krauskopf Award

Machhi, Jasmine (Mecha, Cavagnero) - 2021 Sophomore Research Fellowship, Herscher Scholarship and Chem Undergrad Research Symposium Award

Maheshwari, Sneha - Krauskopf Award

Mau, Jacob - Alpha Chi Sigma Scholarship

McCann, Erin (Yao, Gui, Yu) - Chem Undergrad Research Symposium Honorable Mention

McInerney, Scott - Noland Research Fellowship, Taylor Scholarship and Ackerman Scholarship

Miller, Keegan - Larsen Scholarship, Chemistry Department Scholarship and Dempsky Scholarship

Ni, Chi-Min (Nathanson) - WI ACS Local Section Undergraduate Award for Excellence - Physical

Onnuch, Paul (Weix) - 2021 Hilldale Fellow, Toy Scholarship, Ackerman Scholarship and Boomer Award

Pavelic, Alex - Student Support in Chemistry

Pratt, Jared - Ziarnik Scholarship and Student Support in Chemistry

Prazak, Easton - Krauskopf Award

Quan, Qiuwen (Coon) - Firminhac Scholarship, 2021 Hilldale Fellow

Rupanya, Anuchit "Armor" - ACS P-Chem division undergrad award for graduating senior

Savage, Lauren - Herscher Scholarship

Schmeiser, Abi - Moore Award for Excellence – 109

Snider, Dylan - WI ACS Local Section Undergraduate Award for Excellence - Organic

Snider, Dylan - Chem Undergrad Research Symposium Award (Zhao, Nathanson)

Soedarsono, Falcon - Ackerman Scholarship

Stern, Laura - Krauskopf Award

Tang, Jiayin - WI ACS Local Section Undergraduate Award for Excellence - ChemBio

Tang, Xindi - Maeck Scholarship and Herscher Scholarship

Tucker, Alayna - Ackerman East High Scholarship

Tulus, Dennis - Paulick Scholarship, Firminhac Scholarship

Unger, Maxwell - ACS-Hach Land Grant Undergrad Scholarship and Student Support in Chemistry

Voigts, Lukas (Hoskins) - 2021 Hilldale Fellow

Wang,Taobo (Schreier) - 2021 Hilldale Fellow

Winkler, Gordon (Cavagnero) - 2021 Sophomore Research Fellowship, Fischer Scholarship, Leddy Scholarship and Chemistry Department Scholarship

Winter, Casey (Wickens) - 2021 Hilldale Fellow, Student Support in Chemistry and Reich Undergraduate Scholarship

Xu, Angie - Dorsey Memorial Scholarship, Tong Scholarship and Ziarnik Scholarship

Zappia, Soren (Schomaker) - ACS O-Chem division undergrad award for graduating senior

Prof. Emeritus Lawrence F. Dahl

Department remembers brilliant researcher and thoughtful advisor

Photo submitted by Ilia Guzei

Prof. Larry Dahl at the Chemistry Symposium Celebrating his 80th birthday.

By Charles Campana
Bruker Senior Applications Scientist,
Former Dahl Group Member

Lawrence F. Dahl, Professor Emeritus of Chemistry at UW–Madison, passed away unexpectedly on March 20, 2021, at the age of 91. He was preceded in death by his son, Chris Dahl and is survived by his wife of 63 years, Prof. Emerita June Lomnes Dahl and two sons, Lawrence Dahl and Eric Dahl, all of Madison, and grandson Lawrence Samuel Hendon-Dahl.

Dahl was born June 2, 1929, in Louisville, Kentucky, and received a B.S. in 1951 from the University of Louisville and a Ph.D. in 1957 from Iowa State University, where his adviser was the late Robert E. Rundle. He began his independent career as an Instructor in the UW–Madison Department of Chemistry in September 1957, and spent 49 years as a faculty member, beginning as an assistant professor in 1959. After promotion to associate professor in 1963 and professor in 1964, he became the R. E. Rundle Professor of Chemistry in 1978 and in 1991 he was named a Hilldale Professor of Chemistry. Dahl's research focused on inorganic chemistry, with an emphasis on the synthesis of well-defined transition-metal cluster compounds, analysis of metal-metal bonded molecules and the application of X-ray crystallography to characterization of these and related compounds.

He mentored more than 95 Ph.D. students during his career, and worked with many postdoctoral associates, M.S. and B.S. students and visiting faculty. His classroom instruction included many years of teaching General Chemistry to freshman undergraduates and a graduate-level Chemical Crystallography course. In connection with his research, he served on the editorial boards of numerous journals in his field, including Chemical Reviews, Journal of Physical Chemistry, Journal of Organometallic Chemistry, Journal of Coordination Chemistry and the Journal of Cluster Science.

Dahl's research had a profound impact on the field of inorganic chemistry, and his contributions have been recognized by extensive awards, most notably his election to the National Academy of Sciences in 1988. Other noteworthy accolades include his election as a fellow of the American Academy of Arts and Sciences (1992) and the New York Academy of Sciences (1975) and his receipt of the American Chemical Society Award in Inorganic Chemistry (1974), the Willard Gibbs Medal (1999), the Pioneer Award of the American Institute of Chemists (2000), and F. Albert Cotton Award in Synthetic Inorganic Chemistry (2010). In 1994, he received the UW Hilldale Award from the Division of Physical Sciences.

