



CHEMISTRY

GOESSMANN GAZETTE

The Novel Coronavirus

Research and Teaching During a Global Pandemic

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College of Natural Sciences
Chemistry

THIS ISSUE

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J. Chen Dark Side of Amyloid Aggregation
Min Chen Detecting Foodborne Disease
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DV Artificial Energy for Muscle
You New DNA-based Probe
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Lexus Freitas Innovation Challenge
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Dear Alumni and Friends of UMass Chemistry,



This has certainly been an interesting year in which to be a Department Head! On Friday the Thirteenth of March, the day before Spring Break, UMass decided to switch entirely to remote instruction starting right after the break. Faculty and staff had a week to shift to online teaching. Through a lot of hard work, perseverance, and ingenuity we made it work. I was greatly impressed by the adaptability and resilience of our students, who quickly mastered online labs and lectures, and enthusiastically participated in virtual awards and graduation.

On-campus research, which was nearly halted, has gradually ramped up. Chemistry faculty have started new, collaborative projects to rapidly detect SARS-CoV2. After considering many options, UMass is holding most classes remotely this Fall, with only “essential” classes in person. In our department, the Organic, Physical Chemistry, and Instrumental Analysis labs are in person, with everyone wearing face coverings, goggles and face shields. We are excited to be teaching this Fall, now that we’ve had time to prepare for on-line instruction.

We welcome three new faculty to the department this Fall. Assistant Professor Zhou Lin will teach physical chemistry and run a research program developing and applying quantum chemistry techniques to study and design materials with novel catalytic, optical, and magnetic properties. Lecturers Haoze He and Armanda Formigao Gameiro will teach Organic and General Chemistry Labs, and the General Chemistry lectures, respectively.

The excellence of our faculty and students continues to be recognized. Sankaran ‘Thai’ Thayumanavan was promoted to Distinguished Professor. Senior Lecturer Lara Al-Hariri won the CNS Outstanding Teaching Award and Prof. Lila Gierasch won the CNS Outstanding Research Award. A special issue of *Peptide Science*, edited by Prof. Gierasch, honored the work of the late Prof. Lou Carpino. Isabella Jaen Maisonet (BS, 2020) received an NSF Graduate Research Fellowship, William Johnson (BS, 2020) was selected as one of four “Rising Researchers” on campus, and graduate students Haneen Mansoor and Emily Smith received PPG Fellowships.

In order to thrive, our department must be diverse and inclusive. We are continuously working to be more welcoming and accessible for under-represented students and faculty, and to recognize the contributions of diverse members of the Chemistry community. These initiatives include the *Out in STEM* seminar organized by Prof. Michelle Farkas, graduate recruiting and training via the ACS Bridge program, and recognition of the research of people of color in our department. In this issue we recount the significant contributions of Dr. Brandford Giddings, Sr., a pioneering Black alumnus.

Finally, we continue to be deeply grateful to all of you who have contributed so generously to our department over the years. Your gifts are invaluable towards providing scholarships to students and improving our teaching and research facilities. With your support, we will forge ahead, advancing the frontiers of knowledge and continuing to train top-notch scientists!

Sincerely,



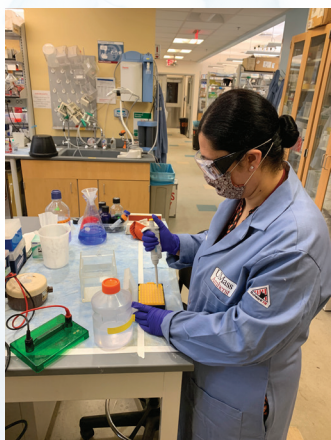
Ricardo Metz, Head of Chemistry

COVID -19 Pandemic Research and Teaching

How do you teach, or more perplexing, conduct research when you aren't supposed to leave your home?

This was the situation the majority of students and faculty in our department found themselves in this past March. As parts of the country were just starting to react to the pandemic, our chancellor and local and state government officials took swift and decisive action in an effort to contain the virus. It was a forward-thinking approach that wasn't necessary well-received until the realization about how the (not yet proclaimed) pandemic was impacting the globe, and that our "normal" would be gone for the foreseeable future. March 13th, the Friday before Spring Break, was the last day of face-to-face instruction when all faculty, students and staff were together conducting classes and research as usual. All UMass personnel, except those designated as "essential," were instructed to work remotely from home. While the pandemic has thrown a wrench into the lives of every member of our department, it has been heartwarming to see the creative solutions that department members have undertaken to lessen the impact of the COVID-19 pandemic.

Setting up the entire department to work remotely with less than a week's notice was a truly formidable task, but one that the department's innovative and dedicated IT team achieved. During the quarantine period, one might imagine that research would grind to a standstill — it was nearly impossible to find personal protective equipment (PPE), campus mail service was suspended, buildings on campus were locked. Fortunately, "essential research" with skeleton crews was allowed to continue. Even after permission was granted to some researchers, it was not clear how researchers would get the supplies they needed. Once again, resourcefulness in the department was on display as Ryan Feyrer sourced hand sanitizer from a local manufacturer in Orange, MA, Marvin Ellin was able to obtain face masks from abroad and Robert Sabola used his personal auto to collect packages containing research reagents and deliver them to our research labs.



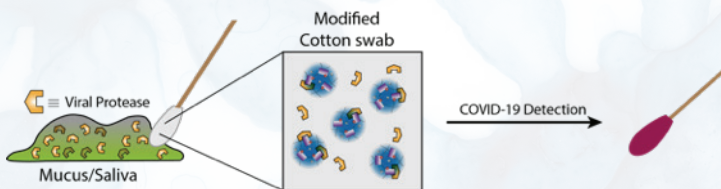
Graduate student Sparsh Makhaik from the Hardy lab

Lab members in our department donned comfortable, effective — and yes even cute — face masks in a wide variety of prints (made by volunteers in the theater department) as they began looking for solutions to the pandemic, trying to help as their expertise allowed. Steve Acquah, Research Associate Prof. of Chemistry, worked with the Digital Media Lab as part of the UMass Amherst COVID-19 Response Teams, leading efforts to produce

3D printed PPE. He reports "Our 3D print farm of fifty 3D printers was used to produce components for over 2000 face shields. We worked with community volunteers to assemble the 3D printed headbands with clear plastic visors and delivered the completed face shields to hospitals and care facilities, including the Soldiers' Home in Holyoke."

Prof. Igor Kaltashov reasoned that it would be ideal to find a currently approved drug that could be repurposed to fight COVID-19. As an expert in the mass spec-based analysis of glycosaminoglycans, some of which are approved drugs, he began applying his expertise to search for a COVID treatment. Some glycosaminoglycans impact cellular entry by other coronaviruses. His lab has begun experiments to identify how approved drugs may be used to prevent viral entry and thus block the SARS-CoV-2 life cycle.

Profs. Trisha Andrew, Jeanne Hardy, and S. "Thai" Thaymanavan pooled their experimental expertise, designed a project, and were awarded an NSF grant to work toward a rapid test to detect SARS-CoV-2, the virus that causes COVID-19. Their test relies on detection of the protease, which is a protein cutting enzyme from SARS-CoV-2. The team has designed and is in the process of synthesizing a new substrate that is clear prior to protease cleavage, but turns bright pink after cleavage.



Members of the Wearable Electronics lab, directed by Andrew, have shown that this substrate can be incorporated and immobilized onto a cotton swab. Provided that the protease levels in SARS-CoV-2 infected individuals are sufficiently high, it ought to be possible to detect viral presence by oral application of the derivatized swab. The team recognizes that even if this test is not developed in time to combat COVID-19, the technology will also be applicable to the next viral pandemic the world faces.

While some research was allowed to continue, teaching in the chemistry department was turned on its head. During the second half of the spring semester all courses occurred in an on-line format, a situation for which faculty had only one week to prepare. Faculty, staff, and students faced the challenge of caring for and overseeing the education of their own children while running labs and teaching lectures remotely or performing their work without adequate internet or access to on-campus materials. Students in laboratory courses were only able to conduct the data analysis, but not the data collection part of their experiments. Many undergraduates swiftly switched their research approach from bench-top experiments to computational approaches to continue to make research progress. In spite of these challenges, we succeeded in completing spring semester.

The Class of 2020 was the first in University history to conduct an online style graduation and departmental awards ceremony. Students were congratulated by star-studded video greetings from Ben Affleck, Rachel Maddow, astronaut and UMass Amherst alumna Katy Coleman, and Governor Charlie Baker. Brigitte McKenna and Lorraine Cox also organized an outstanding virtual graduation celebration to honor each departmental graduate individually.

On May 27th, laboratories were able to reopen at 25% occupancy enforcing social distancing measures and enhanced cleaning protocols. Laboratories now look somewhat normal, but a closer inspection sees that all researchers are wearing face coverings — some of which are fashion statements. Arrows on the floor (like those in local grocery stores), direct traffic flow within the laboratories. Students have been required to abandon their desks inside the laboratories and work in remote locations or off campus if not actively involved in experimentation. Desks have been moved to hallways, conference rooms have been turned into computational spaces and the tiny cubical-like offices in LGRT, which have never before been in such high demand, are now prime real estate as they offer a private, physically distanced place to work on campus while experiments are being run.



Ann Fernandez (Thai group) following arrows, Manisha Shivrayan (Thai group), and Rehab Heikal (Strieter group).

Large research groups within the department have been forced to undertake advanced scheduling techniques. Some laboratories have divided the day into three periods and the research group into three teams, so researchers only interact with members of their 8-person team, limiting likelihood of viral spread. The campus has also instituted a remote buddy system so that these schedules and low occupancy can be adhered to. When asked about the impact of COVID-necessitated changes to their research approach, one faculty member said “We are dedicated to maintaining physical distancing and other protocols so our students can work safely, but we are also trying to get something done in the lab. It feels a bit like running with a parachute attached to your back.” Other graduate students reported that they really miss seeing classmates, and meeting and getting to know new faculty and students. There is a loss of collegiality that is difficult to overcome even with technology on our side.

Other members of the department saw some silver linings to the pandemic-induced changes. A student noted that everyone has been very healthy, “People stay home when they are sick and no one in our lab has even gotten a cold, let alone COVID.” Other students stated that wearing masks was not a “big deal.” Students are required to decontaminate all surfaces after they are used and have found a silver lining in the labs and lunchrooms being “a whole lot cleaner.” One student noted that scheduling had made the biggest impact on his research. “I now have more time to read and think.” He said, “I plan much more specifically before I do something, which has made my success rate higher. It has also made me more productive because I have to do the experiment when I signed up to because I know that my turn to use that piece of equipment may not come up for several days or more.”

As we approached the fall semester we were hopeful that many of our students could be allowed safely on campus. Not long before the start of the semester, with rising case reports across the country, we learned dramatically fewer students would be allowed to return to campus. All lecture courses at the graduate and undergrad level are now being conducted in a remote manner. Even general chemistry labs are being conducted remotely, using simulations and examples. Students in required face-to-face courses and those conducting research on campus visit the Mullins center for COVID testing twice weekly. In contrast, upper level chemistry labs such as Organic, Physical and Quantitative Analysis labs are being conducted face-to-face. The labs have been de-densified to promote physical distancing and all students wear face masks, face shields, goggles, and gloves at all times while in the laboratories. Prof. Ruthanne Paradise has made gigantic strides in adapting the laboratories she leads to a remote format. As of this fall, all of the instrumentation in the Physical and Analytical Chemistry labs can be controlled remotely. Thus, even if we are forced to return to exclusively remote instruction, students can still perform *bona fide* experiments.

After five months spent with all meetings on Zoom, and with near half of the entering graduate class unable to enter the country due to travel restrictions, members of the department have found ways to use many on-line platforms to promote more “personal” interactions. During graduate student orientation the Chemistry Department Graduate Chemists Association morphed the annual fall social to an on-line speed Meet and Greet with a bingo game designed to get to know each member of the incoming graduate class. The Association for Professional Development in Chemistry (APDC) planned and executed a fully on-line ResearchFest. This required thinking how to do *everything* remotely. In the end, the event was a huge success, including four talks, a keynote speech from Rajdeep Kalgutkar from 3M (an alumni of the UMass Chemistry Lahti lab) and more than 45 poster presentations.

While we would all love to see life return to “normal,” we are gratified and proud of members across the department who continue to make our new reality the best it can be.

Equity, Diversity, and Inclusion

We are committed to supporting diversity, equity, and inclusion within our department, college, university, and community. Our Equity and Diversity Committee meets regularly to discuss ways of integrating the core tenet of diversity. Building a truly equitable and inclusive department requires continuous reflection and advancement. Recruiting and maintaining the most possible diverse group of students, staff, and faculty enhances our learning and working environment by bringing the broadest array of perspectives, talents, and ideas together.

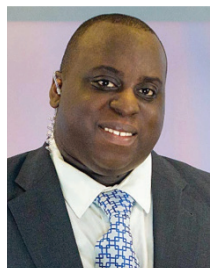


Out in STEM (and Elsewhere) by Michelle Farkas

On February 6th, the department hosted its first LGBTQ+ Diversity Seminar in Chemistry, entitled “Out in STEM (and Elsewhere): What Does it Mean, and Why Does it Matter for Everyone.” In the wake of recent articles in *Chemical & Engineering News* (see “Coming Out in Chem Class” from June 2019) and elsewhere, the word is out that “the lack of LGBTQ+ representation in science has real consequences: queer students have a harder time identifying as scientists and are more likely to leave these fields.” But furthermore, we as a department recognize that we all play a role in the culture and climate of the university. Whether as an instructor, teaching assistant, student or col-

league, mentor or labmate, how we all interact with each other is critical in making UMass a more welcoming and supportive place for all, both within and outside of the department.

To a packed audience filled with faculty, students, and staff, the seminar provided a venue for dialogue and discussion, in a safe space for everyone. At the core of the event was a presentation given by Chemical Engineering Graduate Student Sanket Sabnis that included an introduction to LGBTQ+ terminology and background on domestic and global statistics, as well as recommendations on how to interact with others without pre-determining their statuses. Chemistry department faculty and graduate students also spoke, sharing their own personal experiences. The event concluded with a lively discussion/dialogue driven by the audience, who were eager participants. Following the seminar, a well-attended brain-storming lunch followed, which included members of the department's Equity and Diversity committee, students, faculty, staff, and members of oSTEM (an LGBTQ+ student group at UMass, geared towards those in the sciences and engineering). This has led to a multi-faceted effort to include further diversity elements as part of departmental programming and activities.



A Voice for Diversity in the Sciences – The Research Art Science Exhibition (RASE) by Steve Acquah

I was thankful to have been recognized by the Royal Society of Chemistry as one of the ‘175 Faces of Chemistry’ both past and present, who have helped to shape chemistry and science. The recognition also highlights diversity in the chemical sciences, identifying role models, champions, and ambassadors for the next generation of chemists. Others in the 175 Faces of Chemistry list included: Rosalind Franklin, Adrian V. Stokes, Alfred Nobel, Michael Faraday, Alexander Borodin, and Marie Curie. I have continued to be a voice for diversity and inclusion through outreach activities, including Buckyball workshops and ‘hands-on’ laboratory internships for high school students.

At UMass Amherst, the Campus Climate Improvement Grant provided an opportunity to create the Research Art-Science Exhibition (RASE), highlighting the rich diversity of the students in the College of Natural Sciences in collaboration with the Digital Media Lab in the Du Bois Library and the GEOSSET initiative. Undergraduate and graduate students, especially underrepresented students, were encouraged to create an artistic representation of their research work that could be produced as a picture to be mounted and displayed in the Digital Media Lab. During the opening event, students stood by their artwork and talked to the visitors about their research, giving them the opportunity to engage with the campus community.

The 2020 Research Art-Science Exhibition was postponed due to COVID-19, but I created a virtual 3D exhibition based on the exhibits from last year. This immersive virtual construction preserved the work of the students and provided an opportunity to revisit the exhibition. The 2019 virtual exhibition can be viewed at <https://simmer.io/@GEOSSET/rase-2019>



Annual Cultural Luncheon held in the Chemistry Resource Center

Annual Cultural Luncheon

The Equity and Diversity Committee sponsors multiple events aimed at building bridges between people of all backgrounds, and the Annual Cultural Luncheon gathering, celebrating people and food from around the world, is one example. The lunch is held in November, typically during the university's Thanksgiving Break, with faculty, staff, and students coming together to enjoy a variety of food and conversation. The committee organizes the event with the chemistry community working together to make it a treasured congregation of people and cultures.

faculty Highlights

Acquah Team Second Place in Nobel Laureates Sciathon



During the first 48-hour Sciathon hosted by the Council for the Nobel Laureate Meetings, **Steve Acquah**, the UMass Amherst Libraries Digital Media Lab coordinator and Associate Research Professor of chemistry, worked as part of a team (Group Clifton) to develop a science news verification tool, **authentiSci**. The Clifton group became finalists at the end of June and were recently awarded second place in the category of 'Lindau Guidelines' and a shared prize of 1,000 Euros. AuthentiSci can be accessed through the website authenticsci.com and will primarily be used through a Google Chrome Extension, which is now available at the Chrome Web Store. The extension is one of the first of its kind that gives scientists the ability to score science news stories, providing a measure of confidence for the reader.

