UNIVERSITY OF MICHIGAN

MICHIGAN CHEMISTRY NEWS

Fall 2021

On the cover

Students from around the country and around the globe are back in our labs and classrooms, hard at work. ***Cheng Yang*** *is a fourth year graduate student in the Stephenson research group working on a collaborative project with Professor Stephen Maldonado to develop N-oxyl electrocatalysts for hydrogen atom transfer reactions. Cheng's expertise in chemical synthesis is borne out by his four publications from his undergraduate research at Nankai University and four publications since he started graduate school at Michigan in 2018. Earlier this year, his mechanistic study on N-hydroxyphthalimide mediated benzylic oxidation was published (J. Am. Chem. Soc. 2021, 143, 10324-10332). His results suggest an important role of the catalyst decomposition in the transformation. This insight has allowed him to begin to design more effective catalysts. As we went to press, a manuscript detailing his impressive catalyst design was in preparation.*

Follow us on social media!

Between newsletters, stay up-to-date with Michigan Chemistry through our social platforms. The Michigan Chemistry Social Media committee is sharing job opportunities on LinkedIn; creating videos for YouTube; posting news of awards, research, and seminars on Twitter; and showcasing our people, research, and events on Instagram.

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Department of Chemistry Newsletter

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Welcome from the Chair

Dear University of Michigan Chemistry Community—

Greetings from Ann Arbor! The university has cautiously opened campus to an in-person Fall Semester with a vaccine and mask mandate for all students, faculty, and staff. It has been a joy to interact with students in our lecture halls, discussion classes, and labs again. The energy and enthusiasm of our community in this time has been uplifting, even as we acknowledge the challenges of remaining safe from the pandemic. In our newsletter we bring you some highlights from the past year that reflect on our teaching, research, and service mission.

Our department is blessed with many talented teachers and educators. Among our many great teachers, Alex Poniatowski was recognized this year with an Individual Award for Outstanding Contributions to Undergraduate Education from LSA for his work on CHEM 125/6. You can read about Alex and his award in this newsletter. Collectively our teachers have developed a culture of continual improvement in education. As a result, there are far too many great stories regarding the teaching in the department than we can tell in just this newsletter.

To give you just glimpse of one way that we maintain this culture through our Future Faculty Graduate Student Instructor (FFGSI) program. Graduate students enter into a collaboration with a faculty member to development an improvement in a course. Typically ten or so projects are completed in a year.

In one example, Giacomo Di Mauro, who is earning his PhD with Prof. Ramamoorthy, helped develop an applied NMR lab for General Chemistry students that would take advantage of the benchtop spectrometers used in the organic laboratory program. In the exercise, students learn the fundamentals of NMR and magnetic relaxation.

Alan Rask worked with advisor Paul Zimmerman in CHEM 463 on developing materials and projects to enhance student understanding of the relationship between sustainability and thermodynamics. That term, the team introduced sustainability throughout the course and included a sustainability term project (applying thermodynamics to real world sustainable problems). These projects keep our undergraduate courses on the cutting edge and provide real-world training for the graduate students.

The department's research mission with both fundamental and applied studies has also moved forward this year. In this newsletter you can read about Prof. Anne McNeil's project on recycling polymers, an issue at the heart of sustainability. You can also read about how a collaboration of research groups headed by Professors Charlie Brooks, Anna Mapp, Corey Stephenson, and Matt Soellner made a pivot during the current pandemic to address possible treatments for COVID-19.

Our department covers the breadth of chemistry the way that few departments can match. Over the past few years Chemical Education has grown with the addition of Prof. Ginger Shultz to our faculty. You can read about her collaborative project on teaching chemistry in the context of different cultures.

Overall the department has maintained a thriving research program. Did you know that Chemistry at Michigan is rated as a top 10 producer of chemistry publications in the US by Nature Index?

A remarkable feature of the department this year is that even though the pandemic has impeded much of our work and taken much energy, people have continued to find ways to reach out the community. Last year students formed *commUNITY* as an organization to promote the voice of BIPOC students and faculty. Students have also started a YouTube channel to promote different aspects of the department and student experience.

These activities are just the tip of the iceberg as students and faculty have also been involved in work with the local museum, visiting junior and high school students, and helping with cleanup of the local natural areas.

If anything you read in this newsletter particularly intrigues you, I urge you to contact us. We welcome the involvement of our alumni. You can provide mentoring for our current students through our CALC|UM and CSIE|UM professional development programs, and we are deeply grateful for your generous financial support for the department. This past year we set a new record for new donors on Giving Blueday, UM's 24-hour online fundraising event.

Share with us what you are doing by sending in an alumni update. If you find yourself in the Ann Arbor area, I hope you will take the opportunity to stop by the department. In the meantime, a note or email is most welcome.

Sincerely,

Robert Kennedy
Chair, Chemistry Department
Hobart Willard Distinguished University Professor
Professor of Chemistry
Professor of Pharmacology

Faculty News

The Department of Chemistry is pleased to announce the promotion of five faculty members. These descriptions are condensed from the Regents Agenda materials.


Biteen


Schindler


Szymczak


Ault


Narayan

PROMOTED TO PROFESSOR OF CHEMISTRY

Julie Biteen

Professor Biteen-Johnsen has developed a respected research program that involves inventing and applying techniques for measuring protein dynamics at the single molecule level in living cells. Her emphasis on microbial cells sets her apart from most of the single-molecule imaging field and is timely due to the interest in the microbiome. She contributes high quality teaching in all areas of the chemistry department. Her service is exemplary and she has grown into an acknowledged leader in the department and the scientific community. This year she started as the departmental ombuds.

Corinna Schindler

Professor Schindler has become a leader in organic chemistry by discovering new reactions, including the carbonyl-olefin methathesis reaction, uncovering mechanisms, and developing existing reactions for new transformations. She has provided high-quality instruction, including fresh approaches that involve creation of materials to better train GSIs and allow students to problem-solve and practice with rapid feedback. She has engaged in outreach to promote understanding and interest in science at several levels.

She organizes the Merck Symposium, a large event that brings Merck scientists to UM for a conference.

Nathaniel Szymczak

Professor Szymczak is an inorganic chemist interested in using metals to catalyze reactions. He has developed a creative approach to catalyze chemical reactions that activate small molecules based on ligands that bind to metals and control the reaction from both the first and second coordination sphere. He has been a dedicated teacher and mentor at all levels and evolved his innovative lab course design with success. He teaches his undergraduate laboratory as an "Authentic Research Design" (ARD) class where students are given a problem and use their knowledge to develop a hypothesis and plan experiments to test the hypothesis. He has developed leadership, especially for improving our safety culture.

PROMOTED TO ASSOCIATE PROFESSOR WITH TENURE

Andrew Ault

Professor Ault has developed a creative research program developing new approaches to measure the chemistry of aerosols. He uses Raman Spectroscopy and atomic-force microscopy-photothermal infrared spectroscopy to study the chemistry and physical properties of aerosols at the individual particle level. Knowledge of aerosol chemistry is critical to understanding aerosols' impact on health and climate. He has developed methods to measure the pH of aerosols, an important breakthrough that helps predict chemical reactions within aerosols. He has also developed spectroscopy methods to uncover the composition of aerosols. He is the first to measure lake spray aerosol and has demonstrated their potential to carry toxins from algal blooms.

He has developed a range of classes in environmental chemistry and has been a strong advocate for diversity, equity, and inclusion in the sciences.

Alison Narayan

Professor Narayan has developed a lauded research program at the interface of chemical biology and organic chemistry. She has discovered and characterized enzymes with utility for synthesizing complex molecules. She has harnessed these enzymes through selected modifications to catalyze reactions important in synthesis of natural product derivatives with medicinal potential.

She has successfully taught at the graduate and undergraduate level, including a large gateway course, and proven to be a dedicated mentor.

Professor Narayan uses a blend of chemical biology and organic chemistry to discover enzymes with useful catalytic properties, studies the reactivity of the enzymes, evolves the enzymes to be useful for complex molecule synthesis, and uses the novel biocatalysts for synthetic chemistry. She has participated in numerous outreach activities, including science demonstrations for young women.

Julie Biteen was appointed as the inaugural Chemistry Department Associate Chair of Graduate Studies.

Three faculty members have received NSF CAREER awards over the last year.

- **Aaron Frank** for "Constructing Multi-scale Dynamical Ensembles of Ribonucleic Acids (RNAs)"
- **Kristin Koutmou** for "Molecular level consequences of mRNA modification"
- **Ginger Shultz** for "Creating a model for teachers to bridge cultural divides and provide students with culturally relevant pedagogy"

CAREER awards are the National Science Foundation's "most prestigious awards in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization."

Ted Goodson was elected as a Fellow of the American Institute for Medical and Biomedical Engineering for his outstanding contributions to the understanding of biochemical and biophysical processes utilizing novel quantum light and nonlinear spectroscopy and microscopy. He is featured in a video from the American Chemical Society "JACS in Conversation with Dr. Theodore Goodson, III." Watch it to learn how he started his career, the research he and his group are currently undertaking, and his passion for introducing younger generations to science. You can find a link on Michigan Chemistry YouTube.

Raoul Kopelman continues work with the Kellogg Eye Center to develop a nanoparticle gel to treat "wet" macular degeneration that can lead to blindness. Current treatments are painful injections in the eye. The nanogel would allow an intravenous injection in the arm where the nano gel would self-target and travel to the diseased areas of the eye, carrying an imaging agent and a treatment.

Anne McNeil has received the Akron Section ACS Award, which recognizes young scientists who show great promise in their professional careers and to promote their interaction with the Akron Section members.


Nicolai Lehnert with D-RISE students in 2016. Stephanie Camarena (in black) has since graduated from UM with a biochemistry major. D-RISE was paused in 2020 and 2021 for the pandemic, but from 2014-2019, 27 students participated in D-RISE. Of that group, 90% pursued or are pursuing undergraduate studies at UM. The students all report that this experience further motivated them to pursue STEM careers.

