



# Montana State University Chemistry & Biochemistry News

Summer  
2024



## On the cover

*Photo credit: William Robinson.* Hyalite Peak is the focal point of this photograph. The photo was taken at the Hood Creek campground right on the shores of Hyalite Reservoir, which feeds the Bozeman water supply. The reservoir itself is fed by snowmelt from Hyalite Peak and the other surrounding mountains. In the later summer season, Hyalite peak can be a non-technical summit that yields an awesome view of Hyalite Canyon and the Gallatin Mountain range through an intermediate-level trek along Hyalite Creek that takes you from around 6,500 feet up to 10,299 feet. Hiking along the creek also will take you by several beautiful natural waterfalls.

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## Chemistry & Biochemistry Newsletter Team

**Editors:** Sharon Neufeldt  
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## SHARE YOUR NEWS!

What do you want to see in the next issue of the newsletter? What did we miss in this issue? Share your news, somebody else's news, or your ideas with the newsletter team by reaching out to Sharon Neufeldt or Doreen Brown at [MSUChemNews@montana.edu](mailto:MSUChemNews@montana.edu). Thank you!

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## JOIN THE NEWSLETTER TEAM!

Current students, faculty, and staff: if you are interested in supporting the newsletter, we are seeking team members and contributors with relevant skills or interests including the following:

**writing      interviewing      graphic design      photography**

Please contact Prof. Sharon Neufeldt or Dr. Doreen Brown with questions or to express interest.

# Welcome from the Department Head

## Dear MSU Chemistry and Biochemistry Community—

Hello Friends of the Chemistry and Biochemistry Department,

Our last newsletter was in 2016, and much has happened since then! We hope you enjoy browsing our stories and highlights that convey the department's commitment to the land grant mission of Montana State University. Our faculty and staff embraced the challenges of pandemic years and found ways to enhance teaching, research, and scholarly activities for the benefit of our students. Our department adapted, became stronger, and four years since the start of the pandemic, we have some amazing stories to share.

Profs. Valérie Copié and Mary Cloninger were awarded sabbaticals in AY '23-24. Roland Hatzenpichler, Sharon Neufeldt and Nick Stadie received tenure and were promoted to the rank of Associate Professor. We have hired 4 new Assistant Professors since 2020: Martín Mosquera in 2020, Chris Lemon in 2022, and Heather Callaway and David Fialho in 2023. These latter two are featured in the newsletter. Other faculty have been recognized for several international and national awards. We congratulate our friends and colleagues on their retirements: Professor David Singel (28 years), Professor Ed Dratz, (37 years), Director of the WWAMI Program and Associate Professor, Martin Teintze (32 years), and Regents Professor Patrik Callis (55 years).

As next generation scientists, our graduate students are on the forefront of incredible science, and we feature some of their stories in this newsletter. We highlight Sylvia Nupp (Hatzenpichler lab) and her exploration of the deep sea in the human operated submersible, Alvin. Another story reveals how a "dream team" of scientists in Nick Stadie's lab synthesized a new boron-doped graphite for batteries. Will Walls in the Broderick lab designed a mutant enzyme that sheds light on its chemical mechanism, and another story focuses on Sajia Afrin from the Grumstrup lab, who used time resolved laser microscopy to elucidate the properties of metal-organic frameworks.

This past year, we graduated 40 individuals with BS degrees in Chemistry and Biochemistry with options in Professional, Biochemistry, Pre-med, or Teaching. We have over 175 current undergraduate students pursuing degrees in Chemistry or Biochemistry. At the annual spring Undergraduate Celebration, over 40 students in the department were recognized for their academic abilities, research aptitude, and contributions to

the department. We are proud of our students and alumni!

Some of our stories focus on work-life balance and community involvement. We are fortunate to work and study at a dynamic university set within the engaged community of Bozeman in a setting of incredible natural beauty. Our department understands the importance of taking a break from the stressors of academics and research. Read how our graduate students deal with the threat of burn-out by capitalizing on adventures and activities in the Gallatin Valley, and read how the Undergraduate Chemistry Society inspires young kids from the community to love science.

We are grateful for your continued engagement with our department and MSU, and we hope you will stay in touch. If you have any news or information you would like to share, please send us an email at [msuchemnews@montana.edu](mailto:msuchemnews@montana.edu) – we would love to hear from you. If you want to stay connected to us year-round, visit our website at [www.chemistry.montana.edu](http://www.chemistry.montana.edu) for updated events and news throughout the year.

The generosity and financial support of our donors makes an impact on our students and the mission of MSU, allowing us to honor the achievements of our students and to support students in need. If you would like to make a donation, a link is available on our website at [www.chemistry.montana.edu](http://www.chemistry.montana.edu).

Enjoy the newsletter and have a great summer, a new academic year is right around the corner!



A handwritten signature in black ink that reads "Joan B. Broderick".

Joan B. Broderick  
Professor and Head  
Department of Chemistry & Biochemistry

# FACULTY NEWS

Below we introduce two new faculty members, Heather Callaway and David Fialho, who joined the department in the past year. Until they arrived, Assistant Professor **Christopher Lemon** was the most recent hire in our department. Although a profile of Lemon is not featured in this newsletter because his hire occurred prior to the “news” time frame designated for this issue, we encourage visiting his website to learn more about his exciting research program. Lemon earned his PhD at Harvard University, supported by an NSF Graduate Fellowship, working with Prof. Daniel Nocera on projects ranging from *in vivo* optical oxygen sensing to photochemical M—X bond activation. Lemon then completed a postdoc with Professor Michael Marletta at UC Berkeley developing designer proteins that can be utilized for biological sensing and imaging applications. Lemon joined our department in Fall 2022, where he runs a research group comprising graduate and undergraduate students working toward novel fluorescent proteins and alkane oxidation catalysts.



## Faculty New Hire: Heather Callaway

Imagine stepping into the world of Cryo-Electron Microscopy (Cryo-EM), where the tiniest features of life are visualized with remarkable precision, where the unseen is made apparent, and where the puzzles of molecular structures are interpreted with exact detail. Dr. Heather Callaway, a new Assistant Professor at the Department of Chemistry and Biochemistry is here to guide you through this fascinating era of Cryo-EM, to capture snapshots of life at the atomic level.

Callaway brings the Southern charm of Tennessee and academic expertise to our department. With a mind sharpened by the halls of Emory University, where she completed a dual major in Biology and Physics as an undergrad, she pursued her PhD in Virology at Cornell University in Ithaca, New York, followed by a postdoc at La Jolla Institute for Immunology in San Diego, California.

During her postdoctoral journey, Callaway began to delve deep into the study of flash-frozen biological specimens using Cryo-EM, mastering the art of unveiling the secrets held within the microscopic world of viruses. Her research focuses on studying rabies virus glycoprotein to understand its structure, how antibodies bind to it, and how it interacts with receptors to promote infection. The ultimate goal of her work is to develop a better rabies vaccine that elicits long-lasting immunity.

Callaway secured a prestigious F32 training grant (National Research Service Award) for postdoctoral researchers from the National Institute of Health (NIH). With this grant, she teamed up with the Pasteur Institute and two other research groups in France that are doing research on molecular dynamics of rabies virus glycoprotein. In August 2023, she transitioned her research to Montana State University with a joint tenure-track appointment in C&B and Microbiology.

Callaway developed a passion for teaching as a graduate student when she personally ran a workshop with the “Expanding Your Horizons” program at Cornell University, a one day conference designed to provide hands-on learning experiences for 7th to 9th grade girls. She states that, “I enjoyed how students eyes light up when they learn something new. It was such a nice feeling.” Fuelled by a desire to inspire students, she now steps into the role of principal investigator, hoping to help students under her wing grow as scientists.

As a mentor to students interested in her field, Callaway advised, “Try working in a laboratory and find out if you enjoy research. It doesn't have to be a perfect fit. As an undergraduate, I was doing behavioral research with rats, working with fruit flies, and cloning rhodopsin proteins from fish, but I built my career in virology. If you find working in a lab exciting, think about going to graduate school and specializing in what you find most fascinating. You also have more flexibility after finishing a PhD than you think. Not every PhD spends the rest of their life working in a laboratory - there are all kinds of positions in government, industry, non-profits, administration/policy, and entrepreneurship. You can also work as a postdoctoral researcher after you graduate and branch out, learning new techniques to apply to your area of interest or expanding your research expertise to a new area.”



## Faculty New Hire: David Fialho

Step into the fascinating worlds of photochemistry and the origins of life with new Assistant Professor David Fialho. With a desire to develop innovative photochemical transformations of organic molecules and a curiosity about the earliest ancestors of life, Fialho brings a fresh perspective and enthusiasm to step outside prevailing paradigms in organic chemistry. Through photocatalysis, Fialho hopes to develop new methods to build complex molecules by joining together radical fragments of arbitrary structure. Fialho also takes an iconoclastic approach to understanding the origin of life by setting his sights on proto-nucleic acids rather than RNA.