Al-Hariri Receives CNS Outstanding Teaching Award

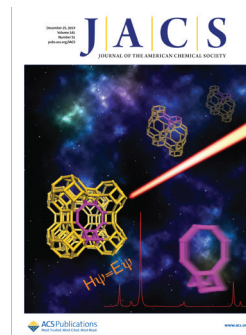


Professor **Lara Al-Hariri**'s ability to inspire her students and help them to appreciate General Chemistry and Organic Chemistry in a way that few others can was emphasized in her nomination letter. Al-Hariri regularly teaches two 300-student sections, doing an outstanding job teaching students which range from science majors to engineers to nursing students to students in public health. It is incredibly difficult to effectively reach students from these different backgrounds, especially with notoriously dreaded courses like Organic Chemistry, but Prof. Al-Hariri is able to do so while making it look easy. In addition, as Director of General Chemistry and via her pioneering work on electronically-delivered exams (eExams), she indirectly influences the education of thousands more students, including almost all of the majors in CNS.

"It is an honor to have received this award in the shadow of the current global pandemic. As a chemist, I have always wanted to be the catalyst that brings the best out of students, helping them to reach their maximum potential. My focus is on fostering the development of skills that establish a foundation for their careers by teaching them 'how to think' rather than 'what to think.' I love creating an engaging learning environment using the best inclusive teaching practices that advance the curiosity for class activities and helps them relate the course material to their experiences. My philosophy involves teaching using innovative, evidence-based methods paired with empathy to show them that I sincerely care about their commitment to higher education." – Lara Al-Hariri

Auerbach Discovers New Building Blocks of Zeolite Nanopores

In an article published in the *Journal of the American Chemical Society* (and featured on the Dec 26, 2019 journal cover), Prof. **Scott Auerbach** and collaborators from UMass Amherst and WPI have discovered new building blocks that they call "tricyclic bridges," which help to explain structures and vibrations of zeolites.



Zeolites are the most used catalysts by weight on planet earth, but the synthetic pathways leading to their crystallization remain poorly known. Raman spectroscopy of zeolites has been useful for shedding light on structures that exist in zeolite crystals and during crystallization. Despite the importance of understanding Raman spectra of zeolites, it is often assumed with little evidence that Raman bands can be assigned to individual zeolite rings. Auerbach and co-workers tested this assumption through an integrated synthesis, spectroscopy, and modeling study, finding the critical role of new building blocks they call "tricyclic bridges" — collections of three zeolite rings connected together. Using this new concept, Auerbach and coworkers discovered a precise relationship between zeolite bond angle and Raman frequency that can be used to pinpoint structures that form during zeolite crystallization.

"This breakthrough is important because it gives us a way to see the invisible — precise structures that lead to zeolite crystals," says Auerbach. "We hope such structural insights will help us to synthesize new, tailor-made zeolites for advanced applications in clean energy and carbon capture."

In future work, Auerbach and his team plan to measure and model Raman spectra during the zeolite crystallization process, to determine which tricyclic bridges are present and become inherited by the resulting zeolites.

Computational Techniques Developed to Explore 'The Dark Side of Amyloid Aggregation in the Brain'



Alzheimer's disease has been intensely studied for decades, but too much is still not known about molecular processes in the brain that cause it. Professor **Jianhan Chen** says new insights from analytic theory and molecular simulation techniques offer a better understanding of amyloid fibril growth and brain pathology.

Chen notes, the "amyloid hypothesis" was promising — amyloid protein fibrils are a central feature in Alzheimer's, Parkinson's disease and other neurodegenerative diseases. "But the process is really difficult to study," he says. Chen and first author **Zhiguang Jia**, a research scientist in Chen's computational biophysics lab, explored how building-block peptides

form fibrils. “We are really proud of this work because, to the best of our knowledge, for the first time we have described the comprehensive process of how fibril growth can happen. We illustrate that the effects of disease-causing mutations often arise from the cumulative effects of many small perturbations. A comprehensive description is absolutely critical to generate reliable and testable hypothesis,” he adds. Details of their multi-scale approach with many atomistic simulations are in *Proceedings of the National Academy of Sciences*.

New Technology to Detect Foodborne Disease



Matthew Moore, Food Sciences, and **Min Chen**, Associate Professor of Chemistry, received USDA grant to develop new technology and evaluate a portable sensing device capable of both identifying and subtyping foodborne pathogens, including bacteria and viruses.

Moore says: “One of the major elements to control these pathogens is the ability to rapidly and portably detect them. Dr. Chen has developed an extremely promising sensing platform that has shown great results for clinical applications, and we hope to translate that progress to pathogenic microorganisms.” Chen and Moore seek to apply sensing/subtyping platforms for foodborne pathogens in the field since the technology developed by Chen has the potential to be used with a smartphone.

Farkas Named Scialog Fellow



Research Corporation for Science Advancement (RCSA) has named **Michelle Farkas**, Chemistry, one of 13 new Fellows for its Scialog: Chemical Machinery of the Cell (CMC) initiative.

Co-sponsored by RCSA and the Gordon and Betty Moore Foundation, Scialog:

Chemical Machinery of the Cell aims to catalyze breakthroughs in our understanding of chemical processes in the living cell that will lead to a new era of advancement in cell biology.

Scialog is short for “science + dialog.” As part of each multi-year initiative, a diverse and inclusive cohort of Fellows is selected from multiple disciplines and institutions across the U.S. and Canada to maximize creative thinking and innovative ideas.

Gierasch Named CNS Outstanding Researcher

We are pleased to celebrate Prof. Lila Gierasch’s 2020 College of Natural Sciences Outstanding Research Award. Prof. Gierasch’s work to uncover the molecular basis of protein

folding has been recognized by a number of awards including membership in the National Academy of Science and the American Association for Arts and Sciences. Her work has been supported by a number of prestigious grants from the NIH, including the Pioneer Award and MIRA. Prof. Gierasch is also the Editor-in-Chief of the longest running and most important journal of its kind, *The Journal of Biological Chemistry*.

Over her long and productive career, Prof. Gierasch has asked and answered fundamental questions about how a protein achieves the correct structure when it is first synthesized as well as how proteins are directed to the proper intracellular location after synthesis. She has also contributed important insights into how molecular chaperones — protein machines that help proteins attain or regain the proper structure — do their work. Her work on one of these folding machines, HSP70, has revealed how ATP binding is communicated across the protein and allosterically regulates substrate folding.



While much of her work focused on protein folding inside test tubes, over the past decade Prof. Gierasch was one of the first scientists to observe how proteins fold or misfold inside living cells. This work is critical, as protein misfolding plays a significant role in a number of diseases including cystic fibrosis, diabetes, neurodegenerative diseases like Alzheimer’s and Parkinson’s, as well as many cancers. The chemistry department is thrilled that her research excellence, which has been recognized nationally and internationally, is once again being recognized, this time here at home!

Inaugural Manning/IALS Seed Grants for Hardy and Thayumanavan

Professors **Jeanne Hardy** and S. “**Thai**” **Thayumanavan** were awarded seed grants after a competitive process that narrowed thirty five teams to six winners. Faculty researchers will receive seed funding of \$100,000 each over three years, along with business training and mentorship from IALS, the College of Natural Sciences, the Berthiaume Center for Entrepreneurship and the Isenberg School of Management, among others.



Hardy continues her research on the “Development of Potent Zika Virus Protease Inhibitors,” and Thayumanavan, along with Steve Faraci will focus on “Pre-Clinical efficacy evaluation of liver-targeted, thyromimetic-encapsulated IntelliGels for the treatment of non-alcoholic steatohepatitis (NASH).”



Martin Lab Receives Acorn Innovation Fund Award



The Martin lab has received an award from the Massachusetts Technology Transfer Center Acorn Innovation Fund. This award “is intended to support the demonstration of the viability of a technology developed at Massachusetts research universities.” From RNA vaccines to mRNA therapeutics, RNA is poised to revolutionize the treatment and prevention of a wide variety of disorders and diseases, but deficiencies in its laboratory synthesis are holding back applications.

Building on recently published work, the Martin lab is leveraging its extensive experience in fundamental mechanisms in transcription to develop dramatically improved approaches towards the enzymatic synthesis of this key molecule. This Acorn Award is supporting the development of a flow synthesis approach, with the immediate aim of demonstrating a path forward to high quality, high yield RNA. A wide variety of new RNA therapeutics lie on the horizon today. From mRNA-based therapeutics, to RNA-guided technologies such as CRISPR, to RNA “logic gate” smart therapeutics. Enabling research in the Martin lab aims to overcome current limitations in the implementation of these exciting technologies.

Rotello Retains Highly Cited Status

Prof. Vincent Rotello is one of ten researchers at the University of Massachusetts Amherst who have been recognized for being among the world’s most highly cited researchers in 2019 by London-based Clarivate Analytics, owner of the Web of Science.



In its sixth year, the citation analysis identifies influential researchers as determined by their peers around the world. They have consistently

won recognition in the form of high citation counts over a decade. These scientists are judged to be influential, and their citation records are seen as “a mark of exceptional impact,” the company says.

The company says it “focuses on contemporary research achievement: Only highly cited papers in science and social science journals indexed in the Web of Science Core Collection during the 11-year period 2008-2018 were surveyed.”

Artificial Energy Source for Muscle

Professor **Dhandapani Venkataraman** “DV” and UMass kinesiologist Ned Debold have a mutual interest in how energy is converted from one form to another – for Debold, in muscle tissue and for DV, in solar cells.



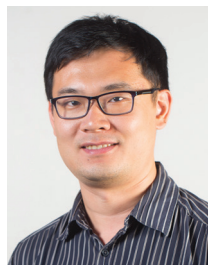
An alternative energy source to replace the body’s usual one, a molecule called adenosine triphosphate (ATP), could control muscle activity, and might lead to new muscle spasm-calming treatments in cerebral palsy, for example, or activate or enhance skeletal muscle function in MS, ALS and chronic heart failure.

Computational chemist, Prof. **Jianhan Chen**, was invited to model interactions between the molecules DV was making and the myosin molecules Debold was using to test them.

Chen explains, “We did computer modeling because experimentally it is difficult to know how myosin might be using the molecules DV was synthesizing. We can use computer simulation to provide a detailed picture at the molecular level to understand why these compounds might have certain effects. This can provide insight into not only how myosin interacts with the current set of compounds, but also it can provide a roadmap for DV to use to design new compounds that are even more effective at altering myosin function.”

The researchers report in the *Biophysical Journal* that they have made a series of synthetic compounds to serve as alternative energy sources for the muscle protein myosin, and that myosin can use this new energy source to generate force and velocity. The next stage for the trio will be to map the process at various points in myosin’s biochemical cycle.

You Receives NIH-MIRA for DNA-based Probes



Assistant Professor **Mingxu You**, chemistry, received a five-year, NIH Maximizing Investigators’ Research Award (MIRA) to fund his research in developing new tools — DNA-based probes — to quantify intercellular mechanical forces and understand a variety of mechano-sensitive cell signaling events at the molecular level.

As he explains, intercellular forces are critical regulators in many physiological and pathological processes, but scientists have until recently lacked the tools and approaches to characterize these mechanical events. “It is a whole new way to understand growth, division, intercellular motion and interaction,” You says.

The You Lab, which includes postdoctoral researcher **Bin Zhao** and chemistry PhD students **Yousef Bagheri** and **Puspam Keshri**, will team with Veterinary and Animal Sciences, Mechanical and Industrial Engineering, to further develop these DNA-based tools to visualize, monitor and quantify such cellular forces. You says, “In the near future, people will be able to apply these tools broadly to depict the basic principles of tissue morphogenesis, growth, and homeostasis. They will serve as a critical foundation for developing novel strategies in tissue engineering, regenerative medicine, immunotherapy and cancer treatment.”

Thayumanavan Awarded Distinction by Board of Trustees



Sankaran ‘Thai’ Thayumanavan was appointed as a Distinguished Professor by the Board of Trustees. The title Distinguished Professor is conferred

on select, highly accomplished faculty who have already achieved the rank of professor and who meet a demanding set of qualifications.

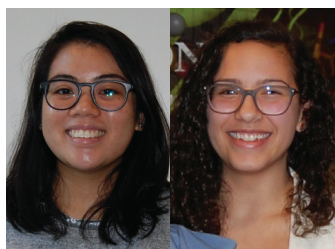
Chancellor Kumble Subbaswamy and Provost John McCarthy wrote, “Professor Thayumanavan’s research is focused on the design and synthesis of supramolecular assemblies with novel functions that advance chemical, materials and biological sciences in applications that range from molecular recognition to drug delivery to renewable energy. His work is distinguished by a focus on dynamics, creating materials with the ability to respond across multiple length and time scales and following exposure to stimuli including pH, temperature, and light.

Prof. Thayumanavan’s research program is characterized by prolific excellence. Since promotion to Professor in 2008, Prof. Thayumanavan has published over 120 articles, with more than 30 in the top tier of chemistry journals as lead author. In the same time period, he has garnered more than \$26 million in external support, given more than 100 presentations on his research since 2008, including keynote addresses and prestigious lectures, and he was elected as a Fellow of the American Association for the Advancement of Science in 2011.”

graduate student Accomplishments

NSF Graduate Research Fellowship Program

Two Chemistry students have been recognized by the NSF Graduate Research Fellowship Program, a highly competitive national program recognizing outstanding students. It is a remarkable achievement that two of our students have been selected in the same year.



Chhe

Jaen Maisonet

Kaitlyn Chhe received an honorable mention in the NSF GRFP competition. Kaitlyn is a graduate student working with Michelle Farkas’ group.

Isabella Jaen Maisonet received an NSF GRFP fellowship. Isabella is an undergraduate currently working with Mike Knapp’s group, and will start graduate school this Fall in the Chemical Biology PhD program at Harvard. Isabella says, “I’m excited to start my virtual classes and rotations, and I plan to join a lab where I can be involved with drug discovery and therapeutics research. I hope to be involved with undergraduate mentorship, since my mentors at UMass had such a positive impact on my career. My goal is to inspire as many young Latines to join STEM as possible.”

PPG Fellowship

Haneen Mansoor from the Kittilstved group, and Emily Smith from the Venkataraman group, were selected as the 2019 recipients of the PPG fellowship sponsored by the PPG Foundation. This fellowship is competitively awarded to outstanding Chemistry graduate students who do research in materials chemistry.



Haneen Mansoor research summary: Multifunctional inorganic materials such as the “layered” Ruddelsden-Popper (RP) phases are attractive prospects for the implementation of next-generation renewable-energy resources and spin-based technologies.

These materials have generated significant interest in the scientific community because

their properties can be tailored for the specific applications. By replacing some of the host ions with targeted chemical dopants and utilizing dopant-specific spectroscopies, we aim to address the chemistry of intrinsic and extrinsic defects in such materials. With the support of the PPG Fellowship, I am working on understanding the structural and electronic interactions of transition-metal dopant ions and the corresponding defects in the RP phase of Sr_2TiO_4 bulk powders. Systematic control over the rich and complex defect chemistry is crucial for the development and application of these materials.



Emily Smith research summary: With the PPG fellowship, I will be furthering my research looking into the implications of ion transport in hybrid perovskite solar cells. One key area of focus for our group is the accumulation and dissipation of ions at device interfaces under illumination, and its implications for overall device performance.

In my work, we have developed a technique that allows us to transiently map ionic charging and discharging of interfaces in devices under operational conditions. We can use this technique to quantify key parameters of interfacial charge accumulation and to explore the transient characteristics of devices which employ various architectures. Overall, these studies will give us critically needed insight into the transient interfacial effects of ions in hybrid perovskite solar cells, equipping us with the necessary knowledge to develop new materials and devices with improved performance and stability.



