

Chemistry MATTERS

Otterbein University

February 2022

Letter from the Chair

“One thing about championship teams is that they're resilient. No matter what is thrown at them, no matter how deep the hole, they find a way to bounce back and overcome adversity.” – Nick Saban

I've admired Nick Saban since he began coaching at Michigan State University in the mid-1990s, while I was residing in that great “State Up North.” While he is likely talking about Alabama, the championship team that I want to talk about is made up of Chemistry students, staff and faculty. Reflecting back on the past year in which educators juggled how they were teaching and students struggled with increased anxiety and the lack of normalcy, I am so proud of my colleagues and students and how they overcame adversity. Every day I am continually amazed at the passion and compassion our Chemistry community brings and the successes they achieve.

Our faculty are amazing coaches who have modified their student-centered courses so that our STEM majors succeed - from creative changes made in General Chemistry to navigating the limits of the pandemic that ultimately led to improved student learning, to a new upper-level course that virtually brought in external speakers who are at the forefront of new and necessary research, including one whose work was integral in helping Pfizer develop treatments against COVID-19. Several additional activities for Integrative Studies and STEM faculty and students coalesced around Cadine Navarro's exhibition *It Sounds Like Love* and Dr. Robin Wall Kimmerer's upcoming visit and her book *Braiding Sweetgrass*. Our faculty have shown such creativity in designing their courses and providing unique opportunities for campus engagement.

Faculty and students have also teamed together to bring back research projects that were unexpectedly paused. Four students conducted research on-campus during Summer 2021 and others joined in over the school year. Some of the research incorporated new instruments that were acquired over the past year, including a benchtop NMR that was funded by the Clements Foundation.

Our students were also able to participate in research and internship experiences off-campus. One student was involved in a National Science Foundation-Research Experience for Undergraduates and two others completed internships that resulted from Otterbein's strong network with practicing chemists and alumni. Otterbein alumni also engaged with current students through talks and career panels. We particularly appreciate the involvement of Dr. Michael Huston '86, Elizabeth Isaac '18, Katie Childers '15 and Elizabeth Tinapple '19.

Lastly, our team of students involved in the American Chemical Society (ACS) Student Chapter won Otterbein's 2021 Organization of the Year and an award from ACS national. These awards recognize exemplary leadership, dedication, and commitment to exceptional programs and activities.

If you are reading this and want to become more engaged with our championship team of educators and students, please reach out to me. We would love for more alumni to engage with our students and share their personal and professional stories and for more prospective students to share in the experiences with our Otterbein team.

Sincerely,

Dr. Joan Esson, jesson@otterbein.edu

Faculty Scholarship

Despite the pandemic, faculty members were able to continue scholarly endeavors.

Dr. Joan Esson had a book chapter and journal article published in the past year. Her chapter, “Incorporating Conservation Science into the General Education Curriculum,” appeared in the ACS Symposium Series book *Contextualizing Chemistry in Art & Archaeology: Inspiration for Instructors*. The chapter described how the primary roles of an art conversation scientist were incorporated into her general education course. She was also a co-author on the manuscript, “Forensic dye analysis in cultural heritage: Unraveling the authenticity of the earliest Persian knotted-pile silk carpet,” which was published in the journal *Forensic Sciences International* and describes work done during her sabbatical at the Indianapolis Museum of Art at Newfields. Joan discussed this work in a virtual event sponsored by the Office of Alumni and Family Engagement in March 2021. This conversation also featured Class of '15 alumna Dr. Katie Childers. Katie discussed her time at Otterbein and what she has been up to since graduating, which included earning her Ph.D. in nuclear chemistry from Michigan State University with a thesis entitled, “Validation of the β -Oslo Method: An indirect method for constraining neutron-capture cross-sections.” Katie is currently completing a postdoctoral fellowship at Texas A&M University.