Although Fialho now practices synthetic organic chemistry, he started his academic journey majoring in biochemistry and molecular biology at Penn State University. It was here that he developed an interest in the origin of life, a topic about which very little is known. After graduating from Penn State, Fialho began his graduate studies in prebiotic chemistry under the mentorship of Nicholas Hud at the Georgia Institute of Technology. Going against the prevailing view that RNA was the earliest biological entity to arise on the early Earth, Fialho's PhD research focused on proto-nucleic acids, especially depsipeptide nucleic acids. These structures are hypothesized to have formed self-replicating polymers that eventually evolved into RNA and DNA. Because

his research required the synthesis of proto-nucleic acid candidates, Fialho's academic expertise slowly shifted away from biochemistry to organic chemistry. He then conducted postdoctoral research in the field of green chemistry with Bruce Lipshutz at the University of California, Santa Barbara. At UCSB, Fialho drew inspiration from his PhD work and focused on the activation and derivitization of carboxylic acids in water through the use of surfactants. He also contributed to the development of "Savie", a totally biodegradable surfactant for organic synthesis in water derived from vitamin E and polysarcosine.

Honing his skills in organic synthesis even further, Fialho then continued postdoctoral research in the lab of Gary Molander at the University of Pennsylvania where he studied photoredox catalysis, using light to promote chemical transformations by catalyzing single-electron transfer between molecules. He primarily focused on the generation and utilization of organic radicals by deoxygenation of alcohols. During his time at Penn, Fialho was also mentored by Dirk Trauner, a world leader in total synthesis and photopharmacology.

Dr. Fialho began his independent career at MSU in the fall of 2023. He aims to develop novel photochemical transformations that can accomplish certain types of carbon-carbon bond formation that are traditionally very difficult. Through a deoxygenative approach that he began developing as a postdoc, he hopes to achieve photochemical cross-coupling of two  $sp^3$ -hybridized carbon-centered radicals in a metal-free manner, diverging from traditional cross-coupling reactions like the Suzuki reaction, which uses the precious metal palladium to couple two  $sp^2$ -hybridized carbon atoms.

In addition to research, Fialho values engagement with the scientific and broader community. In graduate school, he created scientific demonstrations and illustrations for the public as a member of the NASA/NSF-funded Center for Chemical Evolution, a research consortium devoted to understanding the origin of life on Earth. With his hidden artistic talent, he performed outreach activities such as sketching caricatures of children as scientists at the Atlanta Science Festival. Fialho is currently one of the organizers behind the Prebiotic Chemistry and Early Earth Environments (PCE3) seminar series, a collaborative platform uniting researchers funded by NASA. This initiative brings together young, innovative thinkers to work towards the shared goal of unraveling the mystery of life's origin.

Outside of the lab, Dr. Fialho is a passionate music lover. He enjoys music theory, recognizing the striking similarities it shares with quantum mechanics. Just as a guitar string vibrates only in certain harmonics restricted by its length and tension, so too does the electron vibrate only in certain orbitals around a nucleus. In these shared vibrations, he revels in the harmonious bond between music and science, where each note resonates with the rhythms of innovation and discovery.

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## PROMOTED TO ASSOCIATE PROFESSOR WITH TENURE

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*In the past year, three faculty members in the Department of Chemistry and Biochemistry were promoted to Associate Professor with tenure. The descriptions below are adapted from the C&B Retention, Tenure, and Promotion Committee Materials.*



### **Roland Hatzenpichler**

Assoc. Prof. Roland Hatzenpichler is an environmental microbiologist interested in the physiology of microorganisms in their native habitats. Using multidisciplinary approaches to address questions from the cellular to the ecosystem scale, Hatzenpichler is interested in how these microorganisms impact humans and the environment. In the classroom, Hatzenpichler challenges students to think outside of the box. He teaches the undergraduate courses Biochemistry and Metabolic Regulation and graduate level Molecular Biology. Hatzenpichler has faculty affiliations with several different departments on campus, serves on many department and university committees and advises and mentors a large research group composed of post docs, graduate students, and undergraduates.



### **Sharon Neufeldt**

Assoc. Prof. Sharon Neufeldt is an organic chemist whose research focuses on transition metal catalyzed reactions. Using both experimental and computational approaches, some of her main research goals are to develop new strategies for controlling selectivity in catalytic cross-coupling reactions. Neufeldt's enthusiasm for research carries over in the classroom where she focuses on empowering students to learn challenging concepts. She teaches undergraduate courses including Organic Chemistry 1 and 2 (General and Honors), graduate courses in Physical Organic Chemistry and in Organometallic Chemistry, and a course-based research experience in computational chemistry. She advises a large group of PhD students and undergraduates in research and has mentored interested visitors and high school students from the community. Neufeldt serves as the chair of the department's graduate recruiting committee, as a member on the graduate program committee, and as a faculty senate representative.



### **Nicholas Stadie**

Assoc. Prof. Nicholas Stadie is a physical chemist who explores the synthesis of carbon-based materials. His research aims to discover new technologies for sustainable energy storage and its applications. Stadie's passion for undergraduate-level teaching stems from a desire to engage with students of all backgrounds. Stadie teaches several large undergraduate courses including General College Chemistry 1, Honors College Chemistry 1, Physical Chemistry 2, and a university studies course in learning strategies. He also teaches a Classical and Statistical Thermodynamics course to graduate students. Stadie is co-director of our department's NSF REU program, an affiliate faculty with the Hilleman's Scholar's Program, and is the faculty advisor for MSU's American Indian Science and Engineering Society (AISES). Stadie has mentored more than 30 undergraduates since arriving to MSU in 2017 and advises several PhD and MS students in chemistry and materials science.

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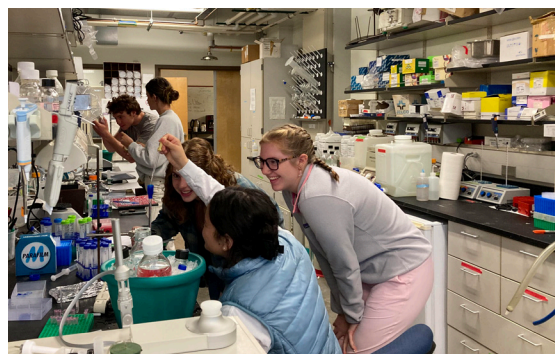
## SABBATICAL ACTIVITIES

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*In the past year, two faculty members in the Department of Chemistry and Biochemistry completed sabbatical activities designed to expand their research program capabilities. Their sabbaticals were awarded based on written proposals that were evaluated by the MSU Faculty Affairs committee.*



Professor **Mary Cloninger** spent most of her two-semester sabbatical right here at MSU in the lab of our colleague, Professor Martin Lawrence. Cloninger's research program involves the synthesis of multivalent frameworks, such as functionalized dendrimers, that allow her to study intercellular interactions related to processes such as tumor formation. Although Cloninger's background is primarily in organic synthesis, she used her sabbatical to learn protein expression techniques in Lawrence's lab. Cloninger's goal was to "trick" *E. coli* into expressing proteins that will help her better understand ovarian cancer cells. Cloninger perturbed the natural machinery of *E. coli* cells by giving them a plasmid containing the genetic code for her proteins of interest, enabling the *E. coli* to express her target proteins, which she then purified and characterized successfully. Cloninger's primary protein targets were galectins-3,-7, and -9 due to their high concentrations in ovarian cancer cells. Galectins are challenging to synthesize, they are expensive to purchase commercially, and they are structurally unstable during transport, so it was important for Cloninger to learn to make them in-house. Cloninger completed this second portion of her sabbatical in Seattle, WA working with Prof. Christopher Kemp at the Fred Hutchinson Cancer Center performing ovarian cancer cell-based assays using her lab's carbohydrate-functionalized dendrimers. In addition to advancing Cloninger's novel ovarian cancer research program, her sabbatical activities also impacted twelve undergraduates and two local high school students by allowing them to learn protein expression techniques in Lawrence's world-class laboratory alongside Cloninger.



During her sabbatical in the Spring 2023 semester, Professor **Valérie Copié** traveled to the Complex Carbohydrate Research Center (CCRC) at the University of Georgia. There, she worked with UGA Professor Arthur Edison who is developing methods for identifying and quantifying metabolites by nuclear magnetic resonance (NMR) spectroscopy at ultrahigh magnetic field strength (1.1 GHz, 1H Larmor frequency). Most commonly used NMR spectrometers are of lower magnetic field strengths (300 to 600 MHz) and are less sensitive than ultra-high field instruments, which can limit the structural characterization of complex proteins and metabolite mixtures. Both ultrahigh and standard field strength NMR spectrometers monitor nuclear spin interactions for nuclei that usual have a spin quantum number  $I$  of  $\frac{1}{2}$ . Other non-zero spin nuclei can also be studied but may require specific hardware and pulse sequences, and resulting NMR spectra can be quite challenging to analyze. Copié's sabbatical provided her with an opportunity to collaborate with other world-renowned experts in NMR and metabolomics, interact with UGA students, and witness opportunities and challenges presented by ultra-high field NMR research applications. She also learned how to use and brought back bioinformatics tools from Edison's group that will enhance her group's toolbox to analyze complex metabolomics data.