Nicolai Lehnert Honored for Efforts to Increase Representation in STEM Fields

When Professor of Chemistry Nicolai Lehnert taught upper level courses for undergraduates, he noticed a lack of diverse faces in his classes. In 2013 he formed a partnership with Cass Technical High School in Detroit crafted to address this issue. The UM Detroit Research Internship Summer Experience—D-RISE—provides summer internships to Cass students to perform full-time research for seven weeks in a chemistry laboratory at the University of Michigan.

The D-RISE program among his other efforts has garned Lenhert a 2021 Carol Hollenshead Inspire Award for Excellence in Promoting Equity and Social Change from UM's CEW+

The goal of D-RISE is to increase underrepresented minority participation in the sciences by motivating students to attend college and work in STEM areas.

Most high school students don't know what sort of careers are available to chemistry majors, says Lehnert. This program lets them meet scientists and college students and experience what college has to offer.

The high school students do not just observe their graduate students and/or postdoctoral mentors in the laboratory, but actually perform ull-time hands-on research for 40 hours per week on projects that are directly related to their mentor's research projects—genuine research experiences. The students are in fact able to produce enough results from their own work to present full research posters at the end of the project, Lehnert points out. The second important hallmark of the program is the fact that the students actually stay on campus during the week, giving them a real college experience, and providing them with the opportunity to explore campus life (supervised by a chaperone) and to interact with undergraduate and graduate students and faculty "after hours," and in this way, to build lasting relationships with their mentors.

Lehnert, an inorganic chemist, joined Michigan Chemistry in 2006. His work is focused on the coordination chemistry of nitric oxide as it pertains to biological systems, in particular NO reductases, but also heme proteins and biocatalysis.

A video, "D-RISE: Encouraging and Growing STEM Participation," prepared as part of the award explains more about the program. It is linked to the Michigan Chemistry YouTube Channel.

Alison Narayan was named a 2022 Arthur C. Cope Scholar. Cope Scholar award is given to recognize and encourage excellence in organic chemistry. She has also received a prestigious Novartis Global Scholars Award which funds breakthrough science not covered by traditional grant support with the objective of being translated to drug discovery and/or clinical research.

Kerri Pratt has received the American Geophysical Union's Atmospheric Sciences Ascent Award, which is given to "exceptional, mid-career scientists" for "excellence in research and leadership in the atmospheric and climate sciences".

Vince Pecoraro was awarded a Docteur Honoris Cause (Honorary doctorate) by Universitè d'Aix-Marseille for contributions in bioinorganic and biophysical chemistries. He also received the 2021 SCF French-American Prize, sponsored by the Société chimique de France and American Chemical Society. He was recognized for his "remarkable discoveries in the field of bioinorganic chemistry, notably on the role of manganese complexes and clusters in the photosynthetic oxidation of water." Also noted was his building of French-American chemistry ties.

Ayyalusamy Ramamoorthy successfully organized a weekly ZOOMinar series on the "Molecular Bases of Proteinopathies" that has been running since August 2020. It provides continued education to the community, and opportunities for junior faculty and researchers to present their research, despite pandemic constraints. The series has a 1000 registered participants and most of the presentations are available on YouTube.

Corey Stephenson was recognized by Web of Science as a Highly Cited Researcher in 2020.

Dominka Zgid was one of three UM scientists whose research was used for "lab in a box" educational packages prepared by the UM Museum of Natural History and sent to middle schools science teachers in Michigan who could no longer bring their students to the UM campus.

Veteran research staffers retire

Combined 68 years of service

Kojiro

Windak

Chris Kojiro, Research Lab NMR Specialist, who began his career at the Department of Chemistry in 1990, retired at the end of 2020. In retirement, he is enjoying working on genealogy, gardening, and spending time with grandkids, wife, and family.

Jim Windak, Research Lab Mass Spectrometry Specialist, retired in February 2021 after 38 years at Michigan Chemistry. He is excited to be able to spend time outdoors on nice days—bicycling, kayaking, or working in the garden—rather than in the lab.

Ageeth Bol Brings Interdisciplinary Background to Michigan Chemistry

Ageeth Bol returns to her chemistry roots when she joins UM Chemistry as professor of chemistry beginning January 1, 2022. For the last ten years she has been a professor of applied physics at Eindhoven University of Technology, following a decade of working in industry. Her move back to academia will allow her to define her own research projects.

Bol earned undergraduate, master's and PhD degrees in chemistry at Utrecht University. Then she worked at Philips Electronics and IBM TJ Watson Research Center. "I did rather fundamental work in my PhD, and I wanted to do something that was more applied…It's sometimes hard to see where [fundamental research] is going in the end," she says.

Working in industry, she gained technical skills and the ability to work on large interdisciplinary teams. "I've tried to mimic industrial collaborations in academia. People with different backgrounds have a different feel for how to solve a certain problem, and this is beneficial for your research outcomes," she explains.

"Ideally, I'd like to build up a group with chemistry students along with students of other disciplines. One of my atomic layer deposition tools will be in the clean room on North Campus, so I hope this stimulates collaborations as well," she adds.

This collaborative mindset has brought her to the cutting edge of her field, which requires knowledge of chemistry, physics, and materials science and engineering. Bol's research projects focus on optimizing the fabrication of new nanomaterials to scale up the synthesis to an industrial level.

"We want to develop new nanomaterials with functionalities that you can tailor," she explains. The chemical and physical properties of some materials are quite different on the nanoscale compared to the same material on the bulk scale, and these unique properties can be especially useful for catalysis, quantum technology, and (opto)electronic applications in semiconductors.

Specifically, she is using atomic-layer deposition (ALD) to create materials for applications such as photoelectrodes and electrocatalysis for the hydrogen evolution reaction (HER).

Bol is also excited for the opportunity to teach chemistry courses, saying "I would like to be teaching in the borderline between chemistry and materials science, which is where my strength is."

—Taylor Soucy, SciCommFellow

Educating Citizen Scientists

Lecturer Alex Poniatowski honored with 2021 College of LSA Individual Award for Excellence in Undergraduate Education

"I think of our students as future colleagues," explains Lecturer Alexander Poniatowski. "We are preparing future experts in our field." He aims to help them not only master the fundamentals of chemistry, but to also to develop the philosophy of a researcher and hone their critical thinking skills. "Really, our mission is not only to help our students earn that diploma but also to develop our students as 'citizen scientists'."

This fall, there are 60 sections of general chemistry labs, serving 1300 undergraduates. Guiding the 34 graduate student instructors for those labs keeps Poniatowksi busy but he is happy to be back to offering chemistry instruction in person. Once a denizen of these very labs—Poniatowski earned a bachelors of science in chemistry in 2003, he guided the abrupt transition from in person to virtual lab sections during the pandemic.

Poniatowski was recently honored by the College of Literature, Science, and the Arts for his endeavors on behalf of undergraduate education with the 2021 Individual Award for Outstanding Contributions to Undergraduate Education. In the citation that accompanied his award, he is described as patient, thorough, approachable, and professional, "the sort of colleague that prioritizes teamwork and departmental mission above any accolades for himself."

He was nominated for his excellent classroom teaching, caring mentorship of a very large number of students and colleagues, and deep commitment to leadership in curricular innovation, especially in CHEM 125/126. He "designed a curriculum that puts early undergraduate students in positions of responsibility at a level they are ready to handle, introducing them to both social and technical dimensions of the scientific process."

Poniatowski is particularly enthusiastic about the approach taken in CHEM 215 and 216 Honors—an organic chemistry lab with an authentic research design where students "try their hand at a synthesis," he says, that the students themselves designed as part of the class.

"Dealing with ambiguity" as we make new knowledge is a challenge for students, says Poniatowksi. What students learn in class may be new to them. In research, the results are novel all around. "Through research, we are making new knowledge that will eventually end up in the textbooks but right now it is new to everyone. I try to help the students see this. Students need to confront the ambiguity and be comfortable with it," he says. "It is part of the process of becoming an expert in the major."

Over his eight years in the department, the number of majors has increased greatly. He is happy to see so many more students involved in research. He is one of a team of advisors for majors. The chemistry majors are rigorous, Poniatowski explains, but the department is committed to supporting the students to the completion of their degrees. He is gratified that the department has crafted an effective program for advising and mentoring students.

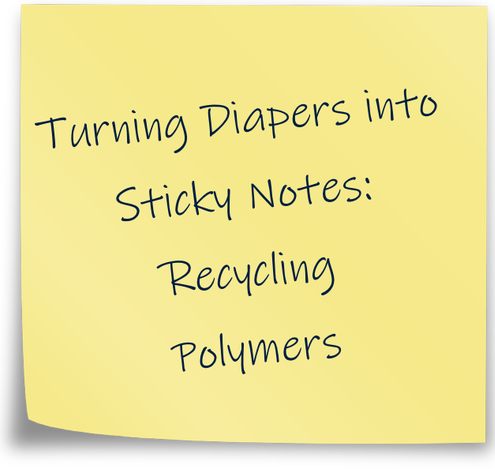
Former students speak of admiring his dedication to students, his "genuine, helpful attitude," his excitement, excellence and respect for everyone. One student summarized: , "[Poniatowksi is a] compassionate, engaging, dedicated, and … exceptional teacher whom I know whole-heartedly cares about his students."

—SuzanneTainter, Chemistry editor

Photos courtesy of the McNeil Lab

Chemistry Community Cleans Up the Huron River Watershed

To raise awareness of plastics pollution and help mitigate the consequences of it, the McNeil Group organized two Huron River Watershed Clean-Up Days. The first was timed to Earth Day in April. Teams collected ~6000 pieces of trash in just 2.5 hrs. The fall edition was even more successful. In September teams collected more than double the amount of trash in nature areas and parks along the river. Teams kept track of the garbage using a debris tracker from the National Oceanic and Atmospheric Administration (NOAA).



In a world dependent on synthetic polymer materials that do not degrade, it is imperative to find innovative ways to recycle or repurpose these materials.