Robert R. Holmes (1928 - 2020)

Professor Emeritus Robert (Bob) Holmes joined UMass Chemistry in 1966 as a tenured Professor, following nine years at Carnegie Institute of Technology (now Carnegie Mellon University), where he was promoted to Associate Professor, and four years at Bell Labs. His research focused on hypervalent (pentacoordinate and hexacoordinate) compounds of phosphorus and silicon, and their role in nucleophilic displacement reactions. His pioneering work in this area led to an understanding of the similarities and differences in the chemistry of silicon and phosphorus. He also made significant contributions to organotin cluster chemistry and the interconversions between the tin clusters. He was notable for combining theory and experiment, for the breadth of his research, and the impact of his work on understanding enzyme mechanisms and on environmental and industrial polymerization chemistry. He served for many years as Editor-in-Chief of *Phosphorus, Sulfur, and Silicon and the Related Elements* and Editor of *Main Group Chemistry News*. The January 1998 issue of *Heteroatom Chemistry* was dedicated to Bob for his 70th birthday and pending retirement from UMass.

new Faculty

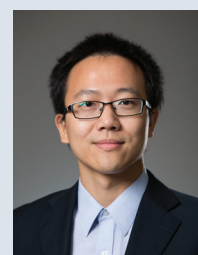
Joseph DuChene

Dr. Joseph DuChene joined the UMass Amherst Chemistry department as an Assistant Professor in January 2020. Joe grew up in Florida, and earned his PhD in Chemistry from the University of Florida under the supervision of Professor W. David Wei. His dissertation involved the development of new methods for the shape-controlled growth of catalytic nanomaterials and fundamental studies of light-matter interactions in plasmonic-metal nanocrystals for solar energy conversion. Upon completion of his doctoral studies, Joe moved to the Joint Center for Artificial Photosynthesis at the California Institute of Technology as a postdoctoral scholar in the lab of Professor Harry A. Atwater. At Caltech, Joe pioneered new directions in plasmon-driven photoelectrochemical energy conversion to increase the selectivity of CO₂ reduction into value-added chemicals. As an Assistant Professor at UMass Amherst, Joe will use his expertise to lead a research group investigating the design and synthesis of new catalytic nanomaterials capable of harnessing sunlight to facilitate a variety of chemical transformations of importance to global environmental sustainability.



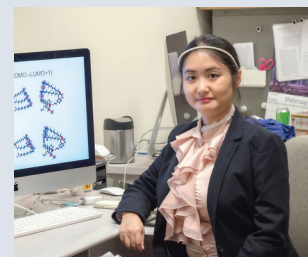
Haoze He

Dr. Haoze He will join UMass Chemistry in August 2020 as a Lecturer in the undergraduate organic laboratory. Haoze received his BS in biological sciences from University of Science and Technology of China (USTC). He obtained his MS in chemical engineering with Prof. Klaus-Viktor Peinemann from King Abdullah University of Science and Technology (KAUST) in Saudi Arabia, where he designed and synthesized block copolymer thin films for water desalination. Later, He completed his PhD in Organic Chemistry in the group of Prof. Ross E. Dalbey at The Ohio State University (OSU), where he discovered and tracked the stepwise mechanism for the in vivo movement of a membrane inserting protein named YidC. Throughout his graduate career, he always served as a seasoned teaching associate. After finishing his education, Haoze spent a year as a project manager in a pharmaceutical start-up company but realized his strong desire to return to academia and assume a teaching position. As an experienced educator, Haoze agrees with the Confucian philosophy of "individualized education" and plans to optimize his teaching strategy for fairness and efficiency in students' learning process.



Zhou Lin

Starting in September 2020, Dr. Zhou Lin will be an Assistant Professor in Computational Materials Chemistry. Zhou received her BS in chemical physics from the University of Science & Technology of China. She completed her PhD in chemical physics with Professors Anne McCoy and Eric Herbst from The Ohio State University, where she evaluated the spectroscopy and dynamics of astrochemical species. She then moved to the Massachusetts Institute of Technology to join the group of Professor Troy Van Voorhis, where she modeled photophysics and photochemistry of molecular electronics. Later she accepted a position from Professors Martin Head-Gordon and Alexis Bell, and migrated to the University of California, Berkeley, where she predicted mechanisms and kinetics for electrochemical CO₂ reduction reactions. Zhou will introduce her broad research horizons and apply her deep insight in quantum chemistry to UMass where she will explore the frontiers of energy, materials, and fundamental sciences with her research group. She will also teach undergraduate physical chemistry and graduate quantum chemistry. Zhou is excited to settle back in Massachusetts, where she can enjoy the natural beauty of the area and the large range of cultural activities.



lab Notes

Auerbach Group

The **Auerbach group** had a great year in 2019-2020 in research, teaching, and administration, despite the massive disruption from COVID-19 and all the unprecedented changes to our many ways of life. Prof. Auerbach and collaborators from the EPFL in Lausanne, Switzerland published an article entitled “A New Kind of Atlas of Zeolite Building Blocks” in the *Journal of Chemical Physics* (JCP). This was the first fruit from Prof. Auerbach’s 2018 sabbatical at the EPFL, and reports on the use of data science to categorize zeolites as a class of three-dimensional network materials. This article was hailed by the editors of JCP as one of their top articles of 2019. Then, in December 2019, Prof. Auerbach and Chemistry PhD student **Tongkun Wang**, along with collaborators from UMass and WPI, published an article in the *Journal of the American Chemical Society* (JACS) entitled “Critical Role of Tricyclic Bridges Including Neighboring Rings for Understanding Raman Spectra of Zeolites,” which provides rigorous assignments of Raman spectra of zeolites from quantum density functional theory calculations, confirmed by experiments. This research, featuring our work on simulation and spectroscopy of zeolite vibrations was the Dec. 26, 2019 cover article of JACS (see page 6), and was the first from Prof. Auerbach’s Dept. of Energy grant, along with **Prof. Wei Fan** from UMass Chemical Engineering, on understanding how zeolites crystallize in solution. Fast-forwarding to April 2020, Prof. Auerbach and graduate student **Babgen Manookian** published an article in the *Journal of Physical Chemistry C* entitled “Experimental and DFT Calculated IR Spectra of Guests in Zeolites: Acyclic Olefins and Host–Guest Interactions,” showing how to use quantum density functional theory along with experimental IR spectroscopy to precisely pinpoint the structures and conformations of organic molecules in zeolites. This article was the first from Prof. Auerbach’s new collaboration with **Prof. Friederike Jentoft**, also from UMass Chemical Engineering. **Babgen Manookian** won the *Dr. Paul Hatheway Terry Award for Outstanding Poster Presentation* from the UMass Chemistry Department in August 2019, speaking on this research. Each of these projects has generated new impressive results in 2020, and we look forward to the next batch of breakthrough articles to come from the Auerbach research group.

This was a special year for Prof. Auerbach as he was appointed to be the inaugural Mahoney Family Sponsored Executive Director of the UMass iCons Program, with major funding from the Mahoney Family Sponsorship. We thank the Mahoney Family for their generous support of UMass iCons and Prof. Auerbach. To read more about the Mahoney Family Sponsorship, please see the UMass iCons Program on page 24.

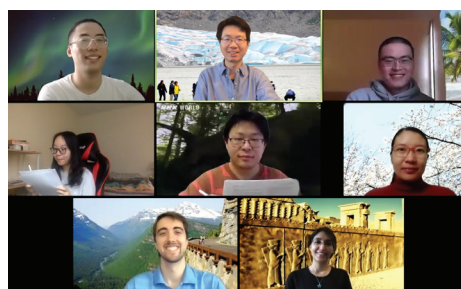
Regarding alumni of the Auerbach group, **Prof. Karl Hammond** (Chem Eng PhD, 2012) was promoted to Associate

Professor with tenure in the Department of Chemical Engineering at the University of Missouri. Prof. Hammond uses computations and experiments characterize materials with energy applications. We send our congratulations to Prof. Hammond.

In closing, we wish all Auerbach group alums a wonderful year. We hope you stay in touch and stay safe and sound, healthy and happy during this unprecedented time of COVID.

J. Chen Group

This past year has been exciting and interesting for the Jianhan Chen lab. We are thrilled to welcome two new graduate students to the lab. **Yumeng Zhang** grew up in the city of Lanzhou in the Northwestern region of China and graduated with a BS in Chemistry from Wuhan University. Yumeng was involved in various chemical synthesis projects during her undergraduate study and is a highly skilled Go player. **Qianlan Jia** was born in Inner Mongolia and grew up mostly in Beijing. He has a Bachelor of Engineering from Minzu University of China and a Master’s degree in Pharmacy from Peking University, working on total synthesis of natural products. We also welcomed **Callie Jillson**, a senior chemistry major, who did a highly successful independent study on the studies of protein chaperone DnaK and was recognized with an ACS Undergraduate Award in Physical Chemistry. We are very happy, and sad at the same time, to say good-bye to **Mahdieh Yazdani** and **Xiaorong Liu**. Mahdieh will be successfully wrapping up her PhD study by the end of summer 2020, and Xiarong will be leaving for a postdoctoral position at the University of Michigan. We wish them the best in their next chapters of life and their careers!



Chen lab with everyone in their dream locations, June 2020

The COVID-19 pandemic is having a major impact on our life and work. The group has shown resilience and continued to make exciting progress on several active projects in the general areas of computational biophysics and biomaterials. Together, the group has published over a dozen original research and review articles on a diverse set of topics including new molecular models, sampling methodology, intrinsically disordered proteins, protein aggregation, ion channels, protein-ligand interactions, and protein-based biomaterials and nano-devices. Several of these papers appear in prestigious journals, including *Nature*, *Nature Communications*, *PNAS* and *eLife*, and have received substantial media attention. The full list of publications can be found on the lab webpage at: <http://people.chem.umass.edu/jchenlab>.

M. Chen Group

Min Chen's group continued work on developing nanopore-based biotechnological applications in biosensing.

We celebrated the graduation of Chemistry student **Xin Li** who successfully defended her PhD thesis. Xin's work on "developing a nanopore-based molecular tweezers for monitoring protein dynamic structural change" was published in *ACS Nano*. We are very excited to extend this new technique into studying fundamental questions about enzymes' functions as well as technological applications such as drug screening and molecular sensing! We also said good-bye to three undergraduate students **Gabrielle Farulla-Bastian** (BMB 2020), **Soumya Sabella** (BMB 2020) and **Kate Martel** (BMB 2020). We wish our alumni a lot of success and happiness in their career and in life!

We welcome our newest member: MCB graduate student **Kaitlyn Gilliam**. With her previous experience in microbiology (University of Oklahoma) and next-generation sequencing, Katie will strive to understand how bacteria evolve an outer membrane protein porin under selection pressure. The other graduate students in the group (**Bach Pham**, **Fanjun Li**, **Spencer Shorkey**, **Joshua Foster** and **Minji Kim**) have been very productive in the lab. Bach's work, in collaboration with Jeanne Hardy's group, involving developing a caspase-7 nanopore sensor was published in *Biophys J*. Both Fanjun and Spencer have made fantastic progress towards expanding the utility of the nanopore tweezers for catching the kinase and deubiquitinase in action! Joshua has demonstrated the concept of multiplex sensing with OmpG nanopore; and most excitingly, his nanopore sensor library is showing promising results in target-selection. We hope to quickly create nanopore sensors that can achieve on-site, minute-detection of infectious pathogens in response to the emergence of epidemics. (You are right! Covid-19 is indeed our immediate target)! Minji has made steady progress in adapting our OmpG nanopore platform for sensing viral contamination in food. We also want to congratulate our undergraduate student **Ryan Pham** (Chemistry 2022) for winning the Tarselli Award and the Mahoney Undergraduate Research Award, as well as **Joshua** for receiving the CBI NIH training fellowship. The Chen group is looking forward to a great year in 2021!

Farkas Group

This has been a momentous year for the **Farkas Lab**. The group saw its first two students successfully complete their PhDs! **Joseph Hardie** (co-advised with **Vince Rotello**) defended his dissertation on the chemical manipulation of macrophage cells at the beginning of the calendar year, in January. He is currently a postdoctoral fellow in the laboratory of Hadi Shafiee at Harvard Medical School. Sadly, due to COVID-19, his might be one of the last 'live' defenses for a while... In May, **Hui-Hsien 'Tanya' Lin** presented her work in our first virtual defense using chemical biology methods to track and

manipulate circadian rhythms in cellular models of cancer. Just a few weeks after her well-attended zoom defense (after which she was surprised by lab mates, who brought her cake and roses on camera), she gave birth to her first child, Kasper. Congratulations to Tanya and her husband Wei-Ting Wong, a graduate student in Electrical and Computer Engineering! May was quite the whirlwind month for her, and Tanya is currently seeking a position in biotech/the pharmaceutical industry. In the realm of undergraduates, **Cameron Sanders** also defended his thesis, which was on cleavable peptide linkers for delivery applications. In a tough market, Cameron was also successful in finding a job; he is currently a lab assistant at Avecia.



Farkas Group: Fall 2019

In other laboratory accomplishments, the group published five scientific papers in 2019-20, including a collaboration with the **Rotello** and **Vachet** groups. As of writing, two additional papers have recently been accepted, and more are on the way! Prof. Farkas continued to play an invaluable role in the department, via admissions, seminar hosting, and assisting in the recruitment of top-notch graduate students. She also led an LGBTQ+ Diversity initiative in the department that was very well received. While it was unfortunate that the biennial Society for Research on Biological Rhythms (SRBR) Conference had to be moved from Florida to an online platform due to COVID-19, graduate student **Sujeewa S. Lellupitiyage Don** was recognized with a Merit Award from the society for his work. Second-year student **Kaitlyn Chhe** not only passed her prospectus this year, but also received an honorable mention from the highly competitive National Science Foundation Graduate Research Fellowship Program (NSF GRFP), and was awarded a Soft Materials for Life Sciences National Research Traineeship (SMLS NRT), also sponsored by the NSF. **Bishnu Joshi** received the Paul Hatheway Terry Scholarship from the chemistry department, and **Javier Mas-Rosario** completed his second (and final) year as a CBI-NIH fellow.

DuChene Group

The DuChene Group is in the process of setting up equipment in our beautiful new lab space located on the first floor of the Physical Sciences Building. We welcome our first two graduate students into the group, **Jackie Davies** and **Koustab Pradhan**, along with two undergraduates, **Bohan Feng** and **Liam Murphy**. We are all eager to get started! Our materials chemistry group will tackle problems of importance to global environmental sustainability by developing new catalysts for

solar-to-fuel energy conversion. In particular, we are interested in harnessing sunlight to selectively convert readily-abundant small molecules like water, carbon dioxide, and nitrogen into useful chemicals for transportation fuels, pharmaceuticals, and agricultural fertilizers. We are excited to get started in our new home at UMass Amherst and are looking forward to making great strides towards these goals in the coming years!

Gierasch Group

COVID-19 did not stop the busy Gierasch Lab in 2019/2020. As result of the lab shutdown last March, we slowed down the usual busy lab schedule, but we kept going full steam ahead from our remote locations. We had an extraordinary end of the Spring semester with undergraduate students Sashrika Saini and Rachel Jansen (both Biochemistry majors) and **Gillian Willcox** (Chemistry) defending their Honors Theses. It was inspiring to see them push through these unprecedented circumstances, presenting their work and graduating remotely. Before graduation, during the BMB Department Awards virtual ceremony, seniors Sashrika Saini and Rachel Jansen were inducted into the ASBMB Honor Society Chi Omega Lambda, and they also had the opportunity to share their research at Northeastern University during the “Active Site” American Society for Biochemistry and Molecular Biology regional meeting and undergraduate poster session November. In addition, Rachel Jansen won the Henry Little Award for academic excellence in the BMB Department. They all did a fantastic job as undergraduate researchers and are now on their way to achieving great success: We are thrilled that Sashrika was accepted into the BMB Master’s program and will stay in the lab to complete her degree; Gillian is now working at Web Industries in Holliston, MA; and Rachel received an NSF fellowship and is off to start graduate school at UC Berkeley this fall. We are sure they will do great in their new enterprises.

As sad as it is to see our much-loved students go, we have the pleasure of welcoming new ones! BMB student Antonia Bogioian-Mullen started working in the lab and already won the Linda Slakey Award for summer research and **Emily Saltzman**, a Chemistry major who already received the Chemistry Department Mr. Tomkins Award for her research. This fall we will be joined by Nina Olds, a Biochemistry major. We look forward to working with all these great students.

During the Fall of 2019, Lila traveled far and wide to present the lab’s research at many conferences, including: the 10th Annual Biophysics Symposium at the Northwestern University Department of Molecular Biophysics in Evanston, IL; the 20th annual Molecular Biophysics retreat at Wesleyan University; the 2019 Linderstrøm-Lang Symposium on “Protein folding and stability — from molecules to disease” at the University of Copenhagen, Denmark; the Peptide Engineering and Biology at the Chemistry and Biology of Peptides Gordon Research Conference in Ventura, CA; and the 18th

Raymond N. Castle Conference sponsored by the Chemistry Department at the University of South Florida in Tampa. She also served on the Max Planck Institute Scientific Advisory Board in Martinsreid, Germany. Also, in September 2019, Research Professor Eugenia Clerico traveled to Istanbul, Turkey, to present at the 7th International Congress of the Molecular Biology Association of Turkey, where she met with Gierasch Lab alumni and shared the exciting research going on in the lab.