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## AWARDS

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**Brian Bothner** and a collaborative team of scientists, including CBB trainees and scientists Luke Berry, Monika Tokmina-Lukaszewska, and Oleg Zadvornyy, received the 2023 Faraday Horizon Prize from the Royal Society of Chemistry for their work on electron bifurcation, a biochemical process which cells conserve energy. Bothner was also awarded a 2024 College of Letters and Science (CLS) Excellence in Integration Award which recognizes faculty who integrate their teaching and research experiences into novel learning experiences for students. He has been a member of the department since 2004.

**Joan Broderick** received the 2023 A.I. Scott Medal for Excellence in Biological Chemistry Research from the Dept. of Chemistry at Texas A&M and the Texas A&M section of the American Chemistry Society. Broderick received this honor for her pioneering research on biochemical reactions involving S-adenosyl-L-methionine. Broderick has been a member of the department since 2005.

**Mary Cloninger** received the 2024 Women in Science Distinguished Professor Award. This award recognizes women faculty at MSU who have made significant contributions in research, teaching and mentorship. Cloninger has been a faculty member in the department since 1999.

**Rob Walker** has been appointed the 2024 CLS Distinguished Professor. The highest honor a faculty member can receive from the College, Walker has been recognized for his scientific achievements and significant contributions to MSU and the state of Montana. He has been a member of the department since 2009.

# RESEARCH NEWS

## Department Statistics at a Glance

numbers represent the time frame of June 2023 – May 2024



**70**

**Publications**  
authored by  
members of the  
department



**~70+**

**Student Coauthors**  
from our department,  
including post-  
doctoral scholars



**15**

**New Grants**  
awarded to faculty  
members in the  
department



**68**

**Active Grants**  
with departmental  
faculty as PI or Co-PI



**\$37.6M**

**Current Funding**  
research dollars  
associated with active  
grants

## RECENT PUBLICATIONS

The department continues its tradition of excellence in scientific publication, with 70 peer-reviewed manuscripts published since June 2023 in scientific journals. Here, we highlight three of these recent publications.

### New Synthesis of Boron-Doped Graphite

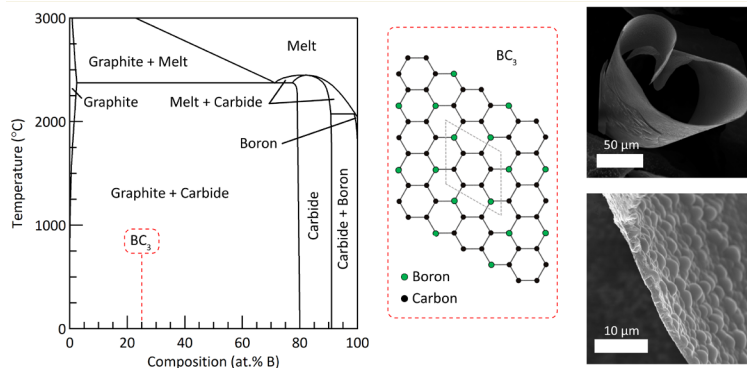
When he was still a graduate student, now Associate Professor Nick Stadie had a hypothesis about a way to make  $BC_3$ , a graphite-like material that was largely hypothetical at the time. Graphite is made purely of carbon atoms, but  $BC_3$  requires that every 4<sup>th</sup> carbon is replaced with boron. Because of this atom swap,  $BC_3$  is likely to behave differently from graphite in some intriguing ways. For example, two-dimensional sheets of  $BC_3$  may be able to sandwich sodium cations to create an anode material for batteries that could be better than the current state-of-the-art material that layers lithium ions between graphite sheets.

Stadie didn't get the chance to test his ideas about  $BC_3$  until he began his independent career at MSU in 2017. He first developed and published a route to  $BC_3$  using  $BBr_3$  as a boron source – a commercially available liquid. However, this route generates  $HBr$  as a corrosive byproduct at high temperatures, making it unrealistic for industrial applications. The obvious next step was to use a bromine-free boron source. Stadie's original idea from his graduate school days was to use halide-free diborane ( $B_2H_6$ ). And so, in 2017, he enlisted PhD student Devin McGlamery to begin testing this idea. Devin dutifully constructed a custom apparatus to handle unstable, pyrophoric diborane gas.

The key challenge in replacing  $BBr_3$  with a different boron compound—as McGlamery eventually discovered—is that the boron source and the carbon source need to “crack” (or decompose) at the same temperature. If they don't, boron and carbon tend to segregate instead of making  $BC_3$ . After multiple years of effort, McGlamery and Stadie reluctantly concluded that diborane decomposes too quickly to be a viable boron source. Numerous alternatives also did not work. As a last resort, they began testing a borohydride salt as the boron source:  $NaBH_4$ . Like Stadie's original idea of diborane, this compound is halide free. Unlike diborane, a decomposition profile of  $NaBH_4$  revealed that it might be

compatible with their preferred carbon source, benzene.

The idea worked, and McGlamery was able to demonstrate the first halide-free synthesis of  $BC_3$ . Stadie recruited several other team members to bring the work to completion, including C&B faculty members Mike Mock (synthetic expertise) and Martin Mosquera (computational expertise), as well as graduate student Charles McDaniel, undergraduate Dylan Ladd, and a collaborator at Lawrence Berkeley National Lab, Yang Ha (X-ray spectroscopy experiments). Stadie calls his group of coauthors a dream team: “Mike and Martin are not just colleagues and friends, but also amazing scientists. The opportunity to work together intellectually was exciting.” The work was [published in \*Chemical Science\*](#) in February, 2024, and was primarily funded by a grant to Stadie from the DOE Office of Energy Efficiency and Renewable Energy. McGlamery recently graduated with his PhD and is a postdoc at Oregon State University, McDaniel is continuing related work in the Stadie lab (the group is exploring the use of  $BC_3$  for  $H_2$  and  $Na^+$  storage), and former undergraduate Ladd is pursuing a PhD at CU Boulder as a recipient of an NSF Graduate Research Fellowship.



## Role of Structural Defects on Exciton Transport in Metal-Organic Frameworks

Associate Professor Erik Grumstrup is known for developing techniques to interrogate phenomena that take place on extremely short timescales. Because of this expertise, Amanda Morris, a researcher at Virginia Tech, proposed a collaboration with Grumstrup after seeing his work presented at a conference. Morris' lab had single crystals of "PCN-222", a porous material comprising zirconium oxide centers linked by organic porphyrin molecules. Metal organic frameworks (MOFs) such as PCN-222 show promise for mediating photochemical transformations of small molecules, such as CO<sub>2</sub>, that can be captured within their pores. The porphyrin linkers can absorb energy from visible light, but at the time that Morris and Grumstrup began collaborating, details of how that absorbed energy migrates through a MOF crystal were murky.

With support from the NSF, Grumstrup and MSU materials science PhD student Sajia Afrin undertook experiments using time-resolved laser microscopy to elucidate the photophysical properties of PCN-222. Afrin pulsed a PCN-222 microcrystal with a femtosecond-scale laser to generate an excited state (exciton). She then watched as the exciton moved through the crystal. Her results demonstrated that the por-

phyrin molecules are strongly coupled together in a quantum sense. As a result, exciton transport is extremely rapid. This rapid exciton transport means that rare defects in the crystal lattice—missing porphyrin linkers—have an outsized effect on quenching the excited state. Because the exciton moves around so easily, there is a high probability that it will encounter a structural defect, even if those defects are rare. Afrin and Grumstrup's work helped to elucidate challenges facing the application of MOFs for light-harvesting. At the same time, their results highlight MOFs' behavior as true materials, rather than just a structured collection of molecules.

Afrin and Grumstrup, together with Morris and coauthor Xiaozhou Yang from Virginia Tech, [published their studies in the \*Journal of the American Chemical Society\*](#) in February 2024. Grumstrup describes first author Afrin to be exceptionally competent, careful, and hardworking. For these reasons, Grumstrup considered Afrin's successful PhD defense in April 2024 to be "bittersweet". Nevertheless, the Grumstrup lab is excited to build on Afrin's studies by studying how structural defects influence the catalytic activity of MOFs toward applications like CO<sub>2</sub> reduction.

## Direct Detection of a Carbon Radical Relevant to Radical SAM Enzyme Activity

Professor and Department Head Joan Broderick is a leading expert in radical SAM enzymes. The radical SAM superfamily of enzymes serve as biological catalysts for a diverse set of reactions involving single-electron transfer. One of these reactions is peptide epimerization: radical SAM effects stereochemical inversion of the chiral carbon of an *L*-amino acid subunit within the peptide, flipping it to the *D*-configuration. In Nature, this process is relevant to the biosynthesis of certain classes of natural products that have attracted interest as possible antibiotics or antivirals. Understanding the details of how SAM brings about this epimerization could help chemists leverage these enzymes—or modified versions of the enzymes—for biocatalytic synthesis of new peptide-based pharmaceutical compounds.