UM researchers, in collaboration with Procter & Gamble (P&G), have identified an energy-efficient way to repurpose a common polymer into another useful material. This opens the door to a new area of research in chemical recycling methods that could reduce single-use product waste and reliance on petroleum for polymer materials. The results are published in an article in *Nature Communications*.

"Superabsorbent polymer (SAP), made with crosslinked poly(acrylic acid), or PAA, is useful because it can absorb 10,000% of its weight in water, but once you use that material and dispose of it in a landfill, it's going to sit there forever," says P. Takunda Chazovachii, lead author on the project, who did this research while a graduate student in the Anne McNeil's group.

PAA is synthesized from the monomer (acrylic acid) to form the polymer that becomes the SAP used in diapers and feminine hygiene products. The global annual production of SAP is over 2 million tons, and about 97% of that is used in baby care diapers, adult incontinence pads, and feminine hygiene products.

P&G wanted to develop environmentally beneficial end-of-life options for SAP—either break it all the way down to a monomer and bring it back up to a polymer to recycle the SAP or repurpose it, McNeil explains.

It was thermodynamically challenging to break the backbone of the polymer down to the monomeric form. Instead, the researchers designed a series of steps to create a different polymer from the original—convert one material into a different value-added material, still a kind of chemical recycling. "We break some bonds to break down the polymer a little bit, make it a bit more soluble, and then we functionalize it," McNeil says.

Inspired by sticky notes

For inspiration, the researchers began looking at other polymers that are made with similar building blocks. "We noted that the monomer that is used to make this polymer, acrylic acid, is also a building block for other polymers," says Chazovachii. "The question we asked ourselves was: 'what if we took the polymerized form of acrylic acid (polyacrylic acid) from the SAP and functionalized it into something that is made from acrylic acid?' In this case, we looked at paints and pressure-sensitive adhesives."

Pressure-sensitive adhesives start with acrylic acid monomers, esterified into alkyl acrylate prior to polymerization. The polymerization of alkyl acrylate is the last step. In this work, instead of polymerizing alkyl acrylate after it has been esterified, the esterification step is performed last, using the poly(acrylic acid) polymer from the diaper materials. Because of this switch, the super absorbent polymer is recycled into a different useful polymer, giving it a second life.

A life cycle analysis showed a 22% reduction in global warming potential and a 25% reduction in cumulative energy demand for the recycling method as compared to the traditional method based on petroleum sources. Chazovachii explains that "it's not enough to just create a recycling pathway; a comparative assessment of the economic and environmental implications of the new methodology versus the conventional will be necessary."

Roadblocks to polymer recycling

The broader implications of this work extend beyond this specific route of repurposing of superabsorbent polymers to pressure-sensitive adhesives.

The researchers have also identified general roadblocks in the field of polymer recycling and investigated solutions to these problems. For example, initial attempts to prepare aqueous solutions with the SAP were not successful due to the superabsorbent properties of the polymer—it simply absorbed all the water. To further complicate the repurposing goal, this polymer is crosslinked, meaning that multiple strands of polymer are linked together. A hydrolysis step resolved both problems. Solutions to these issues could be useful as other researchers look to repurpose other polymers.

P&G affiliate FaterSMART is already collecting and isolating the requisite superabsorbent materials that would otherwise end up in a landfill. Once PAA is isolated, the methods published in the *Nature Communications* article will turn it into the pressure-sensitive adhesives used in tapes, bandages, and sticky notes.

For consumers who may be hesitant about used SAPs ending up in other consumable items, Chazovachii points out that the repurposing method contains harsh conditions that would not allow any bacteria to survive the processing.

There are nearly 2 million metric tons of superabsorbent polymer waste added to landfills each year. This repurposing method could be an industrially scalable and sustainable way to reduce that number by giving SAPs a second life.

Chemical recycling is a relatively small field of study due to the inherent difficulties of breaking down stable polymer molecules, explains McNeil. However, this advancement, with its method development and efficiency, provides some remedies to the issues that are inherent to polymer repurposing and increases visibility to the field.

—Taylor Soucy, SciCommFellow

P. Takunda Chazovachii earned his PhD (July 2021) in the Department of Chemistry at the University of Michigan. Anne McNeil is the Carol A. Fierke Collegiate Professor of Chemistry and Arthur F. Thurnau Professor of Chemistry. This project was performed in collaboration with Dr. Dimitris Collias and Dr. Martin James, scientists from P&G, and with the collaboration of the groups of Paul M. Zimmerman, assistant professor of chemistry, and Jose Alfaro, assistant clinical professor in the School for Environment and Sustainability.

Giving superabsorbent polymers a second life as pressure-sensitive adhesives. P. Takunda Chazovachii, Madeline J. Somers, Michael T. Robo, Dimitris I. Collias, Martin I. James, E. Neil G. Marsh, Paul M. Zimmerman, Jose F. Alfaro & Anne J. McNeil *Nature Communications* 12, 4524 (2021).
https://doi.org/10.1038/s41467-021-24488-9

Photo by Nate May (Pratt lab)

Knowing Snow

An Ilisaġvik College and Michigan Chemistry collaboration leads to an environmental chemistry curriculum that connects academic science with indigenous ways of knowing

As a subsistence hunter, the student knew that caribou sought out snow near sea ice for the minerals it contained. An interview with an Elder in the Iñupiaq community provided knowledge about suitable layers of snow that could be melted to create drinking water during long hunts. The student considered these things when asked to develop a research question to explore in a chemistry class at Ilisaġvik College, a tribal college in Utqiaġvik, Alaska.

Ilisaġvik College students learn general chemistry concepts through a research-based module developed through a collaboration between the college and UM. Associate Professor Linda Nicholas Figueroa, the only science professor at Ilisaġvik College, teaches the module with assistance from UM Chemistry PhD students Jeffrey Spencer and Danielle Maxwell.

Their student drew on this life knowledge to develop a research question focused on differences in chloride concentration in the snow near Utqiaġvik based on proximity to caribou herds and snow depth.

This is one example of how indigenous ways of knowing are shaping a curriculum better aligned to the local community than the traditional western approach to teaching chemistry.

The western approach tends to compartmentalize products and processes, devoid of context and connection to daily life, explains chemistry education researcher Ginger Shultz, a UM assistant professor of chemistry.

The curriculum is being developed within a culturally relevant framework in a partnership of Ilisaġvik College and the UM Chemistry team, and in collaboration with the Iñupiaq community.

It got its start with Kerri Pratt, a UM associate professor of chemistry, who for more than a decade has been conducting field research in Utqiaġvik on the chemical interactions between the Arctic snow, sea ice, and atmosphere. Her projects get logistical support from the local Iñupiaq community. She discussed with local science liaison to the community Kaare Sikuaq Erickson ways to better connect with the community.

Pratt has brought her interest in snow chemistry back to UM classes through the authentic research experience lab that teaches traditional lab skills through the process of answering the students' questions about what ions are found in snow collected from the Arctic. Class final projects include explaining their research in a science poster session, a typical way that scientists transmit knowledge to their peers at science conferences.

When Erickson suggested partnering with Nicholas-Figueroa at the Arctic college, Pratt brought the idea to Shultz, as a chemical education expert to document the process of developing the curriculum, thinking they might learn things others could use.

This is how Shultz's group got involved in developing a curriculum that was respectful of Iñupiaq ways of knowing and that fit Nicholas-Figueroa's approach to teaching.

At Ilisaġvik College they collaborate with Nicholas-Figueroa and Daniel Wall, an anthropologist who helps the students learn how to respectfully interview community elders. Pratt and the Iñupiaq community are also part of the collaboration.

The unit focuses on snow chemistry and processes relevant to Arctic climate change and the lives and culture of the people of Utqiaġvik. Through a process of iteration, the curriculum has developed over the last several years and has been used in a first-semester general chemistry course, an introductory climate change course, and an introductory-level chemistry and society course.

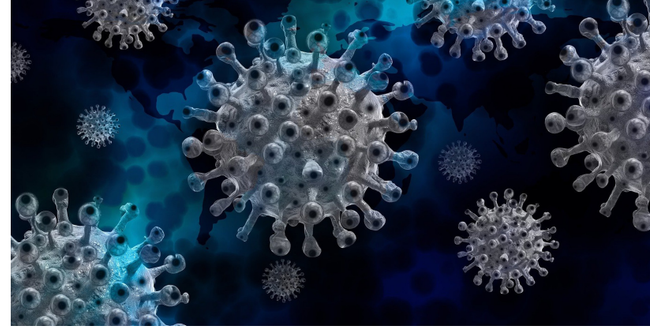
As a final project, teams of students construct presentations telling the story of their research project to be shared with the community. Finally, students reflect on their experiences with the project, what they learned, and changes they would make to guide future students in their projects. In recognition of the role of oral storytelling as a traditional way that the Iñupiat educate their young and how students interact outside of the classroom, the curriculum team has switched the reflections on the class to emphasis verbal rather than written reports.

The experience of working with a different culture and community to think about science teaching has shaped the way Shultz approaches her own research. "I am thinking not just about the concepts but more about the people on the other end of what we do. Who is our research impacting? Culturally responsive education is expansive and inclusive. How do we bring students into the process?"

—SuzanneTainter, Chemistry editor

Learn more about how the curriculum was developed: *Journal of Chemical Education* (2021) Cultural Relevance in Chemistry Education: Snow Chemistry and the Iñupiaq Community. Spencer, Jeffrey L.; Maxwell, Danielle N.; Erickson, Kaare Ray Sikuaq; Wall, Daniel; Nicholas-Figueroa, Linda; Pratt, Kerri A.; Shultz, Ginger V. doi.org/10.1021/acs.jchemed.1c00480

Students Drive Research Pivot to Find COVID-19 Treatments



Other UM Chemistry researchers with SARS-CoV-2 research include Ryan Bailey, Kristin Koutmou, and Corey Stephenson. Read more on the Chemistry website.

When the world was upended by COVID-19 and laboratories across campus swiftly shut down, researchers had to adapt to new ways of working. This has also affected what research directions they choose.