Importantly, Lila received a CNS Outstanding Achievement Award for Research (see page 7) and an Alumnae Achievement award from the Mount Holyoke Alumnae Foundation. In 2020, Lila participated virtually in her first National Academy of Sciences Annual Meeting in April. Many other lab members had conferences planned for this year that were postponed, and we look forward to attending next year and sharing the great progress our lab has made recently.

We have now cautiously resumed our lab activities after the COVID-19 shut-down. During the lab close down we stayed strong as a group: We shared an informal “coffee time” every morning to support each other in addition to regular lab meetings twice a week. We wrote manuscripts, designed experimental protocols, and caught up with the research literature. We feel very lucky that technology allowed us to stay together and endure these rough times. We are happy to be together as a group and look forward to continuing to do great science.

Hardy Group

The Hardy Lab has successfully weathered the COVID-19 pandemic. Instead of focusing on all the cancellations in its wake — the departmental ski trip, the Protease Gordon Conference, the CBI Retreat, Biotech tAles, face-to-face teaching, etc., we are looking for the silver linings in the changes to our work environment. In March, just as the lockdown of UMass was announced, members of the Hardy Lab launched an exciting COVID-19 (and other viral protease) detection project in collaboration with the Andrew and Thayumanavan Labs, which was funded by the National Science Foundation. We have been grateful to be able to apply our scientific expertise to another biomedical problem of societal importance. Hardy Lab members of the COVID-19 team include **Kristalle Cruz**, **Sparsh Makhaik** and **Nathanael Kuzio**. Nathanael is a new 1st year graduate student who hails from Bates College where he worked with Prof. Andrew Kennedy on cytosine-based TET enzyme inhibitors for modulation of cytosine demethylation pathways. The three second-year students in the lab, Sparsh Makhaik, **Irina (Niña) Sagarbarria** and **Andrew Smith** used their time in isolation to prepare and defend outstanding Research Prospectuses. All three of them passed their prospectus defenses in outstanding fashion and celebrated their accomplishments with a virtual toast! **Ishan Soni**, fifth-year graduate student, is doing HDX-MS on caspase-9 to identify the regions involved in its dimerization and sub-

strate-binding. Ishan is also working with our collaborator (Julien lab at the University of Alberta, Canada) to identify caspase-9 substrates and cleavage preference using N-terminomics. **Francesca Anson** won a poster prize at UMASS' annual ResearchFest as well as at the CBI Retreat, she also presented a podium presentation at the annual NoBCCHe conference in St. Louis, Missouri. This year we also welcomed three new undergraduate researchers, **Sashi Weerawarana** (Chemistry), **Andrew Guthrie** (BMB, CHC) and **Srinidhi Raghav** (BMB, CHC) joined **Ethan Goulart** (Chemistry,



Look how close we all were! Hardy Group meeting on March 13, 2020, the day before our world changed.

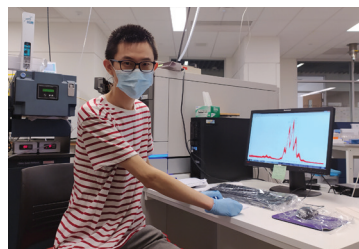
Jackson Group

The Jackson group continues to explore the dynamics of gas-surface interactions, with a focus on methane dissociation on transition metal-based catalysts, the rate-limiting step in the steam reforming of natural gas. Recent work has explored CH_4 reactions on stepped Ni(211) and Pt(211) surfaces, as well as on smooth and stepped Ir surfaces. Using quantum methods, we can now predict how these reactions behave with regard to surface impact site, collision energy, methane vibrational state, and the thermal motion of the lattice. This work was discussed in a Keynote Lecture in Liverpool, UK, at the Frontier Science symposium, *Molecules at Surfaces: What do we really know?* Talks scheduled for Toulouse, France and Rajasthan, India during the spring were cancelled.

Kaltashov Group

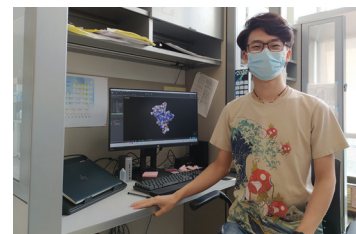
2019 was a very busy year in the Kaltashov laboratory, which included publication of several peer-review papers, as well as several presentations given by the group members at numerous scientific meetings and conferences. The group's research programs were supported by the National Science Foundation and the National Institutes of Health (NIH). The group initiated a new collaborative project with the Hematology Department at McMaster Medical School (Hamilton, Ontario) to study the molecular mechanism underlying heparin-induced thrombocytopenia, a potentially fatal disorder affecting a fraction of patients receiving heparin therapy. Responding to the unfolding COVID-19 pandemic, the group started a new project focusing on the ability of heparin and heparin-like molecules to prevent docking of the novel coronavirus (SARS-CoV-2) to its host cell-surface receptor (angioten-

sin converting enzyme 2). The initial results of this work have been already published in *Analytical Chemistry* (<https://pubs.acs.org/doi/10.1021/acs.analchem.0c02449>).



Yang Yang, a third-year graduate student, uses a mass spectrometer to characterize interactions between the spike protein of the novel coronavirus and the human angiotensin converting enzyme 2.

Yi Du, a first-year graduate student, models binding of heparin to the spike protein of the novel coronavirus.



Chendi Niu defended her PhD dissertation and moved to Amgen (Cambridge, MA), and **Miowei Xu** graduated with a Master's degree and joined Regeneron Pharmaceuticals (Tarrytown, NY). A new graduate student, **Yi Du**, joined the group in December 2019. **Dr. Wenhua Yang**, a Visiting Scholar from China, has joined the group in September 2019 to develop novel mass spectrometry-based methods to address a range of problems related to food allergy, and **Dr. Son N. Nguyen** has joined the group in December 2019 as a post-doctoral fellow.

Martin Group

Yasaman Gholamalipour defended her PhD last August and has now embarked on a postdoctoral position with Michael Brodsky and Neil Aronin at the University of Massachusetts Medical School, where she is attempting to reverse the CAG repeat expansion sequence in the mutant huntingtin gene in cellular and animal HD models using the CRISPR-Cas9 nickase genome-editing tool. This spring, she won the highly competitive HDSA Berman-Topper Family HD Career Development Fellowship to support her in her work. Congratulations!

Yasaman's foundational work has formed the basis for a new direction in the Martin Lab: developing novel approaches towards RNA synthesis using the enzyme we have studied for decades (and that pretty much everyone globally uses to synthesize long RNAs). Approaches such as Moderna's SARS-CoV-2 vaccine require high quality mRNA, as do rising mRNA therapies and the plethora of rapidly emerging CRISPR-based therapies and technologies. All suffer from a specific purity problem that Yasaman demonstrated arises from scaled-up synthesis. Our mechanistic understandings are driving new approaches and attracting attention in both academia and industry.

With funding from a 2020 Acorn Innovation Award from the Massachusetts Technology Transfer Center and a new four year grant from the National Institutes of Health, the lab is developing systems for dramatically improved synthetic RNA. We've also begun working with IALS Innovation Fellows in the Eisenberg School of Management. Stay tuned!

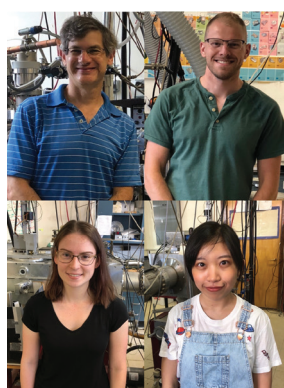
Elvan Cavaç, who has been developing a novel system for synthesis, will defend her PhD in August and will enter an MBA program at UMass in the fall. **Kithmie Malagoda Pathirana** is wrapping up several exciting projects as she approaches her own PhD defense. In the meantime, **Amin Abek** and **Ruptanu Banerjee** have joined the lab and are off to a great start.

Undergraduate researcher **William Johnson** completed his Honors Thesis and is off to graduate study at Tufts University. This spring, Will was chosen as one of four "Rising Researchers" across campus. In the meantime, **Amelia Cochran** and **Julia McBride** will return, one way or the other, to complete their Honors Thesis in the coming year.

The MartinLab has a new web site (<https://martinlab.chem.umass.edu>) and a new @martinlabchem social media presence. Please check us out, follow us, RT us, and if you haven't already, connect with us through LinkedIn (www.linkedin.com/in/cmartinumass/).

Metz Group

The Metz group has had an exciting year exploring the interactions between metal and metal oxide ions and small alkanes and imaging the photodissociation dynamics of metal-containing ions. Graduate student **Apakorn Phasuk** and undergraduate **Irina Biloiu** have been making aluminum oxide



cluster cations and studying their reactions with ethane using our new fast-flow reactor ion source, observing a wide range of reactivities for the different clusters. Graduate student **Justine Kozubal** and undergraduate **Tristan Heck** have been studying how early transition metal cations and their clusters interact with methane molecules, using vibrational spectroscopy to determine the structures of the reaction intermediates. In an exciting development, they observed C-H activation by Zr^+ and characterized the C-H activation products. Graduate student **Schuyler Lockwood** has used photofragment imaging to study the products, anisotropy and kinetic energy release in photodissociation of NiO^+ , NiS^+ and MgI^+ , measuring the bond strengths and how the dissociation dynamics depend on wavelength. He and undergraduate **Tala Chunga** (Chemistry, 2020) have designed and are adding a new ion trap to

the instrument which will trap more ions, and cool them to a lower temperature.

Rotello Group

Vince is looking forward to getting back on the road. Before things shut down in early 2020 he did quite a bit of traveling, with plenary talks in Beijing (twice) and once in exotic Oklahoma City. He was also honored once again in 2019 as a Highly Cited Researcher by Clarivate/Web of Science. The publication total is ticking up, with the current count at 595. The group has new funding from the NIH for liver disease sensing, along with a new grant from the NSF in collaboration with the Thomas group at Tufts on photoactivatable delivery systems group.

Two group members won awards at ResearchFest 2019, **Yi-Wei "Bill" Lee** (Dr. Paul Hatheway Terry Award) and **Jessa Marie Makabenta** (William E. McEwen Award) for Outstanding Poster Presentations. **Vincent Clark**, an undergraduate student in the group, won the 3rd place during the UMass/MIT Science Slam Competition. Bill Lee and Company were also selected by the editors of Advanced Therapeutics as having one of the top articles in the last year!



On the departure side, **Akash Gupta**, **Riddha Das**, **Joseph Hardie** and **Yuanchang Liu** received their PhDs, with Akash joining MIT, Riddha joining University of California Berkeley, and Joseph joining Harvard Medical School. The group bid farewell to Postdoctoral Fellows, Visiting Professors, and Visiting scholars: **Bhavna Kalyanaraman**, **Dr. Lan Zhang**, **Zoe Duponchel**, **Faviola Villariny**, **Beena Kumari**, **Fuad Alami**, **Young-Kwan Yoo**, **Dr. Sohini Basu Roy**, **Dr. Irem Kulu**, **Shuting Pan**, **Dr. Dan Li**, **Dr. Eunhee Jeoung** (back for another visit — she's always welcome), **Yavuz Oz**, **Dr. Erlei Yu** and **Dongkap Kim**. We have had a strong influx of new faces including **Harini Nagaraj**, **Jung Mi Park**, and **Mingdi Jiang**, who have officially joined our group as graduate students. Welcome to the group!

For up-to-date news, please check out <http://www.umass.edu/rotellogroup/> or see what's up on our less formal Facebook page <https://www.facebook.com/rotellogroup> and Twitter account <https://twitter.com/RotelloGroup>.

Thayumanavan Group

The past year has been a productive and exciting one for the Thayumanavan Research Group. Our accomplishments ranged from developing new synthetic approaches to trigger nano- and macroscale materials to methods for delivering biologics inside cells. For example, we reported a chemical switch that concurrently triggers chemical bonding and debonding, in response to specific external triggers. Within a short time after our discovery of these functionalities, called Triggerable Michael Acceptors (TMAc), we have been demonstrated their versatility in a variety of areas, *viz.* protein modification, protein-protein interaction mapping, triggerable drug bioconjugate, programmable emulsions, self-immolative polymers, and cooperative hydrogels.

After the shutdown in mid-March, the lab has reopened with safety measures in place to address issues relating to the pandemic. With a NSF-RAPID grant, we are also contributing to find solutions to the problem as well. We are collaborating with the Andrew and Hardy Research Groups to develop a “smart swab” for COVID-19 diagnostic testing.

This year, we welcomed four new graduate students: **Jayashree Bhagabati**, **Ranit Dutta**, **Jewel Medeiros** and **Theeraphop “Theo” Prachyathipsakul**. Congratulations to Jewel, who has been selected for a BTP Fellowship. Current graduate students, **Ann Fernandez** and **Manisha Shivrayan**, are both participating in internships this summer, with Proctor and Gamble (remote) and Streck (Nebraska), respectively. Kudos to **Stephanie Le**, who has received a National Research Traineeship/Soft Materials for Life Sciences (SMLS) through the National Science Foundation Fellowship.



Graduate students receiving their PhDs in the past year are: **Mine Canakci** (MCB joint with Osborne), Scientist at Eutropics, Boston; **Bo Zhao** (joint with Vachet), Senior Scientist at AbbVie in Worcester, MA; **Ziwen Jiang**, postdoc at UCSF; **Jingjing Gao**, continuing as a postdoc in the group; **Wardah Ejaz** and **Vikash Kumar**, both now working at Intel in Oregon. **Kingshuk Dutta**, soon to be a Senior Scientist at Corteva, the agrochemical branch of Dow Chemical, Indianapolis, IN.

The following are some updates on former graduate students:

Malar Azagarsamy, E Ink Corporation in Freemont, CA; **Yangbin Chen**, Product Development Specialist at 3M; **Aka-**

mol Klaikherd, Thai Wah Public Company Ltd., in Bangkok area, Thailand; **Longyu Li**, Professor at Sichuan University in Chengdu China; **Ambata Poe**, Senior End Use Research Specialist at The LYCRA Company in Philadelphia, PA; **Krishna Raghupathi**, Research Investigator at International Flavors and Fragrances in the greater NYC area; **Rajsekhar Reddy Rami Reddy**, Principal Scientist at Bionees India Private Ltd., Bengaluru, Karnataka, India; **Ilyas Unlu**, Postdoctoral Research Scientist at Washington State University, Pullman, WA; **Hui Wang**, Research Chemist at the US Army Edgewood Chemical Biological Center in Maryland; **Volkan Yesilyurt**, Senior Scientist at Takeda Pharmaceuticals in Cambridge, MA.

A few personal updates from former graduate students: Wardah Ejaz recently married Dr. Atif Yasin. **Nagamani (Chikkannagari) Gavvalapalli**, and her husband Nagarjuna (DV Group Alum) welcomed Krisi, who joins older daughter, Tanvi. **Kishore Raghupathi** and his wife, Bhavana welcomed a baby boy, Shambhu. **Raj Ramireddy** and his wife, Kalyani recently had a baby daughter. **Poornima Rangadurai** and her husband, Sharanyan had a baby boy, Adrith. Congratulations to all!

Postdoctoral Researcher, **Partha Sarathi Addy** left to return to India in January with his wife, **Sohini Basuroy** (alumna of Rotello Group) and new baby daughter Medhasvi. He is now Research Scientist at Amar Chemistry Pvt. Ltd in Mumbai. Recent updates on former postdocs: **Deepak Vishnu Dhamangadan**, now Senior Scientist at Godienergy in India; **Pandi Bharathi**, now Senior Laboratory Scientist, Integrated Laboratory Solutions, Southern Pines, NC.

Two new undergraduate students joined the research group this past year: **Joe Matte** and **Xinzhe Ren**. We congratulate recent graduates **Kevin Bonanno**, **Dimee Livingston-Padilla**, **Jenna Westley**, and **Natalie Williams**. Last summer, Dimee Livingston-Padilla, an undergraduate and REU student in the Group, won first place in the Lee-SIP/LSMAP at the MIT Science Slam.

We welcomed Visiting Scholars from Thailand: **Wereadesh “Man” Sangkhun** and **Kitti “Kik” Yuwawech** (both for six months), **Sawarin “Mind” Saengsaen** (3 months) and **Tatiya “Firm” Siripongpreda** (two months). Firm was hoping to follow up the brief visit with additional time in the spring, but is now delayed due to COVID-19. **Dr. Tuanwei Liu**, Associate Professor of Chemistry at Shangdong Normal University, Jianan, P.R. China spent ten months as a visiting scholar in the Group, before having to return early to China due to COVID-19.