Dr. Katie Childers '15

Dr. Dean Johnston had four peer-reviewed journal articles published and one structure deposition in the past year. In Spring 2021, Dr. Johnston worked with three students that were taking both CHEM 3200 (Inorganic Chemistry) and CHEM 4800 (Structural Methods in Chemistry and Biochemistry). Mia Sethi '21, Aileen Seitz '22, and Calvin King '22 prepared bis(acetylacetonate)dioxomolybdenum(VI) in the laboratory, determined the structure using X-ray crystallography, and published the structure in *IUCrData*. The senior research project of Elizabeth Tinapple '19 and Sam Farrar '20, investigating the structures of benzamide-coordinated zinc complexes, was published as “Crystal structures and hydrogen-bonding analysis of a series of benzamide complexes of zinc(II) chloride” in *Acta Crystallographica E*. The work of Mallory Gasbarre '17 and Carolanne Norris '18 on the properties of an ionic liquid (“Structural and Conformational Analysis of 1-Butyl-3-methylimidazolium Nitrate”) was published in the *Journal of Chemical Crystallography*. The structure of a polymorph of thiosaccharinato-bis(triphenylphosphine)silver(I), determined by Jessica Pierfelice '13, was deposited in the Cambridge Structural Database as entry TIQDIH01.

Dr. Johnston collaborated with a group of faculty to offer an introductory course on Cheminformatics in Spring 2019. With the support of the ACS Division of Chemical Education, the same course was offered at five institutions, leveraging the expertise of other faculty and researchers. An article describing the course and the materials generated, “Teaching Cheminformatics through a Collaborative Intercollegiate Online Chemistry Course (OLCC),” was published in the *Journal of Chemical Education* in December 2020.

Dr. John Tansey had two peer-reviewed journal articles published. The article “Crowdsourcing biocuration: The Community Assessment of Community Annotation with Ontologies (CACAO)” was published in the journal *PLoS Computational Biology* and the second article, “Development of a Certification Exam to Assess Undergraduate Students' Proficiency in Biochemistry and Molecular Biology Core Concepts,” was published in *CBE Life Science Education*. The first article arose from a conference several Otterbein professors (Drs. Tansey, Bennett, and Hayes) attended several years ago. At this conference they learned about a gene annotation project that was being used in classes nationwide. In this project students would research genes with unknown functions and attempt to attribute functions and characterize these based on sequence analysis. The second work stems from his work with ASBMB (American Society of Biochemistry and Molecular Biology). This paper described how the ASBMB exit exam came to be and is currently developed.

Dr. Tansey had two other presentations through the Office of Alumni Affairs that you may have heard of. One of Dr. Tansey's INST courses is INST 3014 (The Business and Science of Whisk(e)y), co-taught with Dr. Levin of the Business Accounting and Economics Department. The two talks (“Pour Decisions: the science behind bourbon” and “Pour Decisions: Part Dos, Tequila with Tansey”) were fun talks geared to bring people together to discuss some of our favorite beverages and how they are produced. These talks were a lot of fun and a great way to interact with alumni and friends.

Chemistry in Action

Renowned scientist and author Dr. Robin Wall Kimmerer will give the 2022 Integrative Studies Lecture on Monday, March 28, from 5-6:45 p.m. in Riley Auditorium in the Battelle Fine Arts Center. Throughout 2021, members of the Department of Chemistry explored interesting connections with Dr. Kimmerer's award-winning book: *Braiding Sweetgrass: Indigenous Wisdom, Scientific Knowledge and the Teachings of Plants*.

Chemistry faculty member Dr. Carrie Hayes has been the director of the Integrative Studies (INST) Program since Autumn 2020. In Spring and Summer 2021, with the help of the Center for Teaching and Learning (CTL), Carrie organized several program-wide conversations regarding campus connections to Integrative Studies. One of these concerned upcoming Museum and Gallery Exhibitions at Otterbein and focused on Cadine Navarro's *It Sounds Like Love*, an art exhibition which took its inspiration from the themes of Kimmerer's book. The ideas sparked in this May 2021 discussion resulted in a summer book group on *Braiding Sweetgrass* for several faculty members, including Dr. Carrie Hayes, Dr. Joan Esson, and Dr. Brigitte Ramos from the Department of Chemistry. Moreover, the book group ultimately led, thanks to the collaborative work of Dr. Janice Glowski (Director of Museum and Galleries at Otterbein), to Dr. Kimmerer's invitation to campus.