One challenge is to develop an effective treatment for COVID-19—the aim of one collaborative effort by Department of Chemistry research groups headed by professors Charlie Brooks, Anna Mapp, Corey Stephenson, and Matt Soellner.

They turned their attention to a relatively obscure human protein, TMPRSS2. This protein had no known function in the body but, last year, researchers demonstrated that it helps the SARS-CoV-2 virus to infiltrate healthy cells. During a Brooks group journal club meeting, graduate student Amanda Peiffer proposed studying TMPRSS2 because, if it were deactivated by a drug, it could prevent SARS-CoV-2 infection without disrupting healthy biological processes.

Graduate student Yujin Wu joined Peiffer to computationally model the 3D structure of TMPRSS2 and to study how its structure would change when exposed to 3D models of known drug molecules. By studying these structural changes in virtual, 3D space, Wu could screen thousands of known drug molecules in a relatively short time and identify which ones would likely deactivate TMPRSS2. The most promising drug candidates from the computational screen were then chosen for laboratory testing.

Peiffer, who is co-advised by Professor Anna Mapp, also recruited graduate student Julie Garlick to help evaluate promising drug candidates in the laboratory. To test for TMPRSS2 deactivation, they first needed to make and purify TMPRSS2, which was a different type of protein than they were used to working with. Garlick then developed an assay to detect TMPRSS2. The assay would fluouresce—light up—when when active TMPRSS2 was present. If a given drug caused a decrease in fluorescence that would indicate successful deactivated theTMPRSS2.

These combined computational and experimental efforts have led the team to identify several drugs with potential to treat COVID-19.

"It was this thing that we had dreamt of back in April and there really wasn't a lot of literature on this protein," Peiffer recalls. "Looking back a year later there is a lot out there. And I think that's been one of the really exciting things, seeing our initial hunch was right!"

For Brooks, the new project was an exciting opportunity to refine his group's computational expertise while addressing an urgent problem. "Every time there is a challenge that comes up like this, it can force you to really test and mature the methods that you're developing in the group," Brooks says. "I saw this as an opportunity to accelerate a lot of development that may have gone more slowly if it wasn't directed to a specific aim."

The researchers were excited to work on challenges that were so tied to daily life in this crisis.

"It was in the news and everybody knew about it, so it was really hard not to read about it," Garlick explains, "Amanda and I thought similarly—this is an issue in our field, maybe we could have an impact."

"To get to apply everything that we had learned, even if it was on different problems and was with different tools, to actually have it be applicable to something so relevant, has just been amazing," Peifffer added.

—Emily Mueller, SciComm Fellow

Learning to RELATE

RELATE—Researchers Expanding Lay-Audience Teaching and Engagement— as of 2021 has trained hundreds of graduate students and early career researchers to address the challenges of science communication. Originally formed to fill a need identified by two neuroscience graduate students, RELATE is a completely volunteer-run program with funding of space and equipment rentals from UM Rackham Graduate School.

One UM Chemistry-affiliated RELATE alum is Dr. Isabel Colón-Bernal *(PhD 2019, Banazsak Holl)*. She participated in the 2018 RELATE program and later joined the coordinating committee as an organizer and teacher. Colón-Bernal now uses her written and verbal communication skills in her day-to-day job as a contractor, performing digital content management at Thermo-Fisher Scientific. While the skills taught in RELATE focus mainly on oral presentation, she has eas-

Continued on page 14

Beautiful Discoveries

LSA is full of laboratories where professors and students research the most fundamental aspects of the natural world. Professor of Chemistry Bart Bartlett is one of four LSA professors who discuss the nuances of "basic science," and show that it's far from basic

"What other people feel standing on the top of the mountain, I get from looking inside a cell," says Gyorgyi Csankovszki. "Nature is beautiful at the maximum scale but also at the microscopic scale."

Csankovszki, a microbiologist and Arthur F. Thurnau Professor in the Department of Molecular, Cellular, and Developmental Biology (MCDB), finds this swell of feeling from the work of basic science: a specific kind of research that aims to refine our understanding of natural phenomena for its own sake rather than for a specific purpose or application. …The motivation, she says, is curiosity. "I go in the direction of answering a question. I don't focus on if it will be useful in the future," she explains.

This type of exploration is the foundation of the world's most powerful discoveries, and for Csankovszki that process is filled with joy. "Frankly, the greatest secret in our job is we get paid to play in a sandbox."

Not So Basic

Research like Csankovszki's exists across the natural sciences in LSA, in MCDB as well as the departments of chemistry, physics, and mathematics. And while it's central to LSA's mission, culture, and many of its transformative scientific innovations, understanding just what exactly basic science is is not so simple.

"It's a really broad question," says Bart Bartlett, professor of chemistry. "Basic science says, 'I'm going to start with a system that I can imagine, that I can test in the lab, and ask some really simple questions that I know I can directly answer.'

"The key to the scientific method," he continues, "is that every good hypothesis should be directly testable. Whether it works as planned or it doesn't, there's still knowledge that's gained in the process, and there's value in having that knowledge. It sets up what the next questions are." For Bartlett, basic science means using the scientific method to identify big questions. The questions identified by basic science may not solve humanity's problems by themselves, but they certainly advance knowledge towards solutions.

In Bartlett's lab, for example, he studies how to take solar energy and convert it into chemical energy. "Lots of people are familiar with the idea of a solar cell that you put on your rooftop that does a great job of converting sunlight into electricity," Bartlett explains. "We want to go one step further and use that electricity to do chemical reactions." To do this, they use a process called artificial photosynthesis.

"Plants take sunlight and water and breathe in carbon dioxide and breathe out oxygen. We'd like to take in sunlight and water, and maybe even carbon dioxide, to make liquid fuels that give off oxygen," he explains. "Most people want the fuel, but the harder chemical reaction is actually turning water into oxygen, and that's where I've spent a lot of my career."

For nuclear physicist and LSA physics professor Christine Aidala, the pursuit of knowledge inherent to basic science is part of our nature. "Desire for knowledge is part of what makes us human," she says.

… "Asking why we do research is like asking why an artist paints," says Sarah Koch, Arthur F. Thurnau Professor of Mathematics. "Math research comes from wanting to understand the world we live in. The research I do is basic in the sense that its questions are simply stated and very accessible. You don't have to have a super advanced math degree to jump in and do your own experiments."

Pure Curiosity

Articulating the wonder inherent to their work can be challenging for basic scientists, especially when it can't be couched in a practical application. "I often have a hard time when people ask what I do," says Csankovszki. "…I find it surprising that I have such a hard time conveying the excitement of finding things out just for the sake of knowing them."

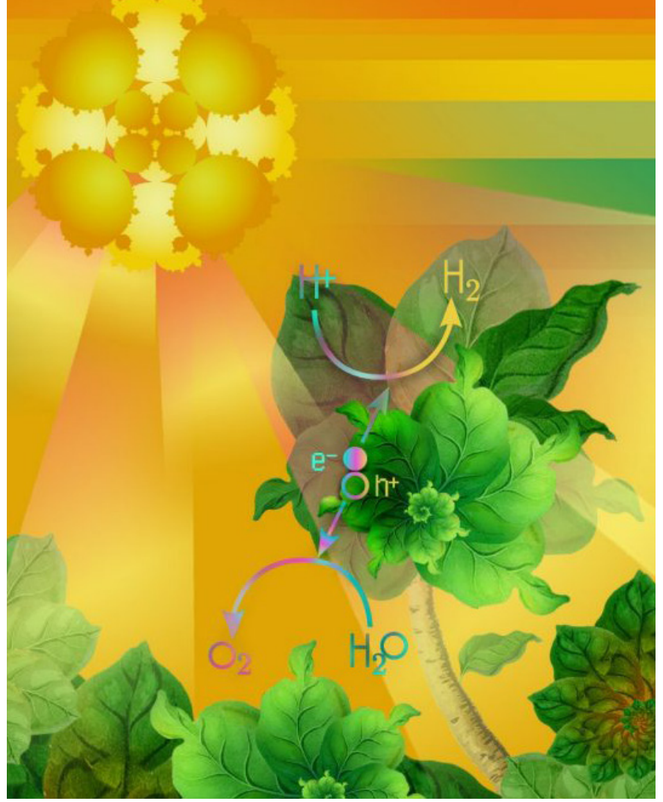
That kind of excitement makes its way into the classroom, also. For these research professors, teaching and mentoring are as fundamental to their work as conducting experiments. "My job is to provide the environment for students to be creative. I really need their contributions in the lab," says Bartlett. "But what drives me is working with students and seeing them grow, develop, and learn as scholars in and of their own right. That's much more valuable than any individual discovery that comes out of the lab."

…"A place like LSA is where basic science should be," Csankovszki says. "When you are looking to answer questions and pursue knowledge, that's what we do in a liberal arts education."

"I was doing an experiment with one of our undergrads, and before we looked at the results, I said to her, 'Do you realize that you are going to be the first person in the world who will know the answer to this question?'" Csankovszki says. "She had wonder in her eyes, and then I got excited. Even if it's a tiny scientific advance, that's an incredible feeling."

—Anna Megdell, LSA writer

This is an abridged version of an article that appeared in the Spring 2021 LSA Magazine online.



Professor Bart Bartlett uses artificial photosynthesis to study how to convert solar energy into chemical energy. For him, basic science research is a way to advance knowledge to solve some of the world's toughest problems. Illustration by Julia Lubas

Department of Chemistry work was featured in LSA Magazine online.

Get the whole story at: lsa.umich.edu/lsa/news-events/magazine.html

The Wow Moment, Remote
Expanding the Laboratory

LSA is filled with lab courses that transitioned remotely during the pandemic, relying on creativity, fortitude, and a knack for experimentation. Here are Department of Chemistry stories of how students and professors adapted to the remote world.