At the end of June, we said goodbye to **Dr. Leyla Keough**, who worked diligently as Manager for the NSF Center for Autonomous Chemistry during the past year. We will surely miss her good-natured, friendly presence in the Group. She will continue at UMass as Manager for the Institute of Diversity Sciences at the College of Natural Sciences.

In August of this past year, Prof. Thai was appointed as Distinguished Professor by the Board of Trustees of UMass. The title Distinguished Professor at UMass is awarded to a select group of highly accomplished professors who have an outstanding reputation for research, teaching and/or public service at the national and international levels, have been highly productive and impactful in their work for an extended period, and are pre-eminent in their field, recognized by professional organizations for their outstanding contributions, among other qualifications.

Please visit our website at <https://www.umass.edu/thaigroup/> for more on our news and achievements. Also follow our group on Facebook or Twitter (links provided in our website). If you are a group alum and we do not have your updated whereabouts, please let us know.

Thompson Group

We are happy to welcome Chemistry graduate student **Jessica Allen**, who joined our lab in December. We said a fond farewell to Research Associate **Aruni Karunanayake Mudiyanse** at the end of May, but are happy that she has not gone far: she is now working with Mingxu You, so she is still part of our 8th floor lab groups. We also congratulate **Brianna Manning** who graduated in May with a BS in Biology, and who is now a PREP scholar at Albert Einstein College of Medicine in New York City. Congratulations to Bri for the travel award that enabled her to present her project at ABRCMS (Annual Biomedical Research Conference for Minority Students) in Anaheim in November 2019, and to Chemistry major **Tiernan Kennedy** who was awarded an Amgen Scholars fellowship for undergraduate research at Caltech, which he is performing remotely in summer 2020.



We also congratulate our three most recent alumni who transitioned to new positions this year: **Libbie Haglin** (PhD 2018) at Aptevo Therapeutics in Seattle, **Xuni Li** (PhD 2018) at Sanofi Genzyme in the Boston area, and **Maryam Kashefi** (PhD 2019) at Hologic in the

San Diego area. Congratulations to Maryam on the birth of her daughter as well!

In summer 2019 Lynmarie gave presentations at three conferences/symposia focused on topics that sample some of the breadth of the lab's research: Solid-state NMR, Membrane Protein Folding, and Advancing Mass Spectrometry in Biophysics & Structural Biology. At the Mass Spectrometry conference, Aruni presented a poster on her HDX-MS of CheA, a project that MCB graduate student **Thomas Tran** is continuing in the lab. In January 2020, chemistry graduate student **Katie Wahlbeck** attended the Winter School on Solid-state NMR in Vermont and presented the work on methylation-induced changes in dynamics of chemoreceptors in functional

complexes that she and postdoc **Nikita Malik** published this year in BBA Biomembranes.

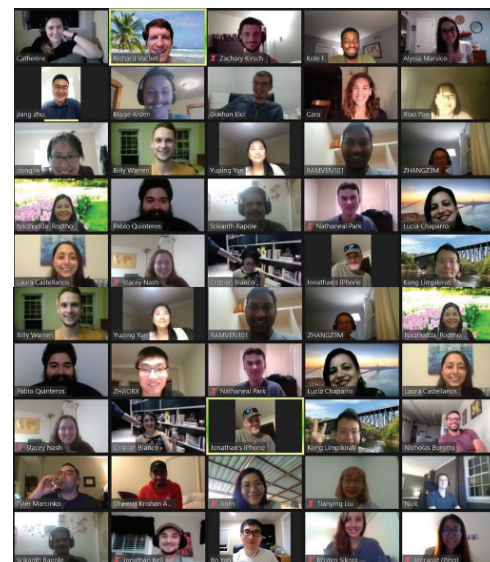
In late January, Lynmarie and Eric Strieter submitted an NIH proposal to continue funding for the Chemistry-Biology Interface Program (CBI). Eric is joining her as co-director for the next 5-year cycle of the program, and this represents the 5th renewal of funding for continuation of the UMass CBI Program. The review panel was impressed by many strengths of our program, including the innovative activities, the broad impact beyond the funded trainees, and excellent outcomes of our graduates. They concluded "overall, this is an outstanding program," and recommended funding an expanded number of slots! We are cautiously optimistic as we await the funding decision, which will likely come in spring 2021.

Shortly after submission of the CBI proposal, Lynmarie flew with Craig Martin to the Netherlands to commence their sabbatical in Utrecht, where Lynmarie spent 6 weeks in the laboratory of Marc Baldus at Utrecht University, and also visited collaborator Ariane Briegel at Leiden University. Lynmarie thoroughly enjoyed learning about projects in the Baldus lab and exploring bike-friendly and walkable Utrecht, and was looking forward to spending spring and summer there. Unfortunately, by mid-March the pandemic threat had become clear and they had to cut their visit short and return to Amherst. However, March also brought some great news: the NIH grant funding the Thompson lab's studies of the signaling mechanism of bacterial chemotaxis receptor assemblies was renewed for four years! We are eager to continue our NMR and HDX studies and also initiate new approaches including covalent labeling in collaboration with the Vachet lab, to test our ideas for the role of stabilization of disordered receptor domains in signaling and reveal the mechanism of control of the kinase in this multi-protein complex.

Vachet Group

The past year in the Vachet group was an excellent one despite the challenges associated with the Covid-19 pandemic that caused the lab to shut down for almost two months.

Researchers in the group transitioned well to remote work with most of the group learning some new computational skills to advance our efforts in understanding protein amyloid formation, developing and applying mass spectrometry imaging to track nanomaterials in biological systems, and creating new methods to ensure the quality of protein therapeutics. The group published 14 peer-re-



viewed papers and made about 15 presentations, including six at a recent remote conference. A highlight was hosting the 2nd Advancing Mass Spectrometry for Biophysics and Structural Biology at UMass Amherst in late July 2019. This international conference was attended by about 125 people from around the world, and the meeting featured almost 40 talks and 65 poster presentations.

In group news, we said sad goodbyes to four students who graduated. **Tianying Liu**, **Meizhe Wang**, **Patanachai ‘Kong’ Limpikirati**, and **Kristen Sikora** successfully defended their PhDs in late 2019 or early 2020. They all left their mark on the lab in one way or another and will be impossible to replace. Tianying took our covalent labeling/mass spectrometry work in new directions. Some of Meizhe’s work was featured as a cover article in *Langmuir*. Kong established our group’s expertise working with protein therapeutics, and he will be missed as a fount of knowledge. And, Kristen was *the* MALDI-MS imaging expert on campus.

We welcomed two new graduate students into the group: **Jeerapat ‘Ping’ Dounghawee** and **Jack Bell**. Ping will be developing mass spectrometry imaging methods to understand the biochemical effects of nanomaterial delivery agents, and Jack will be using covalent labeling/mass spectrometry to study membrane proteins in cells.

In alumni news, we had a great group reunion via Zoom in early June. Almost 40 people from eight different states and five different countries gathered to reminisce and catch up on life (see the picture). Among other news, we learned that **Shaynah Browne** (MS 2011) and her husband and two-year old son are in Seattle; **Gladys Murage Davis** (MS 2011) is working as a chemist in Charlotte, NC; and **Bo Yan** (PhD 2014) and his wife Ting celebrated the birth of their son Ethan Yan in January. Congrats Bo and Ting. In addition, **Nick Borotto** (PhD 2016) started in the Fall of 2019 as an Assistant Professor at the University of Nevada.

Venkataraman Group

The Advanced Laboratory for Iontronic, Electronic, and Nanomaterials (ALIEN) group, aka DV group, had a great 2019-2020 academic year. **Christie Ellis** received the top prize at the 2019 ResearchFest: the William E. McEwen Fellowship Award for Outstanding Presentation. Christie focused on the kinetics of degradation of perovskites and received her PhD in February 2020, and is now a Science and Technology Fellow at the DOE Solar Energy Technologies Office (SETO). We welcomed **Eric Ostrander**, **Zhaojie Zhang**, and **Subhayan Samanta** into the group. Eric will work on designing new abiotic molecules for powering muscle myosin. Zhaojie will join hands with Emily and Hamza to understand the origin of light instability in perovskites. Subhayan will work with Michael on mitigating doping-induced energetic disorder in organic semiconductors. We also welcomed **Brandon Italiano** and **Garrett Maskill**, two excellent undergraduates to our group.

In early March 2020, much like everybody, we transitioned to remote work due to COVID. It took all of us to get used to a new rhythm and work from home. Of course, it also gave us some time to reflect back on the data we had collected, as well as to plan for future experiments. At the end of spring, two of our undergraduate researchers, **Alex Amato** and **Benjamin Frick**, graduated. Alex worked on the effect of substitution of the B-site cation in hybrid perovskites. Alex is an accomplished musician and is pursuing a career in the music industry. So, if you are in Tennessee, check him out (<https://www.alexamatomusic.com/>). Ben, a ChemE major, worked on our device architecture to measure Seebeck measurement and conductivity. He will be working for the city of New York. We already miss Christie, Alex, and Ben!

The DV group had a productive year in terms of publications. Emily (along with Christie and Hamza) designed an ion-selective membrane to probe cation mobility in perovskites. She combined impedance spectroscopy with mass spectrometry to show that there was no experimental evidence for the mobility of lead ions or protons (<https://doi.org/10.1039/C9CP03891D>). Another exciting discovery was that we found that positional isomers of an abiotic triphosphate can modulate the motility of muscle myosin. This paper also received good publicity in the press (<https://www.umass.edu/newsoffice/article/umass-amherst-team-makes-artificial-energy> and <https://doi.org/10.1016/j.bpj.2020.06.024>). This has been an exciting collaboration with the Debold group in Kinesiology and Jianhan Chen’s group in Chemistry.

From the alumni side, **Nagarjuna Gavvalapalli** (Nag) is an assistant professor at Georgetown University in Washington DC, and he received his NSF CAREER award. Nag works in the area of functional organic polymers and nanostructures. **Larry Renna** now works for Intelligent Optical Systems. **Seung Pyo Jeong** is a postdoctoral associate at the Oakridge National Labs and works in the Soft Materials group with Dr. Vera Bocharova. **Matthew ‘Donnie’ Rollings** (BS ’18) is a graduate student with Prof. Felix Fischer at the University of California, Berkeley. Matthew received a 2019 National Science Foundation Graduate Research Fellowship! **Julia Lenef** (BS ’18) is a graduate student with Prof. Neil Dasgupta in the Materials Science and Engineering program at the University of Michigan at Ann Arbor. DV is proud of your achievements and likes to hear from all of you. So, drop a line when you can to dv@umass.edu. For group updates and news, visit us on the web at thedvgroup.com and follow us on twitter @dvgroupumass or Instagram at dvgroup_umass.

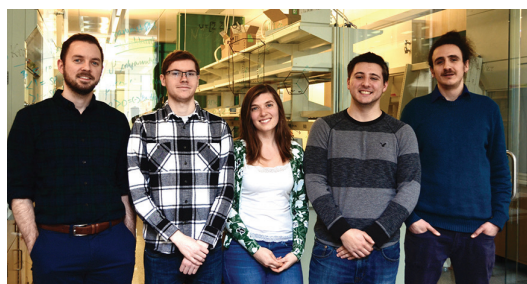
Finally, when we moved to PSB, we got a coffee tree from the



Chemistry Main office. We harvested the first beans from the tree in March. Before we could roast and brew, we had to transition to remote working. The DV group hopes to have a taste of this coffee soon!

Walsh Group

The first year of the **Walsh Group** has been a busy one for our pioneering graduate students as we build out the High-Pressure Chemistry Laboratory. Our first cohort is made up of four graduate students: **Kim Bolduc**, **Nick Manganaro**, **Paul Marshall**, and **Scott Thiel**. The centerpiece of our lab is a brand new Rigaku Synergy-S single crystal diffractometer, which was installed in January alongside the Kittilstved Group's powder diffractometer in the basement of LGRT. This state-of-the-art instrument replaced the "vintage" Bruker-Nomius, which is now spending the remaining years of its life on a farm in Vermont. We are putting the new instrument through its paces, and are using the relics salvaged from the old Goessman X-ray Laboratory to create a chic new X-ray space fusing an eclectic mix of old and new.



James Walsh, Scott Thiel, Kim Bolduc, Nick Manganaro, and Paul Marshall

Our lab space on the ground floor of PSB is also up and running. We have a double glovebox fitted with a microscope to allow us to work with tiny air-sensitive samples in our diamond anvil cells, some high-temperature ovens and furnaces for solid-state reactions, a planetary ball mill, a set of hydro-thermal reaction vessels for "low-pressure" synthesis, and various pieces of recycled equipment sourced from elsewhere on campus through the help of Ryan Feyrer and Bob Sabola. Without Ryan and Bob, we'd probably just have a lab full of unopened crates and boxes.

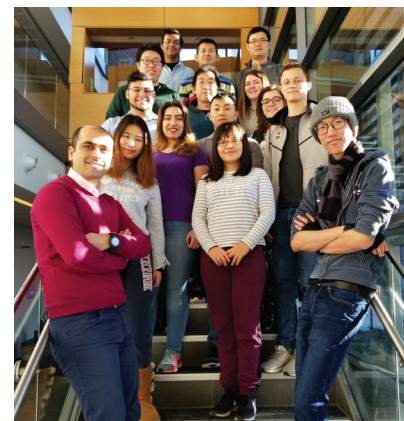
The group visited the Advanced Photon Source in Chicago during a particularly snowy week in January. The students met with future beamline collaborators and other researchers in the field of high-pressure science, and participated in various workshops to get them up to speed with the synchrotron techniques they will soon be using.

We are all looking forward to a return to normality, but continue to forge ahead in the meantime! Check out our website for updates: high-pressure.chem.umass.edu

You Group

This is our fourth year here at UMass, and it has been a busy and special year. In September, Prof. Mingxu You received a five-year, \$1.9 million NIH Maximizing Investigators' Research Award (MIRA) to support our research in developing

DNA-based probes to quantify cellular mechanical forces. In addition, Prof. You has been selected as a Rising Star by the journal *Frontiers in Chemistry* and as an Emerging Investigator by the journal *Nanoscale*. He also joined the editorial board of *Membranes*. This year we have published one book chapter, seven manuscripts, with three more manuscripts under revision or review. **Rigumula Wu**, a fourth year graduate student, described in *Angew. Chem. Int. Ed.* and *ACS Appl. Bio. Mater.* two novel ratiometric RNA-based sensors for quantifying metabolites. **Dr. Kewei Ren** published in *J. Am. Chem. Soc.* with a highly sensitive way for imaging low-abundance RNAs in live cells. These works have been partially supported by a recently granted NSF CAREER proposal to engineer next-generation RNA-based sensors. In another work published in *Chem. Sci.*, **Yousef Bagheri**, a fourth year graduate student, provided a quantitative assessment of the cell membrane modification of lipid-DNA probes. This work has been highlighted as a 2019 HOT article. **Dr. Bin Zhao** published a review article about the design and applications of these lipid-DNA probes in *Curr. Opin. Biomed. Eng.*



Two new graduate students, **Ru Zheng** and **Ahsan Ausaf Ali**, joined the lab this year. **Prof. Yang Shu** from Northeastern University of China and **Nuanfei Zhu** from Jiangsu University joined us for a year-long-visit. **Aruni Karunanayake Mudiyanse** re-joined us as a research fellow. We also welcomed several new undergraduate researchers including **Jikun Wang**, **Yiwen Xie**, **Zachary Gentile**, **Saoirse Connolly**, **David Lutati**, **Zhixin Mo**, and **Alan Chai**. On the departure side, **Dr. Bin Zhao** became an IGB Fellow at the University of Illinois. **Fatemeh Shafiei** finished her visit and will join the chemistry PhD program at Michigan State University. **Manojkumar Narayanan** finished his M.S. thesis research and graduated from the UMass Lowell biology program. Undergrad **Kathleen McAuliffe** graduated from UMass. We will miss all of you!

Lab members have also obtained several awards and achievements. **Puspam Keshri** and **Zhining Sun** have passed the original research proposal defense and become PhD candidates. **Yousef Bagheri** received a Biophysical Society travel grant and attended the 2020 Biophysical Society Annual Meeting. **Qikun Yu** and **Rigumula Wu** were both awarded a William E. McEwen Fellowship Award for outstanding poster presentation during ResearchFest 2019.