In Autumn 2021, Dr. Joan Esson brought the themes of *Braiding Sweetgrass* into the chemistry curriculum, exploring connections between the book and her INST 2408 course, Chemistry in Art. At the Fall 2021 Faculty Conference, Joan worked with Dr. Melissa Gilbert, Director of the Center for Community Engagement, to share with faculty across campus their experiences with the book and the Community Garden and to provide space to consider how they might incorporate the text into their courses. As a result, students in several courses (including Chemistry in Art) read the "Three Sisters" chapter from *Braiding Sweetgrass* and attended the Fall 2021 Teach-In for the Planet, culminating in a Three Sisters potluck meal at Otterbein's Community Garden.

Braiding Sweetgrass involves a variety of perspectives on plants and sustainability. Moreover, as alluded to above, Cadine Navarro's *It Sounds Like Love*, which has been featured through-

out 2021-22 in the Frank Museum, was inspired by the themes of Kimmerer's book. Navarro used the sounds created by prairie seeds in tandem with the Japanese marbling technique *suminagashi* to create an innovative, interdisciplinary exhibit (described in more detail at <https://www.cadinenavarro.com/news/it-sounds-like-love>). Joan's Chemistry in Art course used *suminagashi* and another marbling technique, the traditional Turkish art *ebru*, as a fascinating exploration of intermolecular interactions. Students learned the chemistry behind these methods and gained hands-on experience with both techniques. They also went on a guided visit to the exhibition of *It Sounds Like Love*, guided by Janice Glowski. Readings from the book, along with visits to the Community Garden and the Frank Art Museum, made Chemistry in Art a truly integrative course.

Looking ahead, Dr. Kimmerer's Spring 2022 lecture will be open to the Otterbein community; please reach out to Carrie (chayes@otterbein.edu) or to the Integrative Studies Program generally (ISassistant@otterbein.edu) if you are interested in learning more.



Students in INST 2408 creating art-work using *suminagashi*.



Professor Allen Reichert, one of Otterbein's librarians, demonstrating the art of *suminagashi*.



Chemistry minor and equine pre-vet major Lindsey Payton '23 displaying her artwork created with the *ebru* marbling method.

Structural Methods in Chemistry

In Spring 2021, Dr. Dean Johnston offered CHEM 4800 (Structural Methods in Chemistry and Biochemistry) as an advanced elective for Chemistry and BMB majors. Focusing on the development and application of structural methods in the fields of Chemistry, Biology, Biochemistry, and Materials Science, the course explored questions such as: how do we get from a sample to a three-dimensional structure, how are samples prepared, what are the limitations and prospects for different structural techniques, and how is our understanding of the structure of COVID proteins (**Figure 1**) helping in the development of therapeutics and vaccines?

Three (online) guest speakers joined us during the semester. Dr. Yinka Olatunji-Ojo, User Support Scientist with the Cambridge Crystallographic Data Centre, shared how the Cambridge Structural Database is used in the drug discovery and drug development process. Dr. Amy Sarjeant, Principal Scientist at Bristol Myers Squibb, talked about X-ray diffraction techniques and their applications in the identification of drug molecules and understanding their different structural forms. Finally, Dr. Anne Mulichak, a protein crystallographer working with the Industrial Macromolecular Crystallography Association Collaborative Access Team (IMCA-CAT) at the Advanced Photon Source at Argonne National Laboratory, gave us an overview of the work that she and her colleagues do at the beamline (a very bright source of X-rays), determining the structures of proteins together with their industrial collaborators. Dr. Mulichak's team was integral in helping Pfizer develop the new oral antiviral treatment against COVID-19 (**Figure 2**).