During the 2020-2021 academic year, Nicholas Cemalovic, an LSA junior studying chemistry, worked as a teaching assistant in introductory chemistry classes, leading discussion sections of larger lectures. As a student himself, Cemalovic was able to encourage and relate to his students as they navigated remote learning. "Students build their confidence in those lab sections," he says. "You're fully allowed to make mistakes, ask questions, and try again."

Cemalovic says the main objective of the class was getting comfortable in the lab, especially while conducting experiments. When class went remote, the course pivoted to focus on data analysis. With the students at home, Cemalovic and other instructors would run experiments in the lab, collect data, and send measurements to their students. This allowed students to focus on discovering patterns in large swaths of data, which are more complicated and often contain inconsistencies. "They weren't able to collect the data themselves, but it's the data interpretation that's most important," Cemalovic says. "We always forget that."

Nathaniel Szymczak, associate professor of chemistry, took a similar approach. He taught an upper-level chemistry course designed to allow students opportunities to explore advanced experimentation techniques. "It's their time to move beyond formula-based experiments into owning an experiment, coming up with their own testable hypothesis, going into the lab, and figuring out what works," he explains.

This proved difficult when his class was fully remote at first, then in a hybrid setting with a lower capacity of students allowed in the lab. "Luckily I have curated datasets from prior experiments that students could access," Szymczak explains. "I tried to stress that even if their experiments didn't go perfectly, they could still interpret data and analyze hypotheses."

To encourage a sense of exploration and connection with the scientific process, Szymczak emphasized the skills that students can take out of the lab and into the workforce. "A huge aspect of the class is writing. Even if we can't run an experiment how we'd like, we can instruct students how to write about it," says Szymczak "They need to be able to communicate what they're doing to the public. It's one of the most important skills students can get before joining the workforce."

For Szymczak, the demands of teaching experimental chemistry in a largely remote setting reminded him of something essential: "We've learned that we'll do whatever we need to, no matter what."

—Anna Megdell, LSA writer

This is a sidebar from a larger article, "The Wow Moment, Remote" in LSA's Fall 2021 Magazine

How did one biodiversity class in the Department of Ecology and Evolutionary Biology (EEB) adapt their lab work remotely? Creativity, technology, and a giant toad.

RELATE continued from page 12

ily translated them to other aspects of communication to benefit her career. "Learning how to get my message across concisely has been so important," she said. She says that participating in RELATE gave her an opportunity to expand her communication comfort zone. "We can make our research fun and relatable to real life… There is always a way that you can spice it up or simplify it to make your audience understand a little bit better."

Emily Mueller, a 2019 RELATE alum and current co-coordinator on the RELATE leadership team, is a fifth-year chemistry PhD candidate in the McNeil Lab.

As chemists, it's extremely important to gain science communication skills to convey the importance of the work, she says. "There's the negative perceptions of chemistry and 'chemicals' in the public eye… or people remember that one chemistry class that they took was really hard. Chemists do a lot of really important and fundamental work by understanding things on a molecular level, and so I think it's really important for us to be able to communicate the value and the benefits of this work to society."

Moving to virtual due to the COVID-19 pandemic

The coordinating team thought that the highly interactive nature of RELATE might be difficult to translate over web conferencing. However, Mueller says, "a really nice benefit of this virtual format is that we aren't confined by physical limitations, like the space of how many people we can have in a room on campus. Last year, we had a larger cohort than we ever had previously!"

Despite the change in format, 2020 RELATE virtual participants Claire Cook (Bailey lab) and Lirong Shi (Chen lab) say they both gained essential skills in communication by participating in RELATE.

Cook, who works on developing microfluidic tools to improve epigenetic tests, says "I've always been interested in teaching, and I wanted to improve my skills to be able to communicate what I do." After participating in RELATE and making a video about her research, Cook joined the coordinating team. "I just got more passionate about the idea of scientists really being able to be equipped with tools to effectively communicate whatever they're doing, and why a broader audience should care about it."

Shi, who studies surface chemistry and spectroscopy, says that "ultimately, science serves the public good… [we want] to help people understand what we are doing and build trust between scientists and the public." The YouTube video that Shi made as part of RELATE was the first video she ever made so she says that this experience was highly rewarding. It helped her to visualize her research and make it more accessible to the public, she says.

Mueller notes that this experience not only improved her ability to talk about her research to those outside of the science community, but also improved her scientific presentation skills. Colón-Bernal shared the same sentiment, having participated in the RELATE curriculum the summer before her final year of her PhD, she explains that it was extremely helpful in framing her narrative for her dissertation defense. "We all want to tell our story [of our PhD] in chronological order and that's not always the best way to do it… Finding a more appropriative narrative for your thesis is so important."

Participating in the RELATE summer curriculum is a sizable commitment but Cook explained that the investment in one's communication skills is certainly worth the time. "The overarching thing for me is that if you can't communicate what you've done, there's really no point," she says, adding that "I think everyone could probably benefit from having more of a framework for how to think about communicating to people from various audiences."

—Taylor Soucy, SciCommFellow

Annual Summer Symposium Covers Department Research

Michigan Chemistry's annual Karle Symposium was held on July 31, 2021 in a hybrid format. Every year the event is organized by graduate students and features research from across the department.

The 2021 keynote lecturer was Stuart Conway, professor of organic chemistry, University of Oxford.

Mehran Arbab, PhD, Global Director, Aerospace Materials Science and Technology, PPG Industries Inc., presented the plenary lecture, "Materials Science for Sustainability." Nine student talks covered the range of fields in the department. Two poster sessions were held over the lunch break.

Biosketches of the invited speakers and abstracts of all the talks and posters are available on the Karle Symposium website.

This year's chairs were Gloria Diaz and Phoenix Williams. Twenty-two chemistry graduate students formed the symposium organizing committee. Faculty advisor was Paul Zimmerman.

Sponors were PPG, Dow, the Department of Chemistry, and Chemistry Graduate Student Council.

Follow plans for our annual summer events in 2022 at these websites:

sites.lsa.umich.edu/alum-num/
sites.lsa.umich.edu/karle-symposium

Alum|NUM | URAN|UM

For the second time in its seven-year history, the annual alumni-graduate student networking event was held virtually. Alum|NUM, which stands for the "Alumni Networking at the University of Michigan," started off with an panel of alumni working in industry: Kwan Leung (*PhD 2020, McCrory*) at Intel; Xianouyn Chen (*PhD 2007, Chen)* at Dow; and Nick Miller (*PhD 2019, Sension*) at First Solar. The afternoon session featured alumni in academia: Amanda Cook (*PhD 2015, Sanford*) at University of Oregon; Jeremy Feldblyum (*PhD 2013, Matzger*) at SUNY Albany, and Allison Roessler *(PhD 2020, Zimmerman)* at Oglethorpe University.

Zoom breakout rooms provided the traditional in-person workshops for CV/Resume improvement and Speed Interviewing, and a virtual networking session paired up students and alumni to chat.

Throughout the day, more than 60 undergraduate, graduate students and postdoctoral scholars attended.

Alum|NUM committee volunteers were Brady Anderson, John Andre, Gloria de la Garza, Derek Du Bois, Yilin Han, Kristine Parson, Stefani Schmocker, Taylor Soucy, and Emily Wearing.

In parallel with the alumni networking event, graduate students organized URAN|UM [undergraduate research and networking at UM] that connects students from primarily undergraduate institutions across the midwest with UM graduate students, postdoctoral fellows, faculty, and alumni. Their goal is to empower undergraduates to pursue graduate degrees.

The day included panels on applying to graduate school and what it was like to be a graduate student led by Emily Wearing and Kristine Parson. The panelists were:

- Graduate School Application Process Panel: Michael Lengel, Dominique Blackmun, Chae Kyung Jeon, Mario Gaviria.
- Life in Graduate School Panel: Madison Knapp, Danielle Maxwell, Carolina Rojas Ramirez, Maiko Lunn.

The event also included virtual one-on-one resume and cover letter workshops for each undergraduate with a graduate student or postdoctoral volunteer.

Undergraduates shared their research through a virtual poster session. Schools represented in addition to UM were Concord University, Duquesne University, Eastern Michigan University, Franciscan University of Steubenville, Grand Valley State University, Hope College, Kalamazoo College, Oglethorpe University, Slippery Rock University, St Mary's College of Maryland, UM-Dearborn, University of Minnesota Morris, Westminster College, and Wittenberg University.

Stefani Schmocker served on the organizing committee with Parson and Wearing. Corteva Agriscience provided funding for the event.

commUNITY

first annual symposium held

A student-run organization called commUNITY, established in 2020, held its first annual CHEM|UNITY Symposium in March 2021. The organization aims to create a collaborative and sustainable community among all the various parts of Michigan Chemistry—undergraduate and graduate students, postdoctoral fellows, faculty, staff, and alumni.

It advocates for students who have joined the department, with a focus on those who identify as Black, Indigenous, and People of Color (BIPOC).

Materials PhD student Taylor Bramlett was a founder of the organization and is now serving as president. We asked her to tell us more about the event.

"The goals of the symposium are to:

- highlight science conducted by the BIPOC community and allies to inspire our BIPOC community,
- provide an opportunity for BIPOC professionals to add presentation experience to their CV and aid in their professional development,
- give commUNITY members the opportunity to stand out regarding their research,
- address institutional racism through discussions in an effort to enhance the inclusivity of our department,
- offer a platform for professional development of all of our students, with special attention to those in the BIPOC community,
- and normalize the appearance of the BIPOC community as speakers and innovators in science."

In total about 60 people attended the virtual symposium, from all segments of our faculty, graduate and undergraduate students, and alumni.