We are looking forward to a more healthy and successful year. For more information, please visit our website: <https://elements.chem.umass.edu/youlab/>

Sir Harold W. Kroto & Steve Acquah GEOSET Award by Steve Acquah

The Sir Harold W. Kroto & Steve F. A. Acquah GEOSET Award is presented to a chemistry major at UMass Amherst who has demonstrated excellence in science communication through digital media.

After Sir Harold Kroto received the 1996 Nobel Prize in Chemistry with Richard Smalley and Robert Curl for the discovery of Fullerenes, he continued to focus on research and expand his efforts into science outreach and communication. Directing the Kroto Research Group allowed me to get involved in many outreach activities culminating in the creation of the Global Educational Outreach for Science Engineering and Technology (GEOSET) initiative. After Kroto's passing, I wanted to keep his legacy and passion for research and science outreach alive by establishing this award at UMass Amherst. Central to the work of Kroto and I were our efforts to encourage the next generation of students to pursue science as a career, through local community engagement. Talking with international research students at the 'Lindau Nobel Laureates Meetings' and sharing ideas about how they engaged with their local communities in outreach projects provided added incentive to establish this award.



The 2019 GEOSET Award presented to Dominique Carey by Richard Vachet and Steve Acquah

If Harold Kroto were still with us, he would have undoubtedly been impressed with how students are embracing the maker movement and science communication in response to some of the challenges we currently face in society.

I completed my doctorate at the University of Sussex (United Kingdom) under the supervision of the Nobel Laureate Sir Harold Kroto, Prof. David Walton, and Prof. Dek Woolfson, working on fullerenes and a collaboration based on self-assembling alpha-helical coiled coils for tissue engineering. In my final year, I moved to Florida State University as a Research Scholar to direct the new Kroto Research Group. My research activities there focused on carbon nanotube-based technologies involving hydrogen sensors, piezoelectric devices, and fullerene-based photovoltaic devices.

Directing Sir Harold Kroto's Research Group

Sir Harold Kroto was an English Chemist and a professor of Chemistry at Florida State University, where he focused

on nanoscale research while developing new approaches to STEM educational outreach. In 1996 he received a Knighthood for his contributions to chemistry and was selected as one of the recipients of the Nobel Prize for Chemistry for the discovery of fullerenes. He was a Fellow of the Royal Society of London and held an emeritus professorship at the University of Sussex.

I directed all the undergraduate research projects and some of the graduate research for the group and received funding from the Undergraduate Research Opportunity Program (UROP). My research collaborations enabled me to work at the Bio-Nano Electronics Research Centre, part of Toyo University in Japan, where I currently hold a position as a Visiting Researcher.



One of the first Global Doodles celebrating 25 years of the discovery of the Buckyball (<https://www.google.com/logos/buckyball.html>)

For the 25th Anniversary of the discovery of fullerenes, Google reached out to Harry Kroto about the creation of a doodle for one of their first global interactive doodles.

Science Communication - Global Educational Outreach for Science Engineering and Technology (GEOSET)

Kroto founded The Vega Science Trust to create broadcast quality science films for British television networks, including the BBC. Production for television was expensive, and Harry wanted to explore online videos as a way of delivering on-demand content. The Global Educational Outreach for Science Engineering and Technology (GEOSET) initiative was created to exploit the creative dynamics of the Internet to improve the general level of scientific understanding and awareness around the world.

Prior to my arrival at UMass Amherst in 2018, I was director of the Global Educational Outreach for Science Engineering and Technology Studios (GEOSET Studios) at Florida State University (FSU), and I continue to direct international GEOSET collaborative efforts. GEOSET provides a free resource of educational materials and videos produced by students and educators. I designed and supervised the construction of an educational recording studio at FSU. The \$70,000 facility in the Science Library provided a central location for students and faculty to showcase their passion for science communication. I invited Bill Nye 'The Science Guy', a connection I made at a Google science event, to formally open the facility.

During my time at FSU, I received several international awards for e-learning activities, including the Rich Media Award for Global Reach, and The Enterprise Video Award

— Video Scholarship, which enabled me to present a student at FSU with a scholarship to support their studies. I also received the Enterprise Video Award — Video Maverick, and an Honorable Mention for Scholastic Achievement. GEOSET Studios also provided a support service for funding proposals and outreach activities. Similar support services have been established at the UMass Amherst Digital Media Lab.



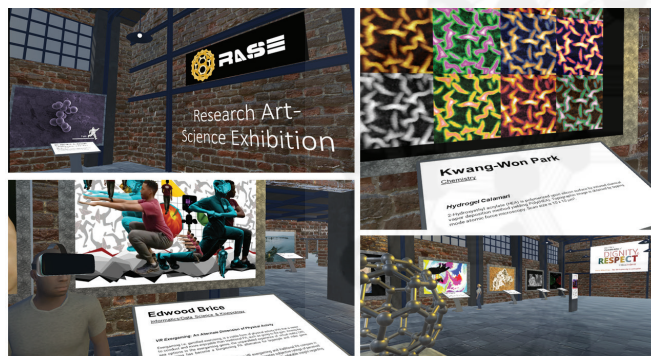
The Official Opening of GEOSET Studios with Bill Nye, and the recording studio setup.

In the early years of GEOSET, the focus was on making impactful connections to academic institutions and organizations to support our goals. Tim O'Reilly (O'Reilly Media), Chris DiBona (Google) and Timo Hannay (Nature) invited me to join them at Science Foo Camp, also known as “Sci Foo”. It is an event organized by Google, Nature, O'Reilly, and Digital Science, where the invitees come from many different areas of science, as well as technologists and policymakers, deciding on the agenda of the conference on arrival.

Science Foo Camp has taken place annually at the Googleplex campus in Mountain View, California, and I gave a presentation about GEOSET and the importance of science communication and outreach. In attendance to the event were Bill Nye, BBC News correspondents, and the author Robert Sawyer.

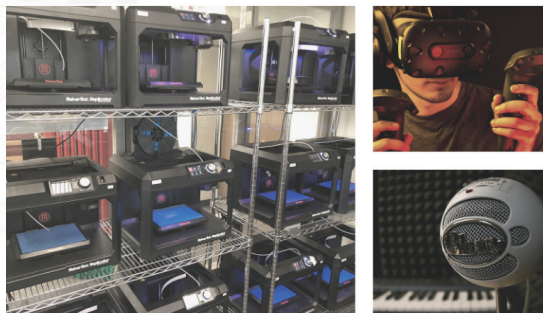
Directing the UMass Amherst Digital Media Lab

At UMass Amherst, I lead the Digital Media Lab and foster collaborations with departments and organizations outside the university in the development of media projects, 3D printing research, and Virtual Reality technology. I host the Research Art Science Exhibition (RASE) each year at the DML and create Virtual Reality based exhibitions to archive the work of the students.



2019 virtual exhibition <https://simmer.io/@GEOSET/rase-2019>

The Digital Media Lab (DML) in the W.E.B. Du Bois Library is a key location for creativity and innovation supporting the university community through engagement on professional audio/video productions, virtual and augmented reality, 3D printing, and artificial intelligence. This centralized facility provides equipment for students and staff to borrow and use in their projects, classroom activities, and to support funding proposals. The virtual reality facility keeps the DML at the cutting edge of technology with a service that delivers a new way to reach out to the university community. We are working on virtual reality applications that cover many issues, including a simulator to help students practice public speaking in a virtual lecture hall.



At UMass Amherst, I was a 2018 Innovation Fellow and a 2019-2020 Sustainability Curriculum Fellow. I

co-instruct the Makerspace Leadership and Outreach course, helping students with hands-on projects that support the United Nations Sustainable Development Goals. My research connects my position in the chemistry department and the coordinator of the Digital Media Lab by investigating new materials for 3D printing.

The Digital Media Lab worked as part of the UMass Amherst COVID-19 Response Teams, leading efforts to produce 3D printed personal protective equipment (PPE). Innovation Hubs, Makerspaces, and Libraries were all activating their large clusters of 3D printers to produce PPE, making an impact in supporting their communities. Our 3D print farm (fifty 3D printers) was used to produce components for over 2000 face shields. We worked with community volunteers to assemble the 3D printed headbands from the DML with the clear plastic visors and delivered the completed face shields to hospitals and care facilities, including the Soldiers' Home In Holyoke.

The Digital Media Lab featured in the 'Be Revolutionary' campaign video highlighting our Virtual Reality equipment. Our new facility under construction in the Library will have two Extended Reality rooms where students and faculty can engage in and receive support with Virtual Reality, Augmented Reality, and Artificial Intelligence.

I was awarded the status of Chartered Chemist (CChem) and Chartered Scientist (CSci) by the Royal Society of Chemistry and The Science Council. The Chartered status is only awarded by Institutions that operate under the Royal Charter by a British Monarch. As a Fellow of the Royal Society of Chemistry (FRSC) and the Royal Microscopical Society (FRMS), I work towards creating opportunities for students to get involved with science communication.

29th annual ResearchFest

The 29th annual research symposium, ResearchFest, introduces first year students to our program, faculty, staff, and fellow students. The keynote address was given by **Dr. A. Ben Mohimen** (Kaltashov lab '04), Director of Regulatory Affairs at CMC Blueprint Medicines.

A career panel provided an opportunity for graduate students to directly interact with UMass alumni, including Dr. Mohimen, **Alyssa Marsico** (University of New Haven, Assistant Professor of Forensic Science, Vachet lab), **Angela Migués** (SUNY, Assistant Professor, Auerbach lab), **Tom Vargo** (Abbvie, Senior Scientist II, Knapp lab), **Krys Bronk** (Ingenuity, Product Manager, Thai lab) and **Derek Macpherson** (Silicon Therapeutics, Contract Investigator, Hardy lab).

The **Marvin D. Rausch Scholarship Award** for Outstanding Presentation was awarded to **Christie Ellis** (Venkataraman group) for her work on "Improving Stability of Hybrid Organic-Inorganic Perovskite Solar Cells by Substituting Larger Organic Cations" and **Yasaman Gholamalipour** (Martin group) received the William E. McEwen Graduate Scholarship in Chemistry as runner up for her work on "RNA-Seq as an Analytical Tool Provides New Mechanistic Understandings and New Practical Approaches in a System Widely Used in the Synthesis of RNA."

Two finalists received **William E. McEwen Awards** for their presentations: **Lin Hui Chang** (Strieter Group) and **Kristen Sikora** (Vachet Group).

Over 60 graduate students presented posters, and **The Dr. Paul Hatheway Terry Awards** for Outstanding Poster Presentations were presented to **Kong Limpikirati** (Vachet Group) and **Babgen Manookian** (Auerbach Group), with **YiWei "Bill" Lee** (Rotello Group) selected as the First Year Student Choice winner.

Six students received the **William E. McEwen Fellowship Award** for Outstanding Posters: **Sandor Babik** (Strieter Group), **Laura Castellanos** (Vachet Group), **Elvan Cavac** (Martin Group), **Jessa Marie Makabenta** (Rotello Group), **Qikun Yu** (You Group), and **Rigumula Wu** (You Group).

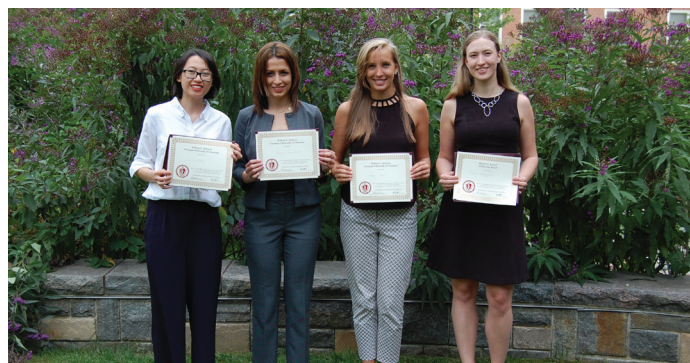
The Association for Professional Development in Chemistry (APDC) held a cookout in the amphitheater behind the ISB for students, faculty, staff, and their families.

We gratefully acknowledge the financial support we received for this event from the UMass Amherst Department of Chemistry, Marvin D. Rausch Scholarship Fund, Dr. Paul Hatheway Terry Scholarship, William E. McEwen Endowment Fund, and alumni. We also thank the following vendors who came to show us what their companies had to offer: ChemGlass, Takara, Celltreat, Fisher Sci, TCI and Thermo Fisher.

If you are interested in contributing to this event, please contact Vicki Hubby at vicki@chem.umass.edu.



Poster winners (left to right): Kong Limpikirati, Qikun Yu, Laura Castellanos, Elvan Cavac, Jessa Marie Makabenta, Rigumula Wu, Sandor Babik, YiWei "Bill" Lee, (front) Babgen Manookian



Talk Award Winners: Lin Hui Chang, Yasaman Gholamalipour, Kristen Sikora, and Christie Ellis



Incoming Fall 2019 Graduate Students: Kyle Winters, Nicholas Manganaro, Jonathan Bell, Jessica Allen, Jeffery Cullen, Theo Prachyathisakul, Jeerapat Douchchawee, Paul Marshall, JungMi Park, Kimberly Bolduc, Amin Abek, Eric Ostrander, Hyung Gu Kim, Zhaojie Zhang, Subhayan Samanta, Ruptanu Banerjee, Koustab Pradhan, Yi Du, Hariri Nagaraj, Mingdi Jiang, Nathaneal Kuzio, Jayashree Bhagabati, Rakesh Sahoo, Scott Thiel, Angira Roy, Ranit Dutta, Yumeng Zhang, Jewel Medeiros. Not pictured: Ashan Ausaf Ali, Jackie Davies, Rehab Heikal, Qianlan Jia, Gaurav Mitra, Ru Zhang



PhD defenses

June 2019 - June 2020

Priyanka Basak, *"Study of the role of biologically-relevant labile nickel pools in the maturation of nickel-dependent enzymes,"* Michael Maroney

Riddha Das, *"Engineered Nanoparticles for Site-Specific Bioorthogonal Catalysis: Imaging and Therapy,"* Vincent Rotello

Kirandeep Deol, *"Utilizing Mass Spectrometry to Study Ubiquitination and Degradation,"* Eric Strieter

Wardah Ejaz, *"Stimuli responsive nanomaterials for CRISPR-Cas9 delivery,"* S. Thai Thayumanavan

Christie Ellis, *"Powering Advances in Next-Generation Photovoltaics through Materials Synthesis and Characterization,"* D.Venkataraman

Jingjing Gao, *"Modulating Nanoparticle-Protein Interactions through Covalent or Noncovalent Approach for Biomedical Applications,"* S. Thai Thayumanavan

Yasaman Gholamalipour, *"RNA-SEQ and Mechanistic Enzymology Confirm RNA Self-Templated Extension by T7 RNA Polymerase and Suggest Novel Approaches Towards Improved in Vitro RNA Synthesis,"* Craig Martin

Akash Gupta, *"Engineering Nanomaterials for Imaging and Therapy of Bacteria and Biofilm-Associated Infections,"* Vincent Rotello

Joseph Hardie, *"Chemical Manipulation Of Macrophages: Nanomaterial And Molecular Approaches,"* Michelle Farkas/Vincent Rotello

Huan He, *"Design, Synthesis and Study of Functional Amphiphilic Polymers and Their Applications"* S. Thai Thayumanavan

Ziwen Jiang, *"Non-cationic Polymeric Materials for Therapeutic Delivery Applications,"* S. Thai Thayumanavan

Vikash Kumar, *"Depolymerizable & Dissipative Chemical Systems: Role in Material Synthesis and Applications,"* S. Thai Thayumanavan

Xin Li, *"Tools for Fundamental Mechanistic Studies: Resolving Protein Dynamics by Nanopore Tweezer and Quantitating Molecular Trafficking by Droplet-Interface Bilayer Technologies,"* Min Chen

Patanachai Limpikirati, *"Structural Analysis of Protein Therapeutics Using Covalent Labeling – Mass Spectrometry,"* Richard Vachet

Hui-Hsien Lin, *"Evaluation and Small Molecule Modulation of Circadian Rhythms in Cellular Models of Cancer,"* Farkas/Rotello

Tianying Liu, *"Covalent Labeling-Mass Spectrometry for Characterizing Protein-Ligand Complexes,"* Richard Vachet

Yuanchang Liu, *"Engineering Nanomaterials for Immune Modulation of Macrophages and Cancer Therapy,"* Rotello/Vachet

Sarah Marques, *"Fluorescence Spectroscopy and Microscopy Studies of Chromophore Coupling in Isolated Small Molecule Nanostructures,"* Michael Barnes

Chendi Niu, *"Novel Mass Spectrometry Based Strategies to Study Heparin-Protein Interactions,"* Igor Kaltashov

Kristen Sikora, *"Investigating the Accumulation, Sub-Organ Distribution, and Biochemical Effects of Nanomaterials Using Mass Spectrometry,"* Richard Vachet

Meizhe Wang, *"Supramolecular Nanoassemblies for the Separation and Mass Spectrometric Analysis of Peptides and Modified Proteins,"* Richard Vachet

Hanwei Zhao, *"Characterization of Biodistribution of Transferrin and Receptor Binding Mechanism by Mass Spectrometry,"* Igor Kaltashov

MS Degrees: Maryam Shahryari (Trisha Andrew), Yidan Cong (Min Chen), and Ran Duan (Michael Knapp)

As the 2019-2020 academic year has drawn to a close, it marks the end of the first decade of the iCons Program. It was a decade of creation, innovation, and transformation. The 2020-2021 academic year is the beginning of the next era for iCons — an era of program growth and broadened student impact, while becoming a more diverse, equitable, and inclusive place for UMass students and faculty.