Broderick and her team envisioned an experiment that would allow them to investigate radical SAM's mechanism for peptide epimerization on a molecular level. They wanted to test the hypothesis that SAM abstracts a hydrogen atom from a chiral carbon (C-alpha) within the peptide, resulting in a carbon radical intermediate. The intermediate would then be quenched by accepting a hydrogen atom from SAM, but on the opposite face, leading to inversion of that stereocenter. To test this hypothesis, Broderick's team needed a way to detect the carbon radical, if it exists. However, such a carbon radical would be very unstable, and its lifetime could be too short to detect.

Broderick's solution was to mutate a radical SAM enzyme in way that would make it harder for it to quench a carbon radical intermediate. By doing so, it might be possible to extend the lifetime of the C-alpha radical long enough to be able to characterize it. Will Walls, a 4<sup>th</sup> year PhD student in the Broderick lab, took on this challenge. He was able to introduce a mutation into the enzyme that completely removed an -SH group

that was suspected of providing the hydrogen atom to quench the carbon radical. Unfortunately, the resulting mutant enzyme was frustratingly insoluble and Walls was unable to study it further. Research and Teaching Professor Will Broderick, another member of the team, suggested a more conservative mutation that would convert the -SH group into an alcohol (-OH) group. The mutation would mean that a hydrogen atom would still be available to quench the radical, but O-H bonds are stronger than S-H bonds, so the quenching should be slower. Importantly, the -OH group would improve the solubility of the enzyme.

The redesigned mutant worked exactly as hoped. Walls created the SAM mutant with the more conservative mutation and then used electron paramagnetic resonance (EPR) to watch it in action as it catalyzed peptide epimerization. The EPR spectrum was crystal clear: the C-alpha radical was indisputably present. Remarkably, once Walls knew what signal to look for in the EPR spectrum, he was even able to detect the C-alpha radical using the wildtype enzyme.

The team [published this study in the \*Journal of the American Chemical Society\*](#) in February 2024. Broderick gives credit to her team of coauthors, describing first-author Walls as an incredibly talented and motivated graduate student with high standards for his work. The team also included Tyler Delridge, a highly productive undergraduate who has recently taken the lead on his own related project, and Anna Vagstad and Jörn Piel, collaborators at ETH in Zurich. Based on the success of this study, Broderick next has her sights set on elucidating the mechanistic details of more complex reactions catalyzed by this family of enzymes.



## NEW INSTRUMENTATION

### New Inert-Atmosphere Glovebox Brings Flow Capabilities to 400 MHz NMR Spectrometer



The department is in the process of setting up a new inert-atmosphere glovebox in the nuclear magnetic resonance (NMR) facility. The glovebox, in conjunction with the department's recently acquired 400 MHz NMR spectrometer, will allow researchers to monitor air- and moisture-sensitive reactions in real time to identify short lived intermediates. Reactions can be set up in the glovebox to run in flow through the spectrometer, which can be set to scan for almost any NMR-active nuclei desired. At the time of this article, the new module can be seen being assembled in room 14 of CBB. Funding for the glovebox came from an internal award of IDC funds to enhance and support strategic investments in research to Assistant Professor Michael Mock who is also the Principal Investigator along with co-PI Professor Valérie Copié in the recently funded Major Research Instrumentation (MRI) proposal from the National Science Foundation (NSF) grant awarded in 2020 that funded the new 400 MHz NMR spectrometer. The addition of flow chemistry capabilities to our department's NMR characterization toolbox represents a practical modernization effort that will offer our synthetic chemists cutting-edge tools to advance their research goals.

## CONFERENCES HOSTED BY MSU

Over the last year, thousands of scientists traveled to Bozeman to participate in conferences hosted in part by C&B faculty here at MSU. As one example, due to a proposal written by Associate Professors Erik Grumstrup and Nick Stadie, MSU was chosen to host the Northwest Regional Meeting (NORM) of the American Chemical Society (ACS) in June 2023. The conference attracted over 460 scientists from an array of disciplines. Scientists from all academic stages as well as from industry came together to share 185 talks and 95 posters. The conference started with a keynote talk by Dr. Joan Broderick, a National Academy of Science member, and ended with an epic "food-truck rodeo" on what can only be described as the perfect summer evening. Many people helped make NORM an incredible success, notably Grumstrup (General Meeting Chair), Stadie (Program Chair), Dr. Doreen Brown and Kimberly Hilmer (Event Organizers), Professor Mary Cloninger (Awards Coordinator), Assistant Professor Michael Mock (Undergraduate Coordinator), and Garrett Moraski (Exposition Organizer).

MSU was also selected to host the annual ACS Division of Organic Chemistry (DOC) Graduate Research Symposium in July 2023. This meeting was organized by the ACS

DOC, and Associate Professor Sharon Neufeldt served as the local host. This conference offered fourth-year Ph.D. students in organic chemistry from around the country the opportunity to network with companies and industry experts. Students also gave oral and poster presentations.

The Montana Aqueous Supramolecular Chemistry Workshop (ASCW), hosted by Dr. Mary Cloninger in July of 2023 brought together around two dozen experts to discuss noncovalent interactions in water. This workshop is a biennial meeting that highlights research performed across the world through a myriad of chemical disciplines including synthetic, biochemical, computational, materials, and physical chemistry. The ASCW brings researchers together from many countries including the US, Canada, Czech Republic, Germany, and Israel to focus on better understanding how molecules interact in one of the most important resources we have on planet Earth.

Materials science, chemistry, and engineering students from MSU and Montana Technological University gathered for the 8th annual Montana Collaborative Materials Science Symposium. The annual symposium, hosted most recently at MSU by Dr. Erik Grumstrup, catalyzes stronger teaching relationships, diversifies research collaborations, and gives students the opportunity to present their research through talks and posters.



# TEACHING AND COMMUNITY ENGAGEMENT

## Benchtop NMR Spectrometer Enables Structural Analysis in Instructional Labs

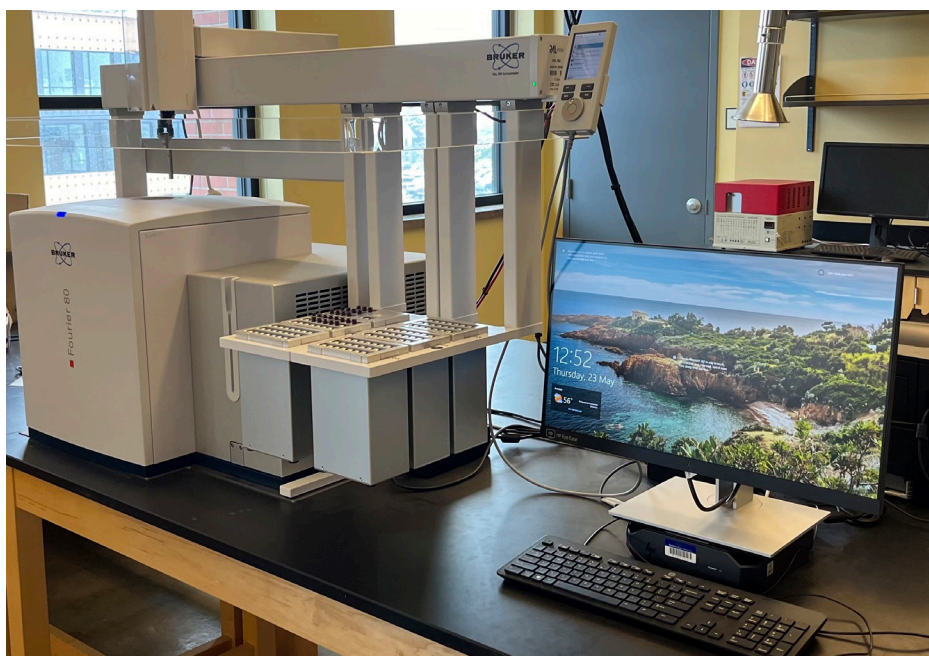
Dr. Steve Holmgren, a teaching professor in the Chemistry and Biochemistry department, applied and was awarded funding through MSU to acquire an 80 MHz benchtop nuclear magnetic resonance (NMR) spectrometer for the teaching labs in Gaines Hall. The new spectrometer is an upgrade from the previous unit which had problems spinning the sample and had become unreliable for a number of years. The new instrument does not require expensive cryo-

genic gases like liquid helium or nitrogen and boasts an autosampler with 132 slots.

The unit allows students to implement the new concepts they learn in their courses to elucidate chemical structures using  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectroscopy including 2D experiments. NMR spectra inform the researcher of bond connectivity by displaying signals characteristic of the behavior of NMR-active nuclei in particular chemical environments. When used in an instructional setting, the ac-

quisition and analysis of NMR spectra in real-time can heighten students' understanding of and confidence in the new concepts learned in their courses.