- (1) Zhang, L.; Lin, D.; Sun, X.; Curth, U.; Drosten, C.; Sauerhering, L.; Becker, S.; Rox, K.; Hilgenfeld, R. Crystal Structure of SARS-CoV-2 Main Protease Provides a Basis for Design of Improved α -Ketoamide Inhibitors. *Science* **2020**, *368* (6489), 409.

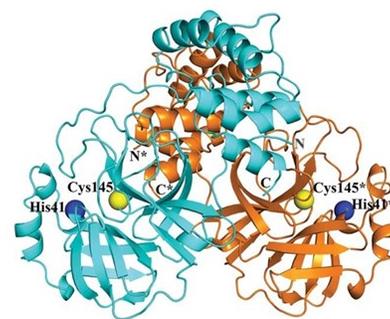


Figure 1. 3D structure of the SARS-CoV-2 M^{pro} protein (1)

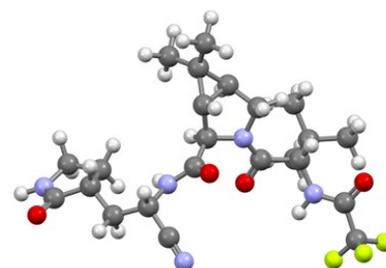
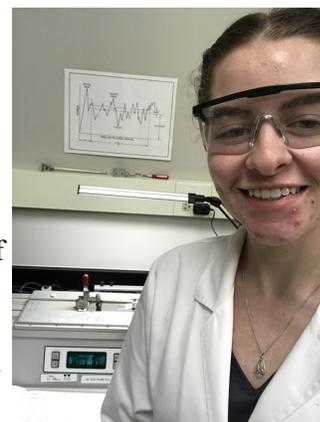


Figure 2. A representation of Paxlovid™, the potent oral antiviral developed by Pfizer for the treatment of COVID-19.

Summer Student Work

This past summer our Chemistry majors were busy with summer research projects. On campus, sophomore Sarah Frix '24 worked with Dr. Carrigan Hayes in using computational methods to explore molecules of interest to Dr. Johnston's research lab, comparing computational results to experimental data available in the Cambridge Crystallographic Data Center (CCDC). Sophomores Kaitlynn Gleich '24 and Owen Gregg '24 spent their summer working with Dr. Brigitte Ramos on developing bio-diesel synthesis methods for use with high-school students. Jaden Watkins '23, a junior chemistry major, worked with Dr. Robin Grote on the investigation of the effect of substitution pattern on the synthesis of oxadiazoles.

Off campus, our senior Chemistry majors were busy too! Erin Kibby '22 worked as a full-time intern at the Core Technologies Lab at Franklin International testing the performance and quality of pressure-sensitive adhesives. Olivia Smith '22 went to Georgia Southern University as part of a Research Experience for Undergraduates (REU) that is funded through the National Science Foundation (NSF). While there she worked on characterizing titanium dioxide nanofibers. Lily Nichols '22 completed an internship at Lubrizol Additives, in the Applied Research Department, studying structure-performance relationships of polymer components. Otterbein has had several students complete internships at Lubrizol, and multiple alumni currently enjoy careers there.



Senior Erin Kibby '22 working as an intern at Franklin International

New Instrumentation Supports Student Learning

The Chemistry Department acquired two new instruments over the past year. One of these – a benchtop NMR - was purchased with funds from the Clements Foundation, which has been a long-time supporter of the Chemistry Department. The Foundation was started by Vida S. Clements, Otterbein Class of 1901, after the death of her husband, Frank Orville Clements, Class of 1896, who worked as a chemical engineer for General Motors and National Cash Register. Both served on Otterbein's Board of Trustees and were staunch supporters of the university.

Over 50 students in Inorganic Chemistry Laboratory and Organic Chemistry II Laboratory in Spring 2021 benefited from having the benchtop instrument in the synthesis laboratory. In these laboratories students used the benchtop spectrometer weekly to analyze compounds they synthesized and isolated, such as benzocaine, a topical analgesic, and inorganic complexes such as acetylferrocene, and bis(acetylacetonate) dioxomolybdenum(VI). We are looking forward to many more STEM majors gaining

hands-on experience with this workhorse instrument in the future.