Speaking of students, we welcomed the 10th cohort to iCons — the so-called “**Planet X**” this past fall. These 60 students come from 23 different majors, from Chemistry to Computer Science, and from Physics to Portuguese. Members of the new cohort represent 7 out of the 10 degree-conferring undergraduate schools and colleges at UMass.

Regarding veteran iCons students, we are proud to report that **Hansen Tjo** and **Joshua McGee** were awarded the Sustainability Innovation & Engagement Award (SIEF) for 2020 for their proposal entitled: “A Pilot-Scale Biodigester: Engineering Campus Sustainability Via Anaerobic Processes.” According to Tjo: “We worked on the idea of the anaerobic biodigester in our iCons 2 class out of a desire to connect renewable energy topics to biotechnology.” This project shows iCons students taking seriously **Chancellor Subbaswamy’s** goal of getting the UMass campus, the largest emitter of greenhouse gasses among Massachusetts state agencies, to net-zero emissions by the year 2030.

As many of you already know, the iCons Program received a generous, five-year gift from the **Mahoney Family** that made possible the creation of an executive director position for iCons. Longtime chemistry professor and founding director of iCons, **Dr. Scott Auerbach**, was officially installed as the Mahoney Family Sponsored Executive Director on November 6, 2019. The Mahoney Family Sponsorship provides funding for Prof. Auerbach’s research on the computational chemistry of zeolites (see LabNotes on page 11 for more details), as well as support for iCons instruction and program evolution. The Mahoney Family Sponsorship has allowed us to launch a new, collaborative research project on the uniqueness of iCons instruction — focusing on both interdisciplinary and applied aspects — with **Profs. Ryan Wells** and **Ezekiel Kimball** of the UMass College of Education. We are excited to share the results of this new research soon and are grateful to the Mahoney Family for their generous support of UMass iCons.

Another wonderful addition to the program was the creation of a new iCons Student Space — the so-called “**iSpace**,” which was officially opened in Lederle Graduate Research Tower 432 with a “housewarming ceremony” in February 2020. The iSpace was conceived of by graduating seniors **Emily Hansen** and **Joseph McGaunn**, created to facilitate iCons-style collaboration outside of the classroom. The iSpace provides a “home base” for the iCons community so that all students, no matter the cohort, can interact with one other while providing a place for formal and informal student-to-student mentorship and guidance. The iSpace promises to be an important part of iCons for a long time.



iCons students celebrate iSpace opening

iCons ended the year much like most of the world, at home, working and learning remotely due to the global pandemic, COVID-19. Due to the unique nature of the final two months of the academic year, iCons was forced to adapt. The annual **Senior Exposition** was held virtually on Thursday, April 30. This year’s Senior Expo featured the seventh cohort of iCons seniors, the so-called “**7th Kingdom**,” with each senior giving a brief online presentation about their research project on one of today’s pressing problems. Following the exposition was the Senior Celebration, to celebrate the accomplishments of iCons seniors, and to present the Mahoney Alumni Award for the iCons Program as well as the Crowley-Nowick Award for iCons Student Leadership and Philanthropy. This year’s recipient of the **Mahoney Alumni Award** was **Lily Fitzgerald ’14**. Ms. Fitzgerald is the Policy and Government Affairs Manager for Ginkgo Bioworks, Inc. in Boston, MA.

Executive Director Auerbach says, “**Lily Fitzgerald** has remained a very close friend of the iCons Program over the years, by staying in touch with iCons students, seeking out iCons students as Ginkgo interns, representing iCons at official events in Boston, and by participating in a research study on the effects of iCons.” We send our heartfelt congratulations to Ms. Fitzgerald!

The **Crowley-Nowick Award for iCons Student Philanthropy and Leadership** was created in 2017 with a gift from **Peg Crowley-Nowick ’86**. Award winners are selected based on their commitment as leaders within their cohort and for fostering a sense of community that will persist beyond graduation. This year’s recipients are **Aurelia Reynolds** of Sandwich, MA and **Andrew Guthrie** of Mansfield, MA. Both students happen to major in Biochemistry & Molecular Biology.

Another way we adapted to the COVID-19 pandemic this year was to create the **iCons Innovation Portal**, an expansion of the iCons website that showcases all iCons student research projects as an interactive instructional tool. The iCons Innovation Portal (icons.cns.umass.edu/innovation-portal) provides a searchable database of student research presentations on topics in its two concentration areas — renewable energy and biomedicine — and allows the online audience to pose questions to student researchers. We hope the Innovation Portal will allow iCons student research to enjoy increased impact through online dissemination. We hope you’ll check out the portal!

As we close the Summer 2020 installment of the iCons Update, we wish to **thank all our supporters and sponsors**, including the Mahoney Family, the Chleck Family Foundation, Anika Therapeutics, Waters Corporation, Zipher Medical Affairs, and all our other benefactors. We are grateful for your much-needed support!

We hope you will visit the iCons website, icons.cns.umass.edu, to keep up to date with what is happening. And we wish you all to stay safe and sound, happy and healthy during these unprecedented times.

Seminar

by Mingxu You, Seminar Chair

We were able to bring many outstanding scientists to UMass Amherst for the 2019–2020 Department of Chemistry seminar series. These speakers included several distinguished members representing the diverse field of chemistry. We are very glad to learn their insights and recent discoveries.

In September 2019, we started our seminar series with **Professor Timothy Lodge** from the University of Minnesota, who presented the Stein-Covestro Honorary Seminar in Polymer Chemistry. Prof. Lodge is a Regents Professor, Minnesota's highest academic rank. In 2016, he was elected to the American Academy of Arts and Sciences. As an internationally recognized leader in polymer chemistry, his research interests center on the structure and dynamics of polymer liquids, including solutions, melts, blends, and block copolymers. His seminar focused on the construction and application of ionic liquids/block polymer nanostructures as versatile functional materials.

Professor George M. Church from Harvard Medical School presented the William E. Mahoney Annual Lecture in September. Prof. Church is known for pioneering the fields of personal genomics and synthetic biology. He developed the first methods for genome sequencing and contributed to nearly all “next generation” sequencing methods. His team also invented CRISPR for human stem cell genome editing and gene therapies. Prof. Church is a member of the National Academy of Sciences and the National Academy of Engineering. During this lecture, he discussed the recent advancement of techniques for reading and writing nucleic acids and proteins, as well as their diverse applications in analysis, synthesis, and functional testing of various complexes.

Due to the COVID-19 pandemic, several of our planned seminars in Spring 2020 were postponed. For example, **Professor Karen Goldberg**, Vagelos Professor in Energy Research at the University of Pennsylvania, was invited to present the Marvin D. Rausch Lecture in Organometallic Chemistry in May 2020. Prof. Goldberg is best known for her work developing mechanistic understanding of fundamental organometallic reactions and for creation of new catalytic systems. She is also a member of the National Academy of Sciences and the American Academy of Arts and Sciences.

Also, a highlight of each year's seminar program, the 5-College Lecture Series in Chemistry was co-hosted by UMass Amherst, Smith, Mt. Holyoke, Amherst, and Hampshire. In Spring 2020, we were planning to welcome **Professor Richmond Sarpong** from the University of California Berkeley as the 5-College Lecturer. Prof. Sarpong's lab focuses on the synthesis of bioactive complex organic molecules that can inspire new medicines.

We are grateful for the generous contributions of our alumni and corporate sponsors, who make the success of the seminar program possible. More information about upcoming seminars and events can be found at <https://www.umass.edu/chemistry/events-seminars>. We look forward to another exciting seminar series next year!



Profs. Rick Metz, Timothy Lodge, Richard Stein, and Don Wardius



Prof. George Church and William Mahoney

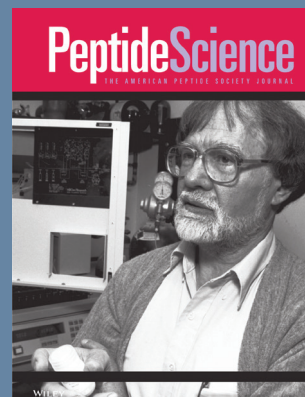
Protecting Group Pioneer

The department pays tribute to the life and scientific legacy of Lou Carpino, Professor Emeritus of Organic Chemistry who died in January 2019 at the age of 91. Lou Carpino was a household name amongst organic chemists for his pioneering work developing amino-protecting groups. One of his most well-recognized contributions was the discovery and development of tert-butyloxycarbonyl (Boc) as a protecting group for amino acids. This protecting group is used by organic chemists around the world for production of all kinds of products including peptides, peptide-nucleic acids (PNA), and many other amide containing compounds.

Prof. Lila Gierasch and Prof. Emeritus Peter Lilly have led the departmental charge to honor Prof. Carpino's legacy. Gierasch is planning a symposium in his honor, and details will be shared on the departmental website when a date is selected. Prof. Gierasch also co-edited a special issue of the journal *Peptide Science* dedicated to Prof. Carpino's work. The issue includes reflections of Lou as a person, and as a scientist, from both colleagues and scientists who trained with Lou as graduate students or post-doctoral fellows. The journal can be accessed at <https://onlinelibrary.wiley.com/toc/24758817/2020/112/4>.

Prof. Gierasch describes her experience preparing for the special issue of *Peptide Science*, “Pete (Lilly) and I went through the amazing treasure trove of scientific history in Lou's office, including 50 years of notebooks on his peptide research written in his own hand, and deposited the material in the UMass Archives. If you are interested, it will be preserved there so that we do not lose Lou's scientific legacy.” A description of the collection can be found at: <http://scua.library.umass.edu/umarmot/carpino-louis-a/>.

The *Peptide Science* issue will provide those who did not have the chance to interact with Lou, and even some of us who did, a better picture of this multi-faceted but nearly reclusive giant of peptide science.



2020 Undergraduate Awards

The department hosted a virtual Undergraduate Awards Ceremony on May 7th via Zoom. Students and their families were joined by faculty, staff, donors, and Dean Serio to recognize the hard work and dedication of our students, and their amazing ability to excel under unusual circumstances.

We chose to keep the ceremony in a meeting format to allow full participation. Each awardee had the opportunity to say a few words, donors were also invited to talk about their awards, and research advisors introduced the research awards winners from their groups.

The awards are made possible because of the generous support the department receives from our alumni, industrial partners, and professional organizations. The committee wishes to thank our outstanding students for their contributions to the department and university and wishes to thank those who, in turn, support our students.



Academic Awards

American Chemical Society (ACS) Hach Scholarships

Olivia Pietrobuono and George Ryan

ACS Undergraduate Award in Analytical Chemistry

Garrett Miskell

CRC Press Chemistry Achievement Award

Bao Le, Sabrina Liang, and Sean Tran

Edward Shapiro Fund

Nicholas Dix, Alexander Hamel, Sean Macken, Erin Monaghan, and Mason Tomko

George R. Richason, Jr. Scholarship

Cameron Kaminsky

Jay A. Pirog Scholarship

Cameron Sanders

John A. Chandler Memorial Scholarship

Nicholas Heller

Michael Bruno Scholarship

Sean Macken

Robert Maxwell Williams Memorial Scholarship

Maya Hegde, Sidney Johnson, Jimmy Tran

Royal Society of Chemistry Certificate of Excellence

Bryanna Lexus Freitas

Thomas R. "Casey" Stengle Scholarship

Mason Tomko

Research Awards

ACS Undergraduate Award in Inorganic Chemistry

Mitchell Buckely

ACS Undergraduate Award in Organic Chemistry

Cameron Sanders

ACS Undergraduate Award in Physical Chemistry

Callie Jillson

Chemistry Undergraduate Research Fund

Ryan Thai

J.F.B. Fund for Undergraduate Research

Tiernan Kennedy

Mr. Tompkins Award

Emily Saltzman and Isabella Jaen Maisonet

Oliver Zajicek Memorial Scholarship Award

Yuying Zhang

Professor Jack Ragle Endowed Fund in Chemistry

Nicholas Heller

Roger G. Bates Chemistry Fund

Ethan Goulart

Tarselli Family Research Award

Ethan Goulart and Ryan Pham

Mahoney Undergraduate Summer Research Award

Ryan Pham

Departmental Awards

ACS-Connecticut Valley Section Student Award

Isabella Jaen Maisonet

American Chemical Society Membership Awards

Thomas Kumlin and Samuel Knight

American Institute of Chemists Award

Luke He

Departmental Recognition Award

Luke He and Samantha Tufts

Distinguished Undergraduate Instructor Award

in Honor of Earl J. McWhorter and George R. Richason, Jr.

Rachid Skouta

Distinguished Graduate Teaching Assistant Award

in Honor of George R. Richason, Jr.

Muhammed Abdullah

Distinguished Undergraduate Teaching Assistant Award

in Honor of George R. Richason, Jr.

Samantha Tufts

Positron Award

Ryan Thai

Richard W. Fessenden Award

Ruby Nelson

Senior Class Award

Luke He



"Congratulations, GRADS! UMass has great Chemistry" was expressed to our students via Zoom by faculty and staff.

Chemistry's Senior Recognition Ceremony on Friday, May 8th, was held in an online meeting style forum. Senior Gillian Willcox was nominated by her peers to be the chemistry "chirper" at the CNS Celebration, and presented her brief speech at the department's ceremony. Our Department Head, Rick Metz, Chief Undergraduate Advisor, Ruthanne Paradise, and Undergraduate Program Director, Mike Knapp all wished our seniors well, and seniors were invited to share photos and stories. The format allowed our graduates to talk with each other, faculty, staff, and parents. Seeing happy faces, talking with seniors, and hearing their plans for the future helped reaffirm connections after an isolating spring semester.

The College of Natural Sciences shared a webpage with a graduation message from Dean Tricia Serio, and well wishes and congratulations from faculty, staff, parents, and fellow students. www.cns.umass.edu/news-events/senior-celebration

The university wished graduates well with an impressive virtual celebration video hosted by Chancellor Subbaswamy and featuring UMass President Marty Meehan, Gov. Charlie Baker, U.S. Sen. Elizabeth Warren, U.S. Rep. Richard Neal, former U.S. Secretary of State John Kerry, former men's basketball coach John Calipari, retired NASA astronaut Cady Coleman, alumnus and Life is Good Co-Founder John Jacobs, news host Rachel Maddow, New England Patriots players Julian Edelman, Devin McCourty, and James White, Patriots owner Robert Kraft, actors Ben Affleck and Rachel Dratch, and many other high profile speakers. The UMass wind ensemble and marching band provided music, and student speaker Grace Jong reflected on her days at UMass and offered words of encouragement. Chemistry Professor, and iCons Director, Scott Auerbach, was one of a few faculty selected to participate in the UMass fight song collage with cheers and applause while chanting "Go, Go U, Go U Mass, Go UMass!" Watch the commencement celebration at www.umass.edu/commencement/



Chemistry Seniors 2020

Alexander Amato
Lauren Bishop*
Kevin Richard Bonanno*
Isabelle Bongiorno*
Tala Chunga
Austin Croke*
Madison Cuppels
Alex Dantone
Bryanna Lexus Freitas*
Taylor Garrey*
Luke He
Uyen Huynh
Isabella Jaen Maisonet*
Natalie Jensen*
Callie Jillson*
Thomas Kumlin
Lynh Le
Jonathan Lee*

Dimee Livingston-Padilla
Pui Chi Lo*
Ruby Nelson*
Jakub Polanowski*
Cameron Sanders*
Damon Schneider
Samantha Tufts*
David Turnbull
Jenna Westley*
Gillian Willcox*
Yuying Zhang*

Fall 2020
Anna Kramer
Sixing Mo*

* American Chemical Society certification

senior Research Reflections



Samantha Tufts '20

In my final year at UMass, I studied gold nanoparticles with the Rotello group. These nanoparticles had previously been probed for drug delivery purposes. I focused on researching terminal groups of the ligands attached to these gold nanoparticles. Specifically, the hydrophobicity of the terminal group affects the kinetics of delivery. By synthesizing nanoparticles with a variety of hydrophobic head groups, we can probe the effect of these changes on delivery kinetics, which will allow the engineering of nanoparticle delivery vehicles with desired kinetic activity. I am looking to go into the pharmaceutical industry, specifically to work in the drug discovery field. Once I find a suitable company, I hope to return to school and pursue a Master's degree in organic chemistry so that I can further my career in this field.