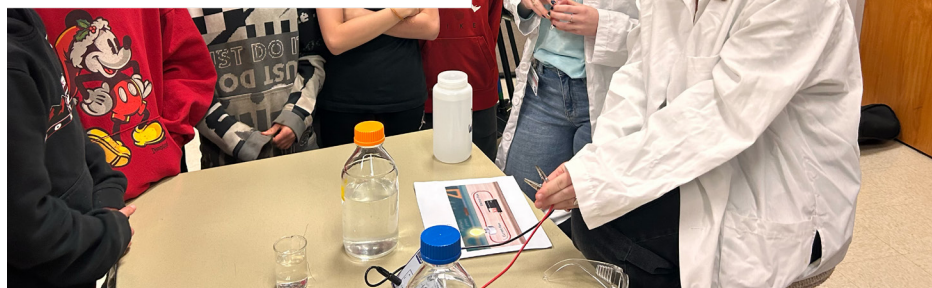
Additionally, the NMR spectrometer enables students to quantify the purity of the samples they prepare during instructional labs. Previously, they could only qualitatively infer the presence of impurities based on observations such as color, consistency, or melting points. In regard to exposure to NMR techniques, Holmgren stated, "The students' ability to routinely run NMR samples is the goal." The NMR spectrometer is being used to elucidate the structures of organic unknowns and for routine use in characterizing compounds synthesized in the lab. Enhancing students' practical knowledge of both infrared and now NMR spectroscopy enables more comprehensive training in structural elucidation. MSU and C&B are committed to providing students with meaningful exposure to industry-standard equipment to set students up for success in future endeavors. Use of the new instrument in instructional labs strengthens students' skillsets needed for undergraduate research within the department and also better prepares them for post-graduate training or industrial jobs.



## Undergraduate Chemistry Society Reaches Out To The Community

Many of us can remember the exact moment we fell in love with science. Maybe it happened when a college professor illustrated the vibrational modes of water molecules through interpretive dance. Maybe it was on a field trip to the local science museum. Whenever it was, it probably happened because someone went out of their way to share their love of science. The Undergraduate Chemistry Society (UCS) is a group of dedicated MSU STEM undergraduates who do just this. They go above and beyond to help students across Montana interact with science in meaningful ways. This last year,

the UCS worked with the Montana Science Center (MSC) and the Museum of the Rockies to plan fun, science-focused events and demos for anyone to enjoy. For example, several groups of homeschooled students learned how to build



*Molly Schmitt and Eleanor Manson giving a demonstration to elementary students.*

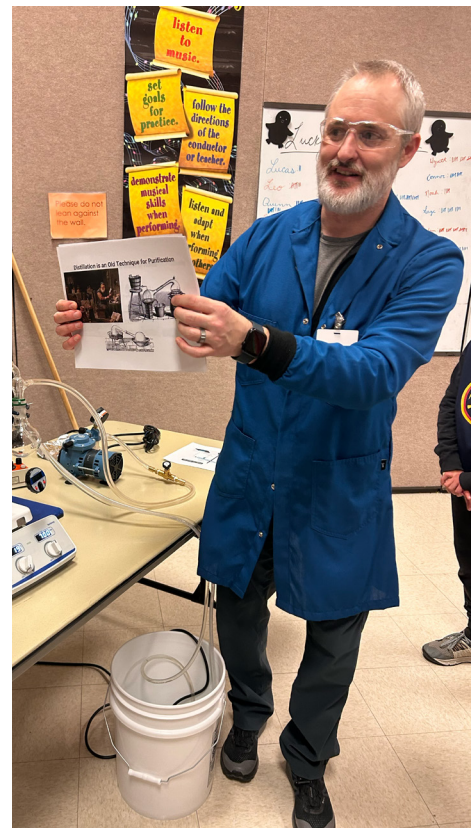


*Dr. Molly O'Hagan speaking at Morning Star Elementary.*

spectroscopes with UCS members at the MSC. In another case, the UCS members conducted a chemistry demonstration for elementary school classes visiting the Brick Breeden Fieldhouse to watch MSU basketball. Though initially attracted by the basketball and stadium food, hundreds of students were mesmerized as UCS members mixed dish soap, hydrogen peroxide, and a catalyst to form a huge elephant toothpaste reaction during

skills, and keep students interested in STEM. The UCS also performs biannual community outreach at the Morning Star Elementary School in Bozeman. These outreach events, spearheaded by Assistant Professor Michael Mock (UCS Faculty Mentor) and Teaching Professor Molly O'Hagan, focus on helping students visualize and understand topics recently covered in their curricula. For example, students watched

halftime. In addition to demos, UCS members help write, proctor, and grade the chemistry portion of the Montana Science Olympiad. During the Science Olympiad, middle and high schoolers from across Montana compete in various STEM-focused challenges. These challenges are designed to build camaraderie, strengthen students' scientific problem-solving



*Assistant Professor Michael Mock explaining a distillation apparatus.*

## New Toolkit Course for First Year Graduate Students

To help build a strong and successful foundation for our first-year graduate students, the Department of Chemistry and Biochemistry recently designed a new "toolkit" course. The course was piloted with the Fall 2023 incoming graduate class. This two-semester course, team-taught by C&B departmental faculty, had three overarching goals: to help first year graduate students acclimate to graduate school, to build a strong first year community, and to communicate academic and professional expectations

of the graduate program. Toolkit sessions met in the early evenings once every other week during the Fall and covered topics including "What does it mean to be a PhD student?", "Professional Etiquette," and "Ethics in Research and Science." Students also learned how to complete literature searches in their disciplines, worked through the steps of designing a scientific experiment and developing hypotheses, and learned about experimental uncertainty and statistics. The department provided pizza and

snacks at the beginning of each session. This brief social time allowed students to meet and catch up with one another and to interact with faculty presenters. Fifteen PhD and MS graduate students participated in the first cohort. Initial qualitative assessment from the participants was extremely positive. The department is refining course content and adding new activities. The updated version of the toolkit course will be offered again to our next incoming cohort this Fall, 2024.

# WORK-LIFE BALANCE

Living in Bozeman offers extraordinary opportunities for activities outside of the lab. In this “Work-Life Balance” series, we will be highlighting extracurriculars of some of our students and faculty. In this issue, we focus on outdoor recreational activities from the perspective of three graduate students in our department.

## Balancing Academics with Adventure in the Gallatin Valley: Insights from Chemistry and Biochemistry Graduate Students

The demands of graduate school can sometimes threaten burnout and a loss of productivity. Fortunately, the graduate students in the Department of Chemistry and Biochemistry at MSU have a unique way to lighten this load through the excitement and fulfillment that can be found in the vast surrounding wilderness. Many Bobcats take full advantage of the proximity to Nature to live a lifestyle balancing academic and career aspirations with personal interests and needs. We sat down with three of our department’s PhD candidates and asked them about their perspectives on balancing what needs to get done with what they want to do outside of the lab.

**Caleb Sindic** (5th year student in the Callis lab) has taken full advantage of being able to integrate academic rigor with outdoor pursuits. Sindic uses computational tools to study the role of solvents in reaction mechanisms, while also seeking adventure in the mountains climbing ice and rock, an activity that calls for a combination of mental and physical endurance.

**Rhys Trousdale** (4th year student in the Walker lab) seamlessly blends laboratory work with outdoor adventures, from running in the mountains to rock hounding. In his time here at MSU, Trousdale has published several manuscripts on spectroscopic methods and attended several conferences all while still

making time for the outdoors.

**Roark O’Neill** (4th-year student in the Mock lab) finds solace in both laboratory work and outdoor pursuits like fishing and hiking. In his four years here, he has familiarized himself with the surrounding geography to a degree that would make other locals blush about their more limited knowledge of the hills. If you’re curious about what a particular mountain is named or how to get to the top of it, he likely knows the answers.

**W.R.:** *Can you describe a typical day or week in your graduate program, including how you balance academic responsibilities with personal or extracurricular activities?*

**C.S.:** I take advantage of the flexibility the grad student schedule offers. I often exercise in the morning when people are not out and about. While I do work very hard, I think I spread it out more than one could do in a traditional job. For instance, last week I climbed most of Wednesday and then worked all of Sunday to compensate for it.

**R.T.:** Mostly, I work a 9 to 5 schedule, but it’s a balance between experi-



Caleb testing out the ice quality in Hyalite Canyon at the Unnamed wall. Photo by William Robinson.

mentation and mentoring my undergraduate as well as younger graduate students. Managing laboratory responsibilities is a huge part of it. As far as balance goes, I take it one week at a time, taking mental refresher days as needed, but when work needs to get done, it gets done.

**R.O.:** I would say as a synthetic chemist a lot of my time is spent preparing, cleaning, organizing, and such for a given work week. So, I work a pretty typical daily schedule and try to use my weekends wisely, prepping and cleaning stuff for the work week. I try to work hard during the semester so that I can use breaks to catch up with family and friends and recreate.

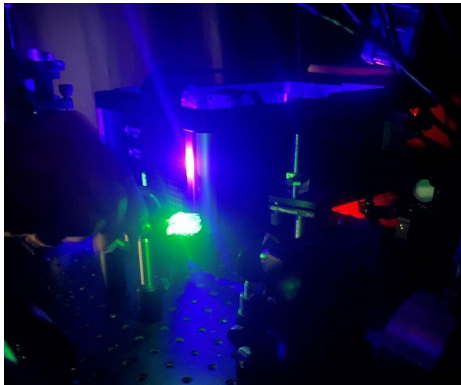
**W.R.:** *What kind of extracurricular activities do you participate in and how does it affect your work life?*



Roark on his trusty gravel bike, 40 miles into a beautiful odyssey from Gallatin Valley into Paradise Valley to the east. The Absaroka Mountains are silhouetted against the Big Sky of Montana. Photo by William Robinson.