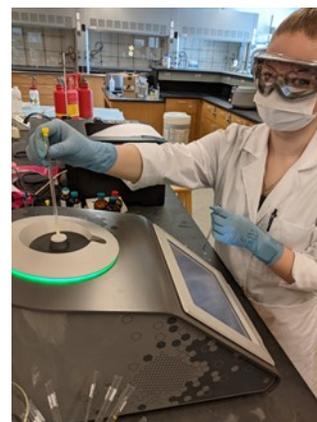


Chinese seals in the C. Y. Woo collection at Otterbein's Frank Museum of Art.

Lifelong Learning Community have been cataloging and studying Woo's works. Mia and her research advisor, Dr. Joan Esson, have been extending this study by examining the chemical composition of Woo's seals and paintings. Mia's research seeks to answer questions such as "Does the composition of seal ink change across the different seals? If so, do we see differences in works that may have been done in China versus those done in the U.S.?" and "C. Y. Woo may have used a seal that was hundreds of years old. Can we see any differences in chemical composition that support this?"

The second instrument is a portable Raman spectrometer that advances the capabilities of the department. Using this instrument, Senior Mia Sethi '21 completed a technical study of the materials used by C.Y. Woo. The Frank Museum of Art at Otterbein has the largest collection of Chinese paintings and artifacts by C.Y. Woo (1899 – 1989), a Chinese artist who emigrated to the United States in the mid-20th century. In collaboration with conservators and curators from the Cincinnati Art Museum, Dr. Janice Glowski, Otterbein's Museum and Galleries

Director, and members of Otterbein's



Lily Nichols '22, Chemistry and Biochemistry & Molecular Biology major, using the benchtop NMR.



Chemistry majors Anna Kugajevsky '21 (left) and Mia Sethi '21 (right)

Save the Dates

2022 is Otterbein's 175th Anniversary <https://www.otterbein.edu/175-years/>

Homecoming 2022 will be October 1st <https://www.otterbein.edu/alumni/homecoming/>

Reach out to the department with any chem-related stories you want to share!



Post-COVID Adjustments in 2020 and Beyond

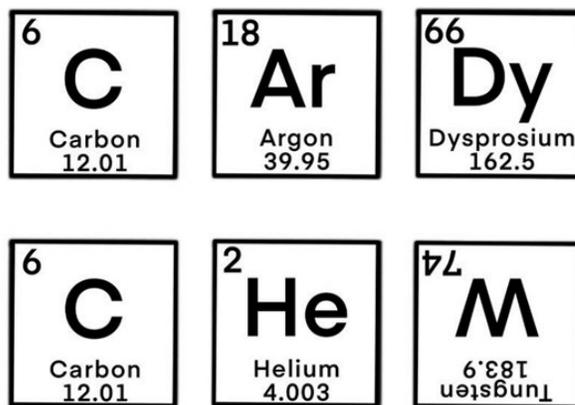
The challenges of the pandemic have led to a variety of creative teaching innovations from all members of the Department of Chemistry, in the time since March 2020. Across the department, faculty members adapted previously classroom-based offerings into a mix of online, hybrid, and distanced in-person classes, throughout 2020-21. The distinct challenges posed by lab courses merited particular increased time and attention, and Otterbein's faculty members rose to the occasion.

Nowhere was this effort more evident than in the complete overhaul of the General Chemistry Lab curriculum! This course sequence serves a large number of students across several departments, and Dr. Wendy Johnston devoted countless hours during Summer 2020, as well as throughout the academic year, to making these two lab courses (CHEM 1410 and CHEM 1510) valuable learning experiences for Otterbein students. She organized lab sections into "blended rotation" groups (limiting in-person work to eight students at a time, to allow for social distancing), created pre-lab videos to demonstrate techniques and equipment, and facilitated synchronous, real-time data collection for remote students. She prioritized the most important lab techniques for the days in which students could attend in-person and adapted other lab days into virtual experiences and data-analysis-focused sessions. As noted in last year's newsletter, Wendy was the recipient of the 2020 Part-Time Faculty Award for Teaching in the Discipline. This would have been richly deserved even if Otterbein had not been dealing with the challenges of the pandemic, but the timing does seem fitting to commemorate such a significant and outstanding effort to support our General Chemistry students.