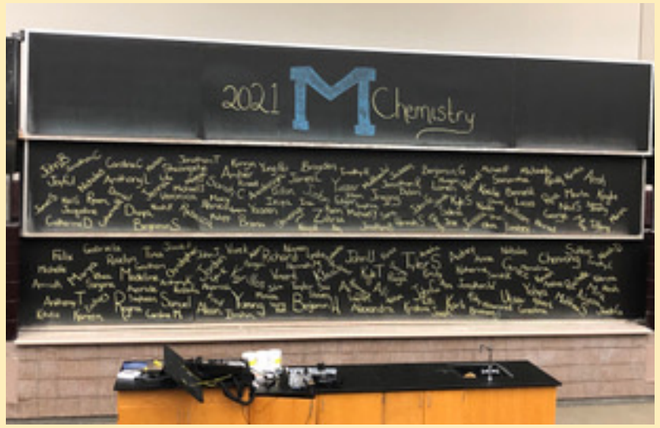
"We are invested in the social, academic, and professional well-being of our members and strive to support them through all aspects of their journeys as scientists, scholars, and beyond," Bramlett added.

The current eboard consists of: President Taylor Bramlett (*5th year PhD, Materials*), VP Maribel Okiye (*4th year PhD, Chemical Biology*), Executive Secretary Carolina Rojas Ramirez (*5th year PhD, Analytical*), and Programing Director Matthew Culberson (*3rd year PhD, Organic*).

Through knowledge and support, commUNITY members hope to build a foundation of trust, bridge the racial gap, and recruit more underrepresented minority chemists who excel academically and succeed professionally.

Follow commUNITY on social media.
Twitter: @commUNITYUMChe1
Instagram: community_umich

Welcome to the newest alums of Michigan Chemistry!



For our virtual celebrations around commencement in May, 2021, Lecturer Kathleen Nolta wrote the names of all our 202 bachelor's degree graduates from the last year on the chalkboards in 1800 Chemistry. It is the largest lecture hall on campus, which we call our "big house," and where every student with a major in our department has spent time in many a lecture.

PhDs Awarded

Fall 2020

Ansel, Annabel Quinlivan Montgomery
Nitrile-Directed C-H Functionalization and Lewis Acid-Catalyzed Oligosaccharide Synthesis

Breuhaus-Alvarez, Andrew G Bartlett
Influence of Electrolyte on the Stability and Activity of WO3 for Photoelectrochemical Oxidation Reactions

Frank, Amie Montgomery
Metallacycle-Based Nickel-Catalyzed Reductive Couplings and Reductive Cross-Electrophile Couplings

Holland-Moritz, Daniel Aaron Kennedy
Innovations in Droplet Microfluidics for Enzyme Evolution

McLean, Alan Michael Kopelman
NanoBioPhotonic Platforms for Nanotherapy and Nano-Imaging: Polymer-Encapsulated Metal Clusters, Plasmonic Nanosnakes, and Targeting Enhanced Nanosystems

White, Corey J Lehnert
Modelling Flavodiiron Nitric Oxide Reductases: Geometric and Electronic Structure of Key Intermediate and Mechanistic Insights

Winter 2021

Aguilera, Ellen Sanford
Development of Palladium-Mediated Transannular C--H Functionalization Methods for Alicyclic Amines

Becker, Marc Rudolf Schindler
Development of New Methods Involving Strained Heterocycles

Chapman, Cole Alexander Bailey
Clinical Diagnostics For Immune Response Assessment Through Multiplexed Biosensor Immunoassays In At-Risk Populations

Connor, Megan Shultz
Teaching and Learning 1H Nuclear Magnetic Resonance Spectroscopy

Dandpat, Shiba Walter
Mechanism of Transcription and Translation Regulation by Riboswitches in Bacteria

Diffley, Kelsey Anne Fierke
Regulation of Activity and Selectivity of Histone Deacetylases

Di Mauro, Giacomo Ramamoorthy
Lipid-Nanodiscs Formed by Paramagnetic Polymers for Fast NMR Data Acquisition

Dodson, Ryan Adam Matzger
Solvent Effects in Metal-Organic Framework Activation, Resolvation, Synthesis, and Linker Exchange

Eshun, Audrey Veronne Goodson
Investigations of Organic Molecules Using Entangled Photons as a Novel Spectroscopic Tool

Medfisch, Sara Marie Bailey
Optimization of Nanodisc Array Generation on Silicon Photonic Microring Resonators for Lipid-Protein and Membrane Protein-Protein Interaction Characterization

Mordan, Emily Bailey
Addressing Common HPLC Detector Challenges Using Silicon Photonic Microring Resonators with Applications for Polymer Separations and More

Mulvihill, Ellen A Geva
Simulating Electronically Nonadiabatic Dynamics via the Generalized Quantum Master Equation

Nie, Weixuan McCrory
Designing Novel Molecular Catalyst Systems for Electrochemical CO2 Reduction with High Activity at Low Effective Overpotentials

Olson,Nicole Ault
Microscopic and Spectroscopic Analysis of Atmospheric Aerosols from Organic and Freshwater Sources

Orlet, John David Bailey
New Interfaces to Silicon Photonic Microring Resonator Arrays for Chemical Separations

Tolbert, Audrey Elizabeth Pecoraro
Fully Selective Pb(II) Templated Heterotrimeric Redox and Hydrolytic Metalloenzymes

Wells, Shane Kennedy
Improving Sensitivity and Throughput for Bioanalytical Measurements with Mass Spectrometry using Microfluidics and Online Sample Preparation

Zhao, Chunyi Ruotolo
Development of Collision Induced Unfolding for the Study of Large Multiprotein Complexes

Spring-Summer 2021

Bornowski, Evan Clay Wolfe
Palladium-Catalyzed Alkene Difunctionalization Reactions: Synthesis of Functionalized Carbocycles and Mechanistic Investigations

Burdick, Ryan Kristopher Goodson
Developing Entangled Two-Photon Absorption for Unique Control over Excitation of Organic Chromophores: An Experimental and Theoretical Approach

Chazovachii, Takunda Banaszak Holl & McNeil
Valorizing and Remediating Synthetic Polymers with Tenacious Backbones

Cheek, Quintin Maldonado
Understanding Nucleation and Growth of Crystalline Germanium Through in-situ Studies of the ec-LLS Technique

Dong, Hai Thanh Lehnert
Synthesis and Reactivity of Non-Heme Iron-Nitrosyl Complexes that Model the Active Sites of NO Reductases

Fejedelem, Zachary Nagorny
Synthesis of Cardiotonic Steroids Oleandrigenin and Rhodexin B and Studies Toward the Synthesis of Bufalin

Garlick, Julie Marie Mapp
Innovations in Targeting Dynamic Proteins With Small Molecule Modulators

Harris, Justin Trammell McNeil
Designing Cellulose-Based Adsorbents For Water Remediation

Kim, Jinhee Banaszak Holl
Hierarchical Detection and Assessment of Material Fatigue Damage of the Human Anterior Cruciate Ligament caused by Repetitive Sub-maximal Mechanical Loading

Kim,Jinhee Chen
Hierarchical Detection and Assessment of Material Fatigue Damage of the Human Anterior Cruciate Ligament caused by Repetitive Sub-maximal Mechanical Loading

Lopez Bermudez,Beatriz Pecoraro
Development of Luminescent Dendrimeric Metallacrowns from Lanthanide-based Metallacrowns

McClain, Edward John Stephenson
Synthetic Studies of Photochemical Radical Generation from N-(acyloxy)pyridinium Salts

McDonald, Kori Bartlett
Non-Hydrolytic Synthesis of Visible Light Active Stable Metal Oxides and Metal Oxide Coatings for Fuel Forming Reactions

Pein,Wesley Montgomery
Design and Synthesis of Nickel N-Heterocyclic Carbene Catalyst Systems and Their Application in the Cross-Coupling of Silyloxyarenes

Pyser, Joshua Narayan
Chemoenzymatic Synthesis of Azaphilone Natural Products

Quevedo, Shannon Phelan Bailey
Organic Phases In Microfluidic Systems: Enabling Real-Time Sensing of Small Molecules

Riordan, Colleen Bailey
Developing Microfluidic Devices for the Optimization of Nanodiscs to Measure Membrane Protein Structure and Function

Salerno, Elvin Pecoraro
Synthetic and Spectroscopic Investigations of Ligand Field Effects in Molecular Lanthanide Ion Complexes

Sorensen, Matthew John Kennedy
Ultrahigh Pressure Capillary Liquid Chromatography-Mass Spectrometry for Metabolomics and Lipidomics

Stanford, Kevon Mapp
Using Peptidomimetics to Dissect Activator-Coactivator Protein-Protein Interactions

Sun, Siyuan Nagorny
Design, Synthesis, and Applications of Chiral Spiroketal (SPIROL)-Based Ligands

Vallejo, Daniel Ruotolo
Development of Ion Mobility-Mass Spectrometry as a High Throughput Assay for Biotherapeutic Characterization

Master's Degrees

Chemistry now offers a stand alone master's degree and a research-based master's degree as part of the Accelerated Degree Program, which includes an extra year after the bachelor's degree.

Aguirre, Anna Li
Postmaa, Alexander J
Ren, Jiayu
Shen, Jiaqi
Spoto, Anna
Wagstaff, Sarah
Whalen, Matthew
Wolfe, Joshua

Alumni News

Nicholas Ball *(PhD 2010, Sanford)* was a recent speaker at the department as part of an Abbvie seminar event. He has been promoted to associate professor at Pomona College.

Charles G. Chavdarian *(BS 1971)* has been honored as a 50 year member of the American Chemical Society (ACS). After graduating from UM he earned a PhD in organic chemistry at UC Berkeley working with Clayton Heathcock and did a post-doctoral fellowship at UC San Francisco Medical Center, Department of Pharmaceutical Chemistry with Neal Castagnoli. He spent 30 years in the pharmaceutical industry, where he worked on 15 drug products that were approved by the FDA and commercialized. He is coauthor of over 35 publications and patents. Currently he is semi-retired and is a part-time consultant in the pharmaceutical industry. He lives in northern California.