**C.S.:** Climbing of course! Very avid rock and ice climber. Occasionally I'll run or mountain bike. I regularly attend the Bozeman Hot Springs and sit in the sauna to clear my mind. There is a fine balance, I need to climb to be sane enough to work, but when I climb, I try to climb the hardest things I possibly can and when I climb that hard, I am exhausted, and when I'm exhausted it's hard to work.

**R.T.:** Oh everything! I love it all, especially hiking, running, snowshoeing, and rock-hounding, I can send you a picture



*A specimen of opal found on Divide Peak in Hyalite Canyon fluorescing under shortwave UV light. Photo by Rhys Trousdale.*

of some hyalite opal I found on Divide Peak, taken under 280nm UV light in the lab. These without a doubt make my work life better, it is always good to spend some time outdoors and get some fresh air, and I usually use this time to think about my research in a stress-free environment where I can refresh my ideas.

**R.O.:** Outdoors! I enjoy hiking, backpacking, peak bagging, fishing, cycling, prospecting, and just general adventuring in the outdoors. Indoors, I can be found playing board games, watching films, listening to music, or playing music.

**W.R.:** *Do you think your access to all these is unique to MSU?*

**R.O.:** Absolutely, the fact that I can do any of these outdoor activities right out my front door or straight from the doors of CBB, so I would say my work-life balance is well attenuated. If I find myself

becoming burnt out at my current research objectives, I can just walk out the door and go straight to the mountains.

**W.R.:** *How do you navigate boundaries between work and personal life, especially considering the blurred lines that can arise in academia?*

**C.S.:** It might be easier for me than others because I am the only graduate student in my group. It can be tempting to try to get one of my office mates to go play pool in the middle of the day, but generally between the two of us there is some modicum of restraint that arises.

**R.T.:** My dog, Pieces, helps with that, giving me a reason to be home at the end of the day, see somebody I love, and take my mind off the work aspects. My dog's needs give me a sort of reminder to step back and evaluate my own needs. Knowing that I have something to take care of



*Rhys' dog, Pieces, wearing his booties to trudge across the snowpack in Bear Canyon. Photo by William Robinson.*

outside of work makes it easy to not get too absorbed by my research.

**R.O.:** My boss has such enthusiasm and presence in my research, and this drives me to come in and make progress towards my degree. Every day I come into the lab I can have access to



*Rhys standing on top of Elephant Peak. Photo by William Robinson.*

him to bounce ideas off of. This constant interaction has led to a positive and inspiring relationship with my PI, and without him I wouldn't want to be here at all.

**W.R.:** *Looking back at your time here at Montana State University, what would you say to prospective students about the work-life balance here?*

**C.S.:** We are afforded a great deal of outdoor activities and a surprising number of indoor activities. Because those can be so abundantly available, it's on you to manage your partaking in them. I think this is very uniquely a Montana State University conundrum. There was a semester where I climbed ice every morning before teaching, and I was super lucky that I never got stuck in the backcountry on my way to teaching a class.

**R.T.:** It's better than most, I think the environment this department establishes is that it's important to get outside, refresh your mind, and take a breather. Bozeman has a lot of opportunities for any sort of outdoorsman or anyone who loves nature; having the quick access to go relax and enjoy your time outside of school is a huge perk.

**R.O.:** I would say that MSU is perhaps one of the best schools in the country for work-life balance simply because of all the things I said above. Speaking of work, I have a reaction to quench, no more questions.

*"If I find myself becoming burnt out ...I can just walk out the door and go straight to the mountains."*

## Semi-Annual 5K Fun Run Inspired by C&B Department Athletic Legends

In 2018, Associate Professor Nick Stadie hosted the first “sort of annual” departmental 5k Fun Run. He drew inspiration from a similar event at the 2017 ACS NORM conference hosted at Oregon State University and by the long tradition of running enthusiasts of the Chemistry and Biochemistry department, including two local legends, Regents Professor Pat Callis and the late Professor Ed Anacker. Anacker created the Bridger Ridge Run and accomplished feats like biking from southern Montana to the Canadian border and back within a day. Callis pioneered ice, rock, and alpine climbing around North America and has held records in the Ridge Run, such as fastest time in the over-60 category. These athletes inspired Stadie to continue the legacy of communal outdoor activities for members of their beloved department. In addition to these

renowned athletes, C&B members—from students to professors—include a variety of other outdoor enthusiasts and current or former collegiate athletes.

The C&B 5k Fun Run event has continued to take place annually and has garnered support from the rest of the depart-

ment. The 2023 event was held on August 3rd at Peets Hill and attracted 45 participants. Prizes for the race winners, Dalton Compton and Maddi Stevens, were handblown quartz sculptures of runners, designed and created by students in the Stadie Lab.



## STUDENT NEWS

### Student Statistics at a Glance

*numbers represent the time frame of June 2023 – May 2024*



**14**

**PhD Degrees**

conferred in Chemistry and Biochemistry



**4**

**MS Degrees**

conferred in Chemistry and Biochemistry



**40**

**BS Degrees**

conferred in Chemistry and Biochemistry



**14**

**New Graduate Students**

joined the department

### PhD Student Receives Award in Venture Competition

Will Christian, a biochemistry Ph.D. student in the Hatzenpichler lab, undertook an entrepreneurial effort called BioCap Solutions, which won fourth place in the 5th annual \$100K Venture Competition. The competition, hosted by the Jake Jabs College of Business and Entrepreneurship and the MSU Blackstone Launchpad, saw competitors present their ideas to a panel of five judges and answer questions for an opportunity

to win a portion of the \$100K. BioCap's placement netted the venture \$10K, and it also received the prestigious People's Choice Award, which came with another \$6K. BioCap's mission is to solve two problems at once: atmospheric carbon and algae blooms. Algae are efficient collectors of CO<sub>2</sub>, and at the same time algae blooms lead to dead zones which pose a threat to marine and freshwater life. Bio-cap seeks to remove these algae blooms,

thereby perma nently capturing the carbon photosynthesized by the algae to prevent that carbon from being released into the atmosphere.



## PhD Student Travels to the Deep Sea for Research

*Sylvia Nupp is a 3<sup>rd</sup> year PhD student in the Hatzenpichler lab. She is the first student from Montana to go to the deep sea on a research cruise. Here, she reports on her recent trip.*

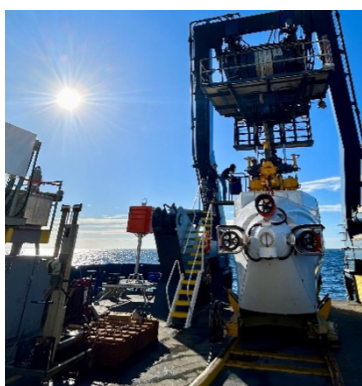


*Sylvia holding a sediment core taken from Guaymas Basin. Samples are all processed in a cold room, at 40 °F.*

I recently traveled to the Gulf of California for field sampling and dove in the submersible Alvin to a depth of 2,014 meters (~6,600 ft).

My research focuses on microorganisms in hydrothermal sediments. Geothermal activity leads to many active hydrothermal vent systems at the bottom of the ocean, including two sites in the Gulf of California, Pescadero Basin, and Guaymas Basin. I was one of 17 scientists from across the United States and Mexico on the

Atlantis, a research vessel based out of Woods Hole Oceanographic Institute (Woods Hole, MA). The goals of the research cruise were to obtain hydrothermal sediment and hydrothermal vent samples to study the microorganisms inhabiting these sites. My focus is on microbes that live in the sediments sur-

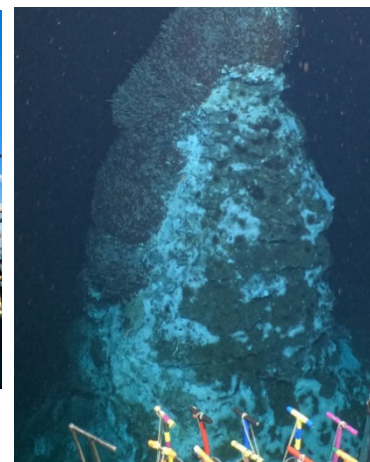


*Alvin being deployed.*

rounding vent sites, particularly those that degrade hydrocarbons and produce methane.

To collect these samples, I had the opportunity to use the human operated submersible Alvin to go down to the seafloor. While underwater, I documented ecological conditions and dictated sampling locations to extract promising deep sea sediment cores for my work.

I am now running experiments on these samples, which will be the third aim of my doctoral thesis.