Upper-level courses also saw a variety of creative teaching innovations, since the "blended rotation" set-up necessary for lab courses meant that students were in the actual lab at most half of the time they would have been in a typical semester.

Organic Chemistry Lab students worked with Dr. Robin Grote and Professor Matt Grote to balance their in-lab work with asynchronous, literature-based case studies, examining real procedures and reactions from the scholarly literature. Dr. Joan Esson used the Community Garden as a teaching space, providing a creative way for her students to relax outside of the confines of the classroom while avoiding the challenges of masks and social-distancing mandates.

While these adjustments have been challenging, we do see some benefits to the increased flexibility and accessibility that we now can include in both our lecture and lab courses. As part of her reflection on teaching in a pandemic, Wendy noted several silver linings to the challenging circumstances of the moment, such as the increased confidence of students who now could consider additional pre-lab resources, as well as the enhanced appreciation that students brought to their in-person coursework during semesters in which many of their classes were online. She commented, "The positive attitude each and every student had for the time they got to be in lab was inspiring. Students working independently (with no lab partners) had ownership of their own lab work and data collection. Now if we could just figure out how to keep our safety goggles from fogging up while wearing masks..."



Otterbein Chemistry logo designed by Lily Nichols '22. This design was printed on masks for Chemistry students, faculty and staff, alumni, and prospective students.

Otterbein University Students Benefit from Faculty Involvement in National Organizations

Drs. Joan Esson and John Tansey are involved in governance of national disciplinary societies – the American Chemical Society (ACS) and the American Society for Biochemistry and Molecular Biology (ASBMB), respectively.

In her role as Councilor for the Columbus, Ohio section of the ACS, Joan organizes meetings for the local section and represents the region at national ACS meetings. She helped to arrange two virtual and two in-person monthly section meetings that featured: Dr. Frederic Bertley, President & CEO of COSI; Julie Reilly and Wendy Partridge, Executive Director and Paintings Conservator, respectively, of ICA-Art Conservation; a panel of industrial chemists and biochemists held at the Point at Otterbein that included Otterbein alumna Elizabeth Tinapple, '19, Analytical Chemist at the forensic consulting company SEA, Ltd; and Dr. Mike Wernke, Practice Lead in SEA, Ltd.'s Health Sciences Group and Senior Toxicologist and Pharmacologist. Chemistry majors and minors attended each of these talks where they were able to learn about careers in chemistry, specific applications of chemistry and the importance of scientific communication.

The Columbus ACS local section also provided Otterbein's ACS Student Chapter with funds to support activities to keep students involved despite the pandemic and recognized the outstanding achievements of two of our students. Meredith Marshall '21 was named Outstanding Senior, while Olivia Smith '22 was named Outstanding Junior. Additionally, Erin Kibby '22 received the national ACS Undergraduate Award in Analytical Chemistry, while Lily Nichols '22 received the ACS Division of Inorganic Chemistry Undergraduate Award.

At the national level, Joan is part of the Membership Affairs Committee (MAC) where she is Chair of the MAC Test Working Group. This past year MAC led an overhaul of the membership structure of ACS. Starting in late 2021, instead of everyone joining at one price point, members can now join at one of three different price points that each have different benefits. Our hope is that this will make membership more affordable for everyone with an interest in chemistry. If you are reading this article and are not a member of the American Chemical Society, you should consider joining the ACS as a community member, which is free.

John is involved in two committees for ASBMB-Programmatic Accreditation and Science Outreach and Communication.