Michael Christie *(BS 1974)* After graduation from UM, he obtained a PhD in organic chemistry from MIT in 1978, working with Jack Baldwin. He retired from full-time work 3 years ago. Mike spent 40 years in the pharmaceutical industry, all in chemical process R&D. His career included research on a lab and kilo lab scale, ten years in support of full-scale production at SmithKline Chemicals, and most recently as Senior Director of Chemical Process R&D at Teva Pharmaceuticals. He founded Cauldron Process Chemistry, a contract services company, that was acquired by ChiRex and later by Rhodia. For the past three years, Mike has served as a consultant primarily to early-phase pharmaceutical companies who lack internal process chemistry resources and who need assistance selecting and managing contract organizations for their syntheses.

Mike writes that he credits the broad undergraduate training he received at UM with his success both in graduate school and subsequent career. He further acknowledges that his senior research with Professor Richard Lawton cemented his love of synthetic organic chemistry. Mike encourages students with a passion for synthetic chemistry to consider a career in process chemistry, where finding the solution to a problem can be enormously satisfying. Mike lives near Valley Forge, PA with his wife Jean, where he enjoys staying in shape, motorcycling, and sporting clays [clay pigeon shooting spread out over a large course].

Roman Davis *(MS 1974)* has been honored as a 50 year member of the ACS. He spent the years 1989-2013 at Glaxo/Glaxo Wellcome/Glaxo Smith Kline. When he retired in 2013 he was the Director, API [active pharmaceutical ingredient] Supply, Early Development of GSK. He now consults for the Male Contraception Initiative, specifically on selecting non-hormonal new chemical entities for conversion to orally bioavailable pro-drugs.

Russell R. Dickerson *(PhD 1980, Stedman)* is Professor, Department of Atmospheric and Oceanic Science and affiliate Professor, Department of Chemistry at the University of Maryland, College Park. His research interests are broadly based on atmospheric chemistry, air pollution, ocean-atmosphere interactions and global biogeochemical cycles. After graduation he spent several years as a postdoctoral fellow working with Paul J. Crutzen (Nobel Laureate, 1995) in the Air Chemistry Division at National Center Atompsheric Research and subsequently in the Abteilung Luftchemie at the Max Planck Institute in Mainz, Germany.

Marion Emmert *(Post-doctoral 2009-11, Sanford)* has been promoted to Principal Scientist in Merck's Rahway catalysis group.

Howard Friedman *(Post-doctoral 1975-77, Ashe)* writes of his memories of Tom Dunn. "My first encounter with Dr. Dunn was in the early 1970s when I was pursuing my PhD in the Chemistry Department of New York University. Tom was a guest speaker during the regular Friday afternoon seminar program. I do not recall the topic of his talk but I vividly remember his broad Australian accent and slicked back hair. Little did I think that I would meet him, again.

Tom was the chairman during my tenure in the Michigan chemistry department. Like the other members of the faculty at that time, he could have not been nicer to someone just starting their career in chemistry.

When it came time for Lori and me to leave Ann Arbor and start my first industrial job, we needed funds for the first month's rent and deposit for an apartment. At that time, the department maintained the Moses Gomberg Fund which provided low interest, short term loans to graduate students and postdocs. Lori and I went to see Tom and asked for an advance from the Fund. We will never forget Tom saying "You do not want to do that." He then took out his checkbook and wrote us a personal check for $500. All he asked is that we repay him when we could, which we did soon thereafter. That was Tom Dunn. It is 44 years later and I still recall his kindness."

We'd like to hear from you!

Share a memory of your time at Chemistry! Which faculty made a lasting impression on you? What was your favorite spot on campus? Send us highlights of your days at the University of Michigan and what you have you done since?.

Send a note to the Department of Chemistry,
930 University Ave., Ann Arbor, MI 48109-1055
Or email the information to chem.alum@umich.edu.

John A. Gladysz *(BS 1971)* has been honored as a 50 year member of the ACS. He holds the Dow Chair in Chemical Invention at Texas A&M University. He writes: "Being reminded that I am a 50 year ACS member takes me back to when I first joined, which occurred during the first 1-2 months of 1970 when I was taking chemistry 294/295 (honors organic) from Dan Longone. At that time, getting reduced journal subscription prices was a major impetus for joining the ACS. So I enthusiastically signed up and promptly subscribed to *J. Org. Chem*. But when I bought the issues in to Longone's research lab, I was advised that *J. Am. Chem. Soc.* was the place for aspiring young chemist to begin. So I immediately added a second subscription.

This anecdote takes me full circle to my present work with undergraduates. Of course, my graduate students do nearly all the supervision, but I've had an excellent run of undergraduate coworkers the last few years. In 2020 I received the Texas A&M College of Science Undergraduate Research Mentoring Award. Although there are many professors who have been much more prolific mentors, I have published 30 papers with undergraduate coauthors during these 50 years, and a total of 90 have worked in my group, with about half going on to graduate school or careers in chemistry. So the one research paper that I had with Longone and the entirety of my great experience at Michigan has leveraged itself many-fold in subsequent years with students at four different institutions—UCLA, University of Utah, University of Erlangen, and Texas A&M."

Michael D. Gordon *(BS 1972)* retired in 2005 after 22 years in Texas as a Senior Scientist with Johnson & Johnson Medical, focused on aldehyde-based instrument disinfectants, and then as a healthcare industry consultant. After graduation, he did his Ph.D. work with Louis Quin, then the Chemistry chairman at Duke University, before starting his career in organometallic chemistry R&D with M&T Chemicals in New Jersey, where he met his wife. He enjoyed a long-overdue visit to the UM campus in on the first day of class in August, having lunch and a tour of the "new" Chemistry building with Professor Arthur J. Ashe, III, who advised his senior research project on "Bismabenzene and The Reaction of Group V Heteroaromatic Compounds with Hexafluorobutyne." He fondly recalls shenanigans with his UM Chemistry classmate John Gladysz, and taking difficult pop quizzes involving "road map" syntheses given by Daniel Longone in Honors Organic Chemistry. He now enjoys golfing and volunteering at professional and college golf tournaments, as well as supporting the student-athletes in the women's and men's golf programs at Michigan and Duke.

Katherine Henzler-Wildman *(PhD 2003, Ramamoorthy)* has been named as the Jean V. Thomas Professor of Biochemistry at the University of Wisconsin, Madison.

Rui Huang *(PhD 2014, Ramamoorthy)* is a tenure-track Assistant Professor of Chemistry at the University of Guelph, ON, Canada.

Charles M. Kausch *(PhD 1989, Ashe)* has started a new position as a research chemist with APG Polytech.

Melissa Lee *(PhD 2018, Sanford)* has joined the Pfizer Co. in Groton, CT.

Christian Malapit *(Post-doctoral 2011-16, Sanford)* will become an Assistant Professor of Chemistry at Northwestern University starting in January 2022.

Joy Racouski *(PhD 2011, Sanford)* has joined EMD Electronics as a Quality Process Improvement Engineer.

Lidaris San Miguel Rivera *(PhD 2008, Matzger)* is recipient of the 2021 HENAAC Award for Professional Achievement Level I. She is a chemist and senior scientist in Dow's Silicone business. Since joining Dow in 2008, she has used her Chemistry expertise and personal drive to lead the development of many unique, innovative solutions across a diverse set of chemistries and applications.

Christo Sevor *(Post-doctoral 2014-17, Sanford)*, an Assistant Professor at Ohio State University, Department of Biochemistry and Chemistry, has won a DOE Early Career Award.

Anuska Shrestha *(PhD 2020, Sanford)* has joined Nura Bio, a biotech company in South San Francisco.

Kara Stowers *(PhD 2018, Sanford)* has been promoted to Associate Professor of Chemistry at Brigham Young University.

Joe Topczewski *(Post-doctoral 2013-15, Sanford)* has joined Corteva Agriscience.

Ester Wertz *(Post-doctoral 2011-15, Biteen)* has been promoted to Associate Professor with tenure in the Department of Physics, Applied Physics, and Astronomy at the Rensselear Polytechnic Institute, Troy, NY.

Ren Wiscons *(PhD 2019, Matzger)* has started her first semester as an Assistant Professor of Chemistry at Amherst College, Amherst, MA.

In Remembrance

Laurie MacDonald

Laurie MacDonald, *Chemistry Environmental Health and Safety Specialist,* passed away on February 15, 2021 at age 63. Laurie began at the Department of Chemistry in 1996. As an Environmental Health and Safety Specialist, she facili-

tated the safe removal and disposal of chemical waste from the teaching and research labs in the Chemistry Building. The volume of chemical and hazardous waste in the building nearly doubled in recent years, yet Laurie handled the challenge with grace and humor, and with curiosity about the new research undertaken.

Laurie would train all the new students and new building occupants on hazardous waste disposal and shipping. She got to know many of the graduate students, post doctoral researchers, and research staff, and they would look forward to talking with her as she went about her duties.

When our research labs closed in March 2020 for COVID, and were able to re-open in late May, Laurie was so excited to be able to come back to work and see all of the researchers again. The graduate students in particular told us that seeing Laurie back in the building once we re-opened, reassured them that things were getting back to "normal," at least on the research side.

As part of the Chemistry Facilities team, Laurie would offer to help out whenever and wherever she could. She kept updated certifications in First Aid, CPR, and defibrillators in the event that she needed those skills to help someone in need as she went about her duties.

Laurie is survived by her mother, two sisters, and a nephew. She was predeceased by her father and two brothers.
See: www.sullivanfuneraldirectors.com/obituaries/Laurie-Macdonald/ —*submitted by Jan Malaikal, chief administrator, Department of Chemistry*

Paul R. Challen

Paul R. Challen *(PhD 1990, Coucouvanis)* died on August 8, 2020 of cardiac arrest at his home in Ohio. He earned a BS in Chemistry from Oxford University and taught high school chemistry in Europe for several years before coming to the United States. He earned his PhD in inorganic chemistry under the supervision of Professor Dimitri Coucouvanis in 1990. His thesis was entitled, "Sulfide Coupling Reactions in the Synthesis of New Iron-Sulfur and Iron Molybdenum-Sulfur Complexes."