*A hydrothermal vent mound, named Matterhorn, in Pescadero Basin.*

## PhD GRADUATES (Summer 2023-Spring 2024)

**Afrin, Sajia** (Grumstrup)  
*Elucidating the Impacts of Structural Heterogeneity on Excited State Dynamics in Solution-Processed Materials*

**Beech, Jessica Lusty** (DuBois)  
*Multilevel Approach to the Improvement of Enzymes Involved in the Biodegradation of Poly(Ethylene Terephthalate) Plastic*

**Charbonneau, Alexander** (Lawrence)  
*Structural Characterization of the Csa3/ Ca4 Complex - A Nexus for Class 1 CRISPR-Cas Immune Response Coordination & Establishing a Cure for Highly Efficient Galectin Expression*

**Costello, Stephanann** (Copié)  
*Investigating the Role of the Metabolism in the Gut-Brain Axis of Familial Dysautonomia*

**Frabitore, Christian** (Livinghouse)  
*The Expansion and Optimization of Zn(II)-Mediated Intramolecular Metalloamination and Subsequent Cu(I)-Catalyzed Functionalization for the Construction of Pyrrolidines and Piperidines*

**Gordon, Isabelle** (Stadie)  
*Chemical Modification by Chemical Doping of Graphitic Carbon and Silicon Based Anode Materials*

**Hollinbeck, Skyler** (Grumstrup)  
*Illuminating Dynamic Phenomena Within Organic Microstructures with Time Resolved Broadband Microscopies*

**Koenig, Heidi** (Livinghouse)  
*Synthesis and Biological Evaluation of Novel Antimicrobial Agents for the Control and Eradication of Pathogenic Bacterial Biofilms*

**Larson, James** (Bothner)  
*Investigating the Metalloproteome of Bacteria and Archaea*

**Lynes, Mackenzie** (Hatzenpichler)  
*Distribution, Diversity, and Physiology of Uncultured Mcr-encoding Microbial Populations in Yellowstone Hot Springs*

**Mattice, Jenna** (Bothner)  
*Changing Shape: An Investigation into Allostery and Protein Conformational Ensembles*

**McGlamery, Devin** (Stadie)  
*Synthesis and Characterization of Boron-Doped Graphitic Carbon for Energy Storage Applications*

**Norman, Jacob** (Neufeldt)  
*Synthetic and Mechanistic Strategies to Achieve Unconventional Site-Selectivity in Cross-Couplings of Dihalo-Heteroarenes*

**Schaible, George** (Hatzenpichler)  
*Investigating Organized Complexity in Multicellular Magnetotactic Bacteria Using Culture Independent Techniques*

**Welhaven, Hope** (Bothner, June)  
*Characterization of Osteoarthritis Metabolism: A Mass Spectrometry-Based Approach*

**Yiyen, Galip** (Walker)  
*Nonlinear Optical Studies of Gypsum Dissolution Mechanisms, Surfactant Adsorption on Gypsum Surface and Analysis of Environmentally Related Ions*

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## MS GRADUATES (Summer 2023-Spring 2024)

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Crawford, Alexandra	Frometa, Magalee (Cloninger) <i>The Synthesis and Characterization of Fluorescently Labeled, Lactose-Functionalized Poly(amidoamine) (PAMAM) Dendrimers</i>	Pollock, Charlie (Mosquera) <i>Computational Study of a High-Spin Fe(I) Complex for Possible Dinitrogen Reduction to Ammonia</i>
McCollar, Abie		

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## BS GRADUATES (Summer 2023-Spring 2024)

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Brenzel, Charles (Chemistry)	Kayser, Cole (Biochemistry)	Schroeder, Samantha (Chemistry)
Brinkmann, Lauren (Chemistry)	Kenney, Dawson (Chemistry)	Shick, Andrea (Chemistry)
Cambria, John (Biochemistry)	Kibodeaux, Marguerite (Chemistry)	Springer, Carli (Chemistry)
Christofferson, Aubrey (Biochemistry)	Kirkpatrick, Tess (Chemistry)	Springer, Kailey (Biochemistry)
De Souza, Gustavo (Chemistry)	Knowlton, Anya (Chemistry)	Stackhouse, Megan (Chemistry)
Dominick, Marie (Biochemistry)	Madden, Caelan (Chemistry)	Stratman, Emily (Chemistry)
Fuchs, Emily (Chemistry)	Malone, Jady (Chemistry)	Vierra, Kaiya (Chemistry)
Gentry, Julia (Chemistry)	Munson, Raven (Chemistry)	Wambolt, Devon (Chemistry)
Graham, Ava (Biochemistry)	Nelson, Teigen (Chemistry)	West, Bernadette (Biochemistry)
Gray, Chase (Chemistry)	Pilsch, Taylor (Biochemistry)	Wilson, Kenai (Chemistry)
Hanacek, Lucy (Biochemistry)	Pliska, Katherine (Biochemistry)	Wolff, Oliver (Chemistry)
Hines, Gabriel (Chemistry)	Reicks, Elizabeth (Chemistry)	Zohner, Aubrie (Chemistry)
Holland, Junia (Biochemistry)	Ripp, Laura (Chemistry)	
Johnson, Ryan (Chemistry)	Romo, Colter (Chemistry)	

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## GRADUATE STUDENT AWARDS

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Afrin, Sajia <i>PhD Completion Award (Spring 2024)</i>	Kothalawalage, Shanikwa <i>Harlan Byker GRA Award 2024-2025</i>	Sobolewski, Tess <i>Professional Advancement (Travel) Grant (Spring 2024)</i>
Beech, Jessica Lusty <i>PhD Completion Award (Spring 2024)</i>	McDaniel, Charles <i>Department of Energy Research Award</i>	Thiebes, Joseph <i>ACS Division of Physical Chemistry Outstanding Student Poster Award (Fall 2023)</i> <i>A.R. Johansson TA Award (2024)</i>
Duletski, Olivia <i>Professional Advancement (Travel) Grant (Spring 2024)</i>	Norman, Jacob <i>PhD Completion Award (Fall 2023)</i>	Walls, Will <i>Professional Advancement (Travel) Grant Spring 2024</i>
Gordon, Isabelle <i>PhD Completion Award (Fall 2023)</i>	O'Neill, Roark <i>CLS Graduate Teaching Award (2024)</i>	Wiita, Ethan <i>Harlan Byker GRA Award (2023-2024)</i> <i>NSF Graduate Research Fellowship Program Honorable Mention (2024)</i>
Hollinbeck, Skyler <i>PhD Completion Award (Spring 2024)</i>	O'Shea-Stone, Galen <i>PhD Completion Award (Spring 2024)</i>	
Ibsen, Grace <i>Extreme Biofilms NRT Seed Grant (Fall 2023)</i>	Posey, Sadie <i>SLOAN Indigenous Graduate Partnership (Spring 2024)</i>	
King, Alex <i>PhD Completion Award (Spring 2024)</i>	Sather, Brett <i>Gordon Pagenkopf Graduate Award (2023)</i>	
Koenig, Heidi <i>PhD Completion Award (Spring 2024)</i> <i>Professional Advancement (Travel) Grant (Spring 2024)</i>	Schaible, George <i>Graduate Excellence Award in Scholarship (2024)</i>	
Kohtz, Anthony <i>Montana Space Grant Fellowship (2023)</i>	Schomberg Sanchez, Isaac <i>Exemplary Undergraduate Lab Instruction: Dept. Head's Award (2024)</i>	



## GRADUATE STUDENT MILESTONES

### Passed Qualifying Exam

Asamoah, Prince  
Bailey, Marguerite  
Flynn, Alexander  
Gleason, Andrew  
Hartney, Shawn  
Janusz, Wilmar  
Kothalawalage, Shanika  
Rankin, Will  
Sappor, Dennis  
Teye, Abraham

### Passed Comprehensive Exam

Adedoyin, Victoria	Demeritte, Amethyst	Reyes, Albert	Walker, Keegan
Akpoto, Manny	Joyce, Ian	Srivathsa, Manu	Wiita, Ethan
Benedict, Rory	Marlott, Alex	Stein, Collin	
Dean, Brahm	Phillips, Austin	Trimmer, Stavros	

### Completed 4th Year Seminar

Compton, Dalton	Jackson, Oliver	Samuel, Bamidele
Duletski, Olivia	Larson, Nate	Theisen, Jonah
Findlay, Luke	Montoya, Stephen	Trousdale, Rhys
Ibsen, Grace	Orcutt, Emma	Walls, Will