Dahl delivered many prominent lectureships, including the Paolo Chini Lectureship endowed by the Italian Society of Chemistry, the J. C. Bailar, Jr. Lectures at the University of Illinois-Urbana Champaign, the Fred Basolo Lectures at Northwestern University, and the Sir Ronald Nyholm Lectureship sponsored by the Royal Society of Chemistry. He was appointed a "Kentucky Colonel" by the governor in 1982. A decade later, he received the first Alumnus Award from the College of Arts and Sciences at the University of Louisville and an Honorary Doctorate Degree from the University of Louisville. In 2015, he was named an American Crystallographic Association fellow.

An archetypal academic scientist, he positively affected lives and influenced careers of an innumerable students and colleagues, offering support and words of encouragement in addition to scientific advice. He was sincerely interested in people and extremely generous with his time. An accomplished writer with a long list of scientific publications, Dahl credited the Goddess Fortuna in one of his papers for good luck in chemical synthesis and crystallization she brought his group over the years. He knew how to enjoy life, had an unfailingly positive attitude, and remained enthusiastic about science to the very end. Dahl was a brilliant researcher, thoughtful adviser, a wonderful colleague, and a dear friend.

In Memoriam

We remember friends, faculty & alumni below.

If a name is missing from the list, please check a previous issue of Badger Chemist Magazine or let us know by email at connect@chem.wisc.edu.

2019

01/30 Higgins, Robert*
02/09 Pantzer, Kathleen*
02/12 Javid, Lida*
02/13 Erney, Frances*
03/01 Doepke, Howard*
03/03 Pearce, Douglas*
03/13 Skrabek, Emanuel*
03/27 Luening, Robert*
04/14 Brand, Nathan*
05/29 Thacher, Sonia*
06/28 Palmer, Carol*
07/14 Stahl, Neal*
09/09 Casada, Edgar*
10/07 Jones, Guilford
Ph.D. 1970 (Zimmerman)
11/03 Weiler, Norma
BS 1996 (Ellis)
12/13 Taylor, Esther*
12/19 Abrahamson, Shirley*
12/20 Graf, Peter*
Ph.D. 1956 (Willard)

2020

01/17 Blohowiak, Alex
BS 1996 (Corn)
01/23 Oehler, Maurice*
MS 1961 (Zimmerman)
02/11 Brenner, Gerald*
Ph.D. 1961 (Van Tamelen)
03/06 Baldwin, Robert*
BA 1950 (Williams)
04/09 Suits, William*
BS 1963 (Melloche)
04/19 Fieder, Donald*
BS 1958
06/10 Ley, Douglas*
06/11 Bates, Robert
Ph.D. 1957 (McElvain)
08/23 Immke, Joshua
Graduate Student
10/02 Luening, Dorothy*
10/13 Frazier, William*
10/19 Underwood, Chester*
BS 1957, M.S. 1962
10/25 Conner, M. Bernice*
11/10 Brockhurst, Barbara
MS 1980 (Taylor)
11/13 Bird, R Bryon
Ph.D. 1950 (Hirschfelder)
11/17 Freemen, Mary Clare*
11/29 Kuczmarski, Thomas*
12/07 Schultz, Harry*
BS 1942, Ph.D. 1946
(Adkins)

2021

01/03 Martin, Ronald
MS 1955, Ph.D. 1957
(Meloche)
01/04 Bower, Carol*
MS 1965 (Whitlock)
01/09 Graczyk, Donald
MS1970, Ph.D. 1975
(Taylor)
01/09 Patton, James
Ph.D. 1961 (Kosower)
01/17 Lindauer, Madonna
BA 1992
01/29 Luebke, Delbert
BS 1950 (Meloche)
02/09 Kouri, Donald*
MS 1962, Ph.D. 1965
(Curtiss)
02/20 Tanner, Martha*
02/21 Wallace, Carol*
Ph.D. 1949 (Willard)
02/28 Foseid, Thomas*
03/13 Davidson, John*
BS 1971 (Vaughan)
03/13 Keifer, William
MS 1966
03/20 Dahl, Lawrence*
Faculty/Staff
04/28 Bergstrom, Clarence
MS 1947 (Harris)
04/28 Kluetz, Michael*
BS 1971 (O'Leary)
04/29 Kowalski, Daniel
Ph.D. 1995 (Nathanson)
05/05 Roach, Braden
BS 1977 (Evans)
05/08 Gialamas, George*
05/09 Hansen, Roger
Ph.D. 1985 (Taylor)
05/20 Weyna, Philip*
Ph.D. 1958 (McElvain)
06/20 Woolsey, Neil
Ph.D. 1962 (Wilds)
07/25 Ciriacks, Kenneth*
07/25 Williams, Elaine*
08/31 Bock, Robert*

*Donor

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