Dr. Challen joined the Chemistry Department of John Carroll University, University Heights, OH in 1990. He regularly taught courses in General and Inorganic Chemistry. He served as the chair of the Chemistry Department from 2001-2005. He also developed an independently funded research program based on the synthesis of new compounds with applications in catalysis and materials with novel electronic and magnetic properties.

Lenore (Lennie) Damrauer

Lenore (Lennie) Damrauer *(BS 1963)* died in Denver on November 21, 2020 at the age of 77. She was born in New York City in 1943 and received her BS from the UM in 1963 and her PhD from Boston University in 1968, both in chemistry.

Lennie taught at University of Colorado Denver 1969-1982. She was subsequently employed by Microproducts/Wellspring Data 1982-4 and 1985-87, McDonnel Douglas Communication 1984, Horizon Data 1987-88 and Children's Hospital of Denver 1988-2009. She returned to CU Denver 2013-20 where she worked in the registrar and admissions offices.

She is survived by her husband Robert, sons Craig and Niels, and four grandchildren.

Maria Cecilia Espada Torre

Maria Cecilia Espada Torre *(PhD 1996, Meyerhoff)* passed away peacefully at her home in San Jose, CA, on Thursday, August 12, 2021, after a long battle with breast cancer. She was surrounded by her two sons (Luis and David) and her husband (David) at the time of her passing. Cecilia grew up in Mexico City and graduated Summa Cum Laude with B.S. in Pharmaceutical Chemistry from the National University of Mexico in 1988. She moved to Ann Arbor in 1989 and received her M.S. in Pharmaceutical Chemistry in our School of Pharmacy in 1991. Cecilia then pursued a PhD in our Chemistry program, conducting research in Prof. Meyerhoff's laboratory. Her efforts resulted in 6 publications (four as first author) that focused on developing novel materials/chemistries to create more biocompatible chemical sensors for both in vitro and potential in vivo sensing applications. She was the lead author on the first report of using nitric oxide (NO) releasing polymers to create more thromboresistant ion-sensors (JACS, 1997), which led to an R01 NIH grant on this concept to improve the in vivo performance of implantable chemical sensors (this grant was renewed multiple times and lasted some 20+ years).

After graduation, Cecilia moved to California, where she worked as a scientist at a couple of biotech companies and at the Advanced Drug Delivery Department at Stanford University. Motivated to have a more direct influence on society, Cecilia obtained her Teaching Credential from San José State University and went on to build a career as a Chemistry High School Teacher, inspiring many students to pursue degrees in chemistry. Cecilia was also very proficient at playing the piano and was a supporter of the arts by generously donating to Opera San Jose, the Vivace Youth Chorus, and the San Jose Youth Symphony.

During the last stages of her disease Cecilia regretted that she would miss her sons' weddings, but she died in peace knowing that she would meet her creator in a place where there is no pain or sorrow. Cecilia left us much too soon but her legacy as an outstanding/creative chemist, and as a source of love, goodness and wisdom, will live on forever.—*Submitted by Mark Meyerhoff*

William (Bill) C. Kaska

William (Bill) C. Kaska *(PhD 1963, Eisch)* died on May 31, 2021 in Santa Barbara, CA from complications of Alzheimer's Disease. Professor Kaska was born in the Panama Canal Zone in 1935. He attended Canal Zone schools and graduated from Balboa HS. He received his BS in Chemistry in 1957 from Loyola University in Los Angeles and his PhD in Chemistry from UM in 1963. After spending a year as a post-doctoral fellow at Pennsylvania State University Bill joined the chemistry faculty at the University of California in Santa Barbara (UCSB) in 1964. He remained at UCSB for his entire career, retiring in 2004.

Professor Kaska took sabbatical leaves working with Dr. Ludwig Maier at Monsanto in Zurich, Switzerland and Professor Hans Bestmann at the University of Erlangen, Germany. He also collaborated extensively with Ekkehard Lindner and Hermann Mayer at the University of Tuebingen, Matthias Haenel at the Max Planck Institute in Mullheim and Gerard Van Koten, University of Utrecht.
Kaska's principal research efforts were on the syntheses and chemistry of transition metal organometallic complexes. He was particularly known for his work on PCP-pincer ligand complexes. His research has been summarized in over 120 scientific publications.

He met his wife Deborah (Drew) Kaska at UM where she was working on an undergraduate project in the same lab where Bill was doing graduate research. He is also survived by his son Serge, daughters Kathleen Perez, Marya Darabont, Kristen Woolley and seven grandchildren.

Ernest F. LeVon

Ernest F. LeVon *(MS 1957, PhD 1959, Elderfield)* died at the age of 89 on January 13, 2021 in Evanston, IL. He was born in Chicago and attended public schools there. He earned his BS in chemistry in 1954 from the Universi**ty of** Illinois at Urbana-Champaign and his PhD in organic chemistry under Professor Robert Elderfield. Following graduation from the UM Dr. LeVon was hired by G. D. Searle Pharmaceutics of Skokie, IL. He spent his entire career with Searle, where he was ultimately Manager of Chemical Development of the NutraSweet Division. He had coauthored 64 patents. Dr. LeVon is survived by his wife Elizabeth Stegner, sons Peter, Paul and Steve and stepson Bernhard Asher. **See:** *C&EN Obituary, April 12, 2021.*

Forest A. MacKellar

Forest A. MacKellar *(PhD 1974, LeQuesne)* died on January 1, 2021 from Alzheimers/Dementia at Arbor Hospice, Saline, MI. He was born in Kalamazoo, MI on August 27, 1931. He served in the US Air Force 1953-1958. After his military service, he earned a bachlelor's degree from Western Michigan University where he also taught mathematics. He received his PhD in analytical chemistry from the UM in 1974. He spent his career working as an analytical chemist in pharmaceutical chemistry for the Upjohn Corporation, General Mills and Parke Davis-Warner Lambert (now Pfizer Pharmaceuticals).

He was predeceased by his wife of 62 years, Barbara Joan MacKellar, and is survived by his three sons, Michael, Mark and David and three grandchildren. See: *Ann Arbor News Obituary, January 17, 2021.*

John C. Rosemergy

John C. Rosemergy *(BS 1943)* died in Fort Worth, TX on April 2, 2021. He was born in Rochester, MI on April 8, 1921 and attended public schools there. Following his undergraduate work at Michigan, he attended officer training at the US Coast Guard Academy and was commissioned as an Ensign in the Coast Guard Reserve in December 1942. He saw active duty in the Pacific during WWII after which he remained in the US Coast Guard Reserve for 38 years, ultimately commanding a reserve unit in Detroit and retired as a Captain.

John returned to the UM following WWII. He earned teaching credentials and three graduate degrees, MBA, MA and PhD in Science Education. He began his career a teacher at Grass Lake, MI high school. After four years he was hired by the Ann Arbor Public Schools where he had a long career as a teacher and scientific educator. He served as Coordinator of Science Education K-12, Director of the Argus Planetarium and taught science education at the UM during several summer sessions.

John retired in 1989 and he and his wife Margaret Lindsay moved to Fort Worth, TX. She predeceased John in 1994 after 49 years of marriage. For a complete list of survivors see**:** *Ann Arbor News* obituaries, April 8, 2021.

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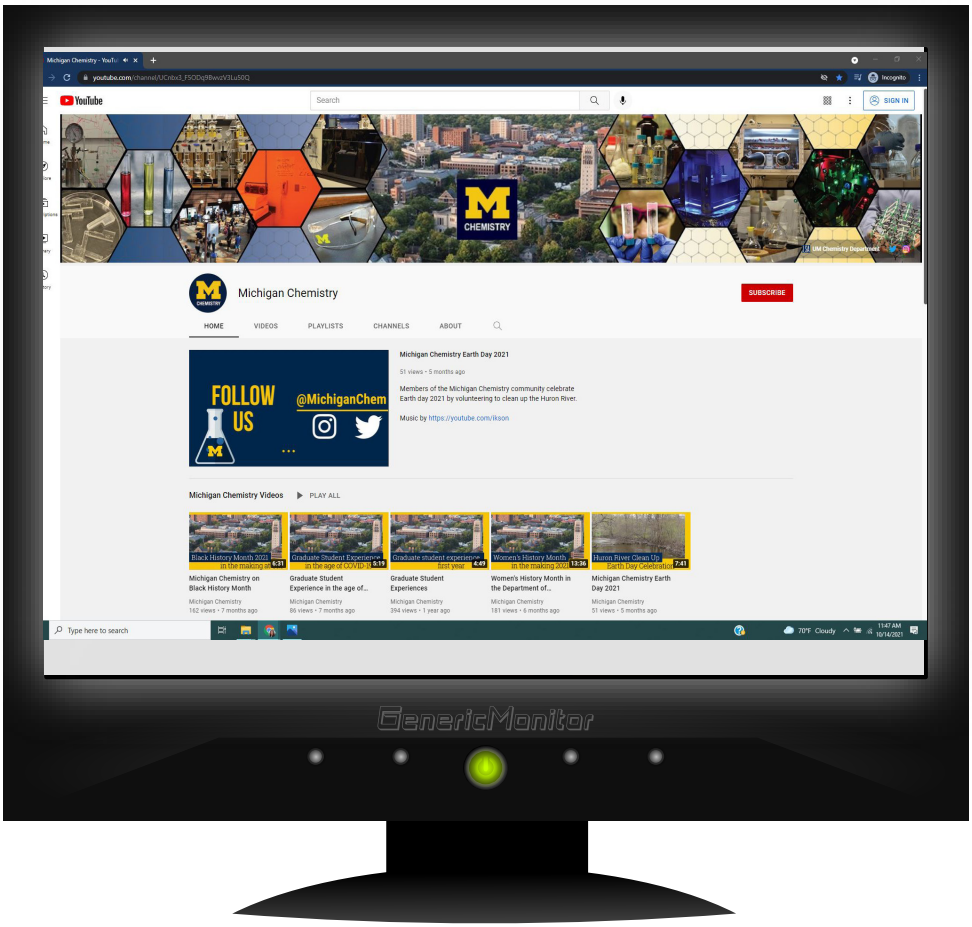

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