## UNDERGRADUATE AWARDS

### Adams, Sophia

*Swager Summer Research Award*

### Alexander, Brett

*Lorna Copple Otzenberger Memorial Scholarship*

### Arntson, Laini

*Lois Dale Thom Scholarship*

### Bruckhart, Kaylin

*ACS Physical Chemistry Award*

*Ray A. and Margaret Woodriff Memorial Scholarship*

### Bullis, Janelle

*Harold Urey Award*

### Cambria, John (Jack)

*Outstanding Graduating Senior*

### Castro, Jose

*Edna Tracy White Chemistry Scholarship*

### Clark, Reagan

*E.E. Frahm Scholarship*

### Caldwell, Kaitlyn

*Lorna Copple Otzenberger Memorial Scholarship*

### Gibbons, Gracie

*Marie Curie Award*

### Graham, Ava

*Outstanding Graduating Senior*

### Gray, Chase

*Outstanding Graduating Senior*

### Horan, Danielle

*Gordon Pagenkopf Research Award*

### Harper, William

*Marie Curie Award*

### Hasenoehrl, Ethan

*John and Joann Amend Chemistry Scholarship*

### Hatfield, Kate

*Ray A. and Margaret Woodriff Memorial Scholarship*

### Hemer, Owen

*Lewis H. McRoberts Scholarship*

### Hemphill, Jackilyn

*John and Joann Amend Chemistry Scholarship*

### Hisey, Steven

*ACS Analytical Chemistry Award*

### Holman, Delaney

*ACS-Hach Land Grant Scholarship*

### Jensen, Jordan

*Ralph A. Olsen Award*

### Jordan, James

*O.E. Sheppard Scholarship*

*Outstanding Freshman*

### Knowlton, Anya

*Outstanding Graduating Senior*

### Lake, Linnea

*B. L. Johnson Memorial Scholarship*

*Swager Summer Research Award*

### Lucas, Breonna

*Fry Scholarship*

### Madden, Caelan

*ACS Inorganic Chemistry Award*

### Manson, Eleanor

*Fry Scholarship*

### Munson, Raven

*ACS Organic Chemistry Award*

### Peterson, JD

*Geer Howald Callis Undergraduate Research Award*

*Fry Scholarship*

### Puckett, Lydia

*Energy Laboratories Chemistry Scholarship*

### Pierson, Micah

*Crowley Family Biochemistry Scholarship*

### Rausch, Keilen

*Linus Pauling Award*

### Sanderson, Makayla

*Chi-Tang Li Scholarship*

*Geer Howald Callis Undergraduate Research Award*

### Sandifer, Sydney

*B. L. Johnson Memorial Scholarship*

### Schutte, Bethany

*P.C. Gaines Scholarship*

### Shick, Andrea

*Outstanding Graduating Senior*

### Summerhill, Peyton

*Geer Howald Callis Undergraduate Research Award*

*Marie Curie Award*

### Thatcher, Nicole

*ACS-Hach Land Grant Scholarship*

### Thorson, Gavin

*Kekule Award*

### Tulloch, Aubrey

*Harold Urey Award*

### Wagner, Ryan

*Lorna Copple Otzenberger Memorial Scholarship*

### Webster, Logan

*Linus Pauling Award*

### Wilcox, Kelly

*B. L. Johnson Memorial Scholarship*

### Wold, Norah

*Marie Curie Award*

### Woolner, David

*John and Joann Amend Chemistry Scholarship*

# ALUMNI NEWS

**Leidy Violet Hooker** (*BS 2019, Neufeldt*) started her Ph.D. studies at Colorado State University after graduating from MSU. There, she joined Prof. Jeff Bandar's group and has been conducting research on base-promoted functionalization of organofluorine small molecules. She will be graduating from Colorado State this summer with her Ph.D. in Organic Chemistry and will be moving to New Mexico to start a postdoc position at Los Alamos National Laboratories working on high explosives and propellant chemistry.

**Jac Miller** (*MS 2016, Peters*) never thought she'd end up working for municipal government but 7 years later she is working at the City of Bozeman Water Treatment Plant. She has a great working lab to keep her mind engaged and enough regulatory documents to filter through that she's often reminded why she doesn't miss primary literature articles. She says it's wonderful having a solid position after grad school that allowed her to stay in the valley and connected to the community.

**Sarah Partovi** (*PhD 2018, Peters*) married **Ky Mickelson** (*PhD 2017, Livinghouse*) in 2016 and moved to Tucson in 2018 shortly after Sarah defended. Sarah is currently a Sr. Manager in CDx Regulatory Affairs at Roche, and Ky is a Principal Chemist and Materials Engineer at Raytheon. They live in Tucson with their two beautiful young kids, two cats, and one large dog. Their family takes part in many outdoor activities such as camping, hiking, running, biking, and swimming.

**Steven Rehbein** (*PhD 2022, Neufeldt*) will join Idaho National Lab this summer as a Glenn T. Seaborg Distinguished Postdoctoral Research Associate where he will be researching aqueous separations and radiochemistry. Since finishing his Ph.D., Steven has been working in the Cone-Thiel Group (MSU Physics Department) as a postdoc and research scientist investigating novel materials for quantum information science.

**John Russell** (*PhD 2022, Neufeldt*) has been serving as a temporary assistant professor in the Chemistry and Biochemistry Department at Utah State University (USU) from fall of 2022 until May of 2024. He recently accepted a position at USU as a Chemistry Lecturer starting this fall. During his time at USU, he has been teaching the full organic chemistry sequence, the first semester of general chemistry, and managing the organic chemistry teaching labs.

**Anna Scott** (*BS 2017, Broderick*) recently began a Postdoctoral Research Assistant position at the Max Planck Institute for Chemical Energy Conversion, Mülheim an der Ruhr, Germany, working with Prof. Dr. Serena DeBeer. This position follows

her graduation in June 2023 with her PhD in Inorganic Chemistry from the California Institute of Technology. At Caltech, she worked with Prof. Theodor Agapie and she was a National Science Foundation Graduate Research Fellow (2017-2022). Her recent first-author publication in *Angew. Chem. Int. Ed.*, "High-Spin and Reactive Fe<sub>13</sub> Cluster with Exposed Metal Sites," was designated a "Hot Paper" by the journal.

**Nida Shaikh** (*PhD 2022, Walker*) transitioned into a technology transfer role at MSU after graduation, which allowed her to stay connected with science across all fields of research. She currently supports the evaluation, licensing, and marketing of technologies developed within Department of Defense labs nationwide, as well as technologies developed within Montana State University. She was always passionate about research having a broader impact, and with her current role she is able to provide a gateway for inventors to collaborate on research and to commercialize inventions and have a positive impact.

**Katie Steward** (*PhD 2021, Bothner*) is starting her third year working as a field scientist for Metabolon. She says that it has been a learning experience and wonderful to be a remote field worker.

**Ryan Swimley** (*BS 2021, Broderick*) will be attending UNC Chapel Hill this fall to get his PhD!

**Erin Taylor** (*PhD 2022, Stadie*) is currently a Visiting Assistant Professor in Analytical Chemistry at Boise State University. Last summer, she was awarded a COAS Innovation Grant to enhance their Analytical Chemistry laboratory curriculum by developing new labs, such as analyzing capsaicin content in hot sauces and quantifying the amount of citric acid in limes. Outside of the lab, she has been enjoying gardening, reading, and exploring the vibrant community of Boise.

## We want to hear from you!

Share your news, your current occupation, family updates, reminiscences of your time at MSU, etc. Contact Doreen Brown or send a note to [MSUChemNews@montana.edu](mailto:MSUChemNews@montana.edu)

## RETIREMENTS

After joining the MSU faculty in 1968, Professor of Chemistry **Pat Callis** is retiring in August of 2024. For the past 50+ years, Callis has taught quantum chemistry to both undergraduates and graduate students and is well-known for his research in photochemistry. Callis was named a Montana State University Regents Professor in 2018.

Professor of Chemistry **David Singel** joined the MSU faculty in 1994. He served as Department Head from 2005-2011 and as an Associate Provost before retiring in August of 2022. Singel helped to advance undergraduate education during his time as an administrator.

After 37 years in the department, Professor of Biochemistry **Ed Dratz** retired in May of 2023. He has a passion for teaching and taught several undergraduate biochemistry classes. His research focused on disease mechanisms using proteomics, metabolomics, lipidomics, multiomics, nutrition, and systems biology. Dratz was granted emeritus status in the Fall of 2023.

After 32 years at MSU, Dr. **Martin Teintze**, Associate Professor of Biochemistry, retired in May of 2024. Teintze spent the last 15 years as the director of Montana's WWAMI Medical Education Program. During his tenure as director, he was credited for MSU's WWAMI program expansion.

## THANK YOU TO OUR DONORS

We are grateful for the continued support of our alumni and friends of the department. Your donations help to support programs such as the following student awards and fellowships:

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If you'd like to make a donation, please visit the [Chemistry & Biochemistry website](#) and click the "Giving to the Department of Chemistry and Biochemistry" link at the bottom of the homepage, or [click here](#).

## STAFF NEWS

**Kim Hilmer** received the Kathy Griffith Employee Excellence Award for Spring 2024. This award annually recognizes employees in the College of Letters and Science whose work performance is exceptional. All professional and classified staff are eligible for the award. This includes all administrative staff, lab coordinators, program coordinators, etc. We are enormously grateful to Kim for everything she does for this department. Congratulations, Kim!

## IN MEMORIUM

Former Chemistry Professor, **Dr. Bruce Murray** passed away September 24, 2023. He was a member of the department from 1957-1962.

Former Chemistry Professor, **Dr. Richard Geer** passed away on March 12, 2024. He was a member of the department from 1964-1996.

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