Yuying (Chloe) Zhang '20

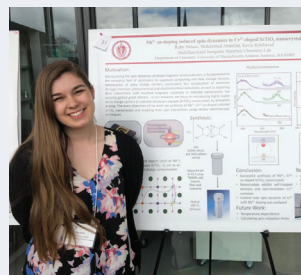
As one of the world's most consumed crops, rice contains concentrations of inorganic arsenic, a class I carcinogen, that can lead to cancer if overconsumed. The effect of inorganic arsenic in rice has been a growing concern in the science community. When "inorganic arsenic in rice" is searched, the Web of Science Core Collection found a total of 567 publications with over 1,830 researchers from 41 countries. As demand for information grows, a simple and inexpensive measurement procedure is required. The goal of my research is to measure arsenic concentrations in rice by adjusting the field test kits developed for drinking water analysis.

The maximum contamination level in drinking water proposed by the World's Health Organization (WHO) is 10 μg per L. In the US, expensive and complicated assays are available. However, in many developing countries, such as Bangladesh, such expensive equipment is not available. To solve this problem, we worked in collaboration with Chemists Without Borders to develop a method to determine the inorganic arsenic concentration in rice that can be implemented in a rudimentary laboratory at the Asian University for Woman in Bangladesh. Our approach was to modify the Hach EZ test kit designed to measure inorganic arsenic in drinking water down to a concentration of 10 μg per L for rice analysis. The test is based on the reaction of arsine gas, generated by reaction of the inorganic species with powdered zinc in acid solution and purged from the solution by the co-evolution of hydrogen, with mercuric bromide crystals immobilized on a paper support. The resulting depth of the yellow/brown color is compared with colors on a standard chart, either visually or with the help of processing of the digital images taken with a smart-phone camera. The research was summarized in an 80-page thesis paper, including a mini-literature review for future experimental suggestion. Hopefully, this will be published and sent to the university in Bangladesh for replication.

I have always wanted to make a difference in underserved communities, and this research served as the first experience that allowed me to do so. Research has offered me an invaluable learning experience to critically analyze literature articles and to effectively extract information to improve the design of my own experiment. Moving forward, I will continue to pursue my passion in the field of research as a medical student.

Ruby Nelson '20

Working as an undergraduate in Professor Kittilstved's research lab introduced me to much more of the research experience than I could have ever expected. Not only did I have the opportunity to focus on a subject that was almost completely new to me, but I gained experience using multiple instruments, including some that I had never even heard of before, including the electron paramagnetic resonance spectrometer. Jumping into the study of doped transition metal ions in colloidal semiconductor nanocrystals was an adventure like no other. This work showed me both the joys of success (for example, when I was able to synthesize co-doped strontium titanate for the first time) and the frustrations of failure (when I was unable to provide an explanation for why my barium titanate samples would crash out of solution). It gave me the opportunity to present at many student poster sessions, showcasing my research to the general public, and helping me become more comfortable with public speaking.



I came into this research lab with no idea of what to expect from the graduate students around me, or from the research itself. Once there, I found that the lab community was willing to take me under their wings, and help me discover what I wanted to do in the future. They helped me through the frustrations that come through research, and guided me through my constant questions and confusions. They showed me that having a support network and a positive working environment can make a space feel welcoming, even to a sophomore with no experience with anything inorganic related. Though at this point, I have decided to work for a few years before going to graduate school, this lab has shown me what I want from a lab environment, and how I can positively impact a lab space.

Bryanna Lexus Freitas '20

Senior chemistry major Bryanna Lexus Freitas' team tied for first at the Innovation Challenge: Seed Pitch, receiving \$5,000 in equity funding from the Berthiaume Center for Entrepreneurship. Bryanna, along with Hadley Beauregard and Hailey Charest, won the funding for their company Bac-Be-Gone, a cleaning product to eliminate MRSA. MRSA is an antibiotic resistant bacteria that kills thousands of people in hospitals across the US. Bryanna says that the company has been "looking at bacteriocins as an alternative method of treatment since we are entering the post antibiotic world."

While there's often been a reliance on antibiotics in the medical field, Bryanna says, "Bacteriocins are amazing alternatives since they can be less toxic than antibiotics; they are narrow range killers which can avoid collateral damage to our microbiomes (a big issue), they have high stability, and they have a significant potency. We have shown that our drug works effectively in comparison to the "gold standard" drug that's available out there for MRSA. We came up with a product that can be applied as a wipe/spray and is organic, nontoxic, versatile, and our drug has already been FDA approved so getting our product approved should hopefully be relatively smooth. Also, the active drug that we're using is already used as a food preservative and hasn't shown resistance in over 50 (now going on 60) years. It also has so many other applications just outside of our MRSA spray/wipe which I think makes it amazing."

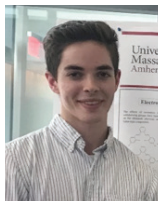


Bryanna Lexus Freitas, Hadley Beauregard, and Hailey Charest

undergraduate Research Focus

by Mitchell Buckley '21

As a rising senior majoring in Biochemistry and Molecular Biology with a minor in Chemistry, independent research has always been a focal point of my academics as well as something that I truly enjoy. Beginning in the second semester of my Freshman year, I was fortunate enough to have been given the opportunity to further my chemistry and biochemistry studies through an undergraduate research position in the Knapp Research Lab, working under Dr. Phillip Shivokevich.



My research has focused on the synthesis of salen-type compounds and how their interactions with different metal centers affect their spectroscopic properties, specifically, surface-enhanced Raman spectroscopy. Surface-enhanced Raman scattering (SERS) can be achieved through the interaction of salen frameworks and the surface of gold nanoparticles. This signal enhancement can allow for the detection and identification of various metals when complexed with the salen framework due to spectral shifts. The ultimate goal of my research has been to further ideas previously proposed about detecting various metals when bound to gold nanoparticles and developing a spectral identification library. By binding the metal-chelated salen complexes that we synthesize to gold nanoparticles through covalent thiol linkages, we hope to enhance the Raman spectroscopy signal in a way that may prove useful in detecting and identifying various metals in a biological setting. Alkyne and nitrile functional groups have been incorporated into these complexes due to their unique SERS absorption values. The unique Raman signals attributed to triple bonds of the alkynes and nitriles may allow for improved detection of metals. This will allow us to detect these unique absorption values even in the presence of other molecules that may produce "background noise."

Ultimately, I have spent much of my time in the lab synthesizing the salen frameworks with varying functional groups, chelating different metals to the frameworks, experimenting with different synthetic methods to incorporate thiol functionality into the salen complex, and finally, characterizing these complexes. I have gained valuable experience using and analyzing nuclear magnetic resonance spectroscopy, infrared spectroscopy, ultraviolet-visible spectroscopy, and Raman spectroscopy. I have been able to develop a much deeper understanding of how to analyze the data collected from these methods because of the extensive experience I have acquired over the past three years of research. As a student who intends to pursue a career on the biochemical side of medicine, the exposure and experience I have gained with these industry-standard characterization techniques will allow me to excel professionally.

Working in the lab with the mentorship of Dr. Shivokevich, I feel as though I have been able to professionally develop from a "student" into a scientist with the capability to independently deconstruct and understand the underlying concepts of chemical procedures as well as synthesize, work-up, and analyze characterization data of organic compounds. This transition from student to scientist gives me the confidence that I will be able to meet the challenges presented to me in my professional life after completing my degree at UMass Amherst.

Staff Notes

Lorraine Cox has been a vital staff member in the undergraduate program, and this winter she was hired into a full-time role. She tracks student progress, helps with advising, monitors enrollments, plus many other important functions. Lorraine finds her experience as the parent of a UMass student especially helpful, as well as her background in finance, relating to her work.

With Lorraine's additional support, **Brigitte McKenna**, the Undergraduate Program Manager, has taken on Communications and Graphic Arts responsibilities. Brigitte received her BFA in Computer Graphics from UMass Amherst, and looks forward to increasing the department's profile by sharing more research, faculty, and students highlights on social media. She also plans to incorporate science-related art installations in the main chemistry office spaces.

Chemistry Club

The **UMass Chemistry Club** aims to inspire an interest in and provide an environment for the UMass community to explore the joys of chemistry through interactive chemistry-related activities and demonstrations. Such interactive activities include ice cream socials, pottery, and soap making. Open to majors and non-majors alike! During parents' weekend, we made soap and did other chemical demonstrations for families.



Alumni

Mahoney Family Gift and iCons Program Poised to Transform STEM Education



A gift of \$1.25 million from the Mahoney family, over five years to the College of Natural Sciences at UMass Amherst, will significantly expand the reach of the Integrated Concentration in Science program (iCons)

by recruiting more faculty, providing more mentors for STEM students, and funding the spread of the pioneering iCons program to other higher education institutions.

“Interdisciplinary solutions have always been the key to solving the tough problems,” says Richard J. Mahoney, a longtime UMass supporter whose family is providing the increased funding for iCons. “Although academic institutions are often stuck in their silos in the way they teach and operate, I’m happy to see that UMass Amherst is pioneering a more integrated real-world education for its students. I was present at the creation of iCons, and having watched the program grow, I’ve seen first-hand its impact on students and their future in science.”

Mahoney’s family, including Barbara M. Mahoney ’55, William E. Mahoney ’55, Robert M. Mahoney ’70 and Kathleen S. Mahoney ’70 are longtime supporters of the sciences at UMass Amherst.

“The iCons program has invented a revolutionary approach for teaching that fosters innovation, integration and impact,” said UMass Amherst Chancellor Kumble R. Subbaswamy. “This generous gift from the Mahoney family enables UMass to provide national leadership in this 21st century way of learning.” (See page 24 for more iCons news.)

Researching COVID-19 at Dana-Farber Cancer Institute

by Katrina Nguyen ’18

I work for the Marasco Lab at the Dana Farber Cancer Institute. The lab has had previous discoveries in SARS and MERS outbreaks back in 2004 and 2012 respectively using a naive library of 27 billion human antibodies against all sorts of bodily invaders. Our goal is to utilize this same library to conduct phage display methods to find antibodies that bind our target antigen. The principles of phage display are quite simple: transfect E. coli cells with the bacteriophages containing plasmids from our library. These plasmids contain encoded protein sequences for the antibodies of interest. The colonies that subsequent-



Katrina Nguyen (right)

ly grow are able to express these proteins on the surface of the bacteriophage. Each individual clone obtained is then sequenced and unique antibody sequences are compiled. My job is to take all the phage clones and screen for relevant antibodies from binding to the “Spike” protein on SARS2. This includes downstream characterization of the antibodies by binding assays and neutralization assays. These finalized antibodies will hopefully go out and contribute to the current need for both antibody therapy and detection processes for SARS-Cov2. Because the lab previously used this for the SARS antibody discovery campaign, many of the techniques used are very similar.

Alumni Perspective by Mike Tarselli ’03



As I write this, the COVID-19 pandemic has been at the forefront of our international conscience since January 2020; about 7 months. The organization I worked for — Society for Laboratory Automation and Screening (SLAS), a nonprofit devoted to automation and

drug screening — found itself suddenly in the spotlight. Our members were the scientists devising detection assays, speeding up PPE production, and creating diagnostics to determine viral infection and antibody response. How best to support their efforts?

We provided as much information as possible to help the public understand the pandemic progression, and to empower researchers to learn from one another’s data. The SLAS publishing staff released an open-access collection of all SARS- and coronavirus-related assay technology. Our marketing team and I collaborated on a series of infographics to explain serological testing and drug repurposing. We recorded podcasts with people on the “front lines” of government and Pharma response. We also collected up more stories into a web series to share the diversity of response across the scientific continuum. All available free, here: <https://slas.org/resources/information/covid-19-infographic-resources/>

During this trying time of remote work and lockdown, my former CIO from Novartis, now at Flagship Pioneering, reached out with a potentially life-changing opportunity: did I ever think about becoming a Chief Scientific Officer in the start-up world? On Aug 17, I joined TetraScience, where we pithily call ourselves “digital plumbers.” The company takes data from instruments, automates its storage, organization, and transformation on the Cloud, and then provides it transparently to data scientists and operational staff. I will work to institute a scientific culture of excellence, expand product use, and improve our messaging. A dream job at an odd time, but that’s the way life has played out over my decidedly non-traditional scientific career. Excited to take on this new challenge, and deeply appreciative of the UMass staff and students who’ve helped me along the way.

Not Your “Standard” Life

Brandford Giddings, Sr. PhD (1929 - 2019)



We honor Dr. Giddings for the trailblazing work he did, not only in chemistry as one of the first two Black students to earn PhDs in our Department, but as a role model and mentor to other scientists of color during his career in organometallic and petroleum chemistry.

Dr. Giddings came to the US from Trinidad and Tobago in 1954 to attend Fisk University (an HBCU) in Nashville, TN. At that time, Fisk was an epicenter of the civil rights movement. During his time at Fisk, he met many figures of historical importance. Jesse Jackson, the late senator John Lewis, and Bernard Layfayette were all contemporaries at Fisk. In fact, Dr. Giddings was assigned as a roommate to Marion Berry, who went on to become an iconic mayor of Washington DC. Dr. Giddings loved his time at Fisk, and there met his wife Maxine, who was salutatorian of her graduating class and also a chemistry major. Nevertheless,

having come from a country that was populated and governed by people predominantly of African heritage, he found some aspects of life difficult in Nashville during that period. As a Fisk student Dr. Giddings was not allowed to use some Nashville libraries. If he needed to read a book or journal at Vanderbilt, he was not allowed to enter through the library front door, but had to use a separate entrance. After graduating from Fisk, Giddings matriculated at the University of Kansas, under the mentorship of Prof. William McEwen. When McEwen moved his laboratory to the University of Massachusetts, Giddings and another Black student, Arnold Smalley (UMass PhD 1965) joined the UMass Chemistry PhD program, becoming the first two Black PhDs from our department. Giddings reported how refreshing it was to live and study in the Amherst area, recounting to his children some of the contrasts between living in Nashville and a community in the Northeast.

In addition to trailblazing for subsequent UMass chemists of color, the work of Dr. Giddings as a PhD student in organometallics made substantial impact in life as we know it today. In 1967, Dr. Giddings produced a dissertation entitled “The preparation of quaternary stibonium salts and their reactions with sodium alkoxides.” Emeritus Prof. Peter Lilliya recalled that “Giddings, Smalley, and Jerome Knapczyk worked with Prof. McEwen on decomposition (base promoted and thermal) of onium salts of second-row and heavier elements like phosphorous, arsenic, and antimony. This body of work eventually led to the discovery by McEwen & Knapczyk that aryl sulfonium salts like triphenyl sulfonium halides and sulfates photo decompose in UV light to produce arylsulfonic acids. This became the basis of photoresists that worked with acetal polymers in the manufacture of integrated circuits.” Prof. Venkatraman similarly noted after reading Dr. Giddings’ thesis, “Fascinating chemistry. [Jean] Frechet used this chemistry in his IBM days to deprotect t-butylesters to create these photoresists.”

Upon completion of his PhD, Dr. Giddings accepted a job with Standard Oil of Ohio. His daughter Candace reports that there was “No greater proponent of Standard Oil than my dad. Wherever he went, he proudly displayed Standard Oil of Ohio logo, on shirts, on caps...on everything! When Standard Oil was acquired by BP, he immediately started to wear the green and yellow of BP.” The team Dr. Giddings led developed a number of different plastics for which he was issued 7 patents, including one for “unbreakable plastic.” Dr. Giddings served as *Supervisor of Oil and Petroleum* which included directing production of oil on the Alaskan pipeline, requiring frequent trips to Alaska. Dr. Giddings was offered a position as President of Old Ben Coal, but due to his love of his BP work, declined the offer. Dr. Giddings’ later projects at BP focused on developing biological processes to “eat plastic” for bioremediation. During his long career, Dr. Giddings was a mentor, hiring supervisor and advocate for many Black chemists, and a member of the White House Committee on Historically Black Colleges and Universities. Dr. Giddings retired from BP in 1991, but filled his days teaching math at Cleveland State University and consulting for the oil industry.

Dr. Giddings passed on his passion for chemistry-