ASBMB offers undergraduate programs the opportunity to become accredited based on their curriculum, campus infrastructure, and faculty. There are currently over 100 accredited programs nationwide including three in Ohio (Otterbein was first). John chairs this subcommittee. Annually this committee reviews over 15 applications and holds a study section to discuss them. Accredited programs have the ability to offer their students the ASBMB exit exam which enables students to earn an added credential upon graduation.

John is also a member of the Science Outreach and Communication committee. This committee has several functions. They organize and run the ASBMB Art of Science Communication course which John has both completed and instructed. This committee also organizes the flash talk competition at the ASBMB national meeting, reviews grants for outreach, and generally helps give a platform for science outreach and communication between ASBMB members and the public.

By serving on these committees John not only is giving back to his society and the broader scientific and educational communities, he is also staying on top of recent developments nationally in education, scientific communication, and outreach. This helps in turn to connect Otterbein students and alumni with opportunities. Several Otterbein alumni have completed the Art of Science Communication course and use it in their professional lives.



Otterbein students, alumna and faculty at the September 2021 Columbus, Ohio ACS monthly meeting at the Point. Left to right: Dr. Joan Esson, Elizabeth Tinapple '19, Colleen Bungard '23, Erin Kibby '22, Olivia Smith '22, Lily Nichols '22, and Tatum Poulton '24.

Otterbein Student Chapter of ACS Nationally Recognized for the Second Year in a Row

For the second year in a row, Otterbein's Student Chapter of the American Chemical Society was nationally recognized for their contributions to Otterbein, to the local community, and to chemistry, receiving an Honorable Mention Award from ACS. This award was earned through the completion of a Student Chapter Annual Report by the Student Officers, submitted to ACS for Undergraduates, detailing the events and efforts of the 2020-2021 academic year. In addition to the national award, the Otterbein Student Chapter of ACS was recognized as the Organization of the Year at the Otterbein Celebration of Service and Leadership: "This award is given in recognition of your exemplary leadership, dedication, and commitment."

In the 2020-2021 academic year, Otterbein ACS, like all student organizations on campus, faced tricky COVID-19 guidelines and restrictions and pivoted to more online events and activities. Some of the most memorable events of the year include a Graduate School Panel with OSU Inorganic Chemistry Graduate Students, Chemistry BINGO and Trivia Nights, and Campus-wide Tie Dye. Otterbein ACS also attended many virtual events hosted by the Columbus ACS Local Section, Center for Science and Industry (COSI), and OSU chemistry and STEM organizations. In addition to hosting and attending fun events and speakers, Otterbein ACS is committed to the professional development of its members and all Science majors at Otterbein. Two workshops were hosted to better prepare students for professional opportunities during their time at Otterbein and after graduation, featuring presenters from our very own Chemistry faculty: Dr. Joan Esson shared guidance on the many summer opportunities for Chemistry students such as REUs and internships, and Dr. Carrigan Hayes led a workshop on how to write personal statements in STEM.

Otterbein ACS continues to grow membership and involvement across campus, joining forces with many campus organizations to broaden our reach and enhance campus life for STEM students at Otterbein.

By Erin Kibby '22, ACS Chapter President 2020-21, Current Vice President



Spring 2021 ACS Tie Dye Event. Pictured from left to right: Manhattan Miller '21, Melissa Knapp '22, Megan Bishop '22, and Olive Schnittker '24.



National Chemistry Week 2022. Playing with splatter designs studied in forensic analysis. Students used squirt guns and spray bottles to tie dye a large sheet. Pictured from left to right: Erin Kibby '22, Aileen Seitz '22, and Olivia Smith '22.



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Are you interested in keeping up-to-date more regularly with Chemistry Department activities and people, and in networking with other Otterbein alumni? Then join the Otterbein Chemistry Department LinkedIn page and/or Facebook page!

We also invite alumni to interact with current students. If you are an alum who wants to give a technical talk, participate in a panel about careers, or is willing to mentor a current student, please reach out to Dr. Joan Esson (jesson@otterbein.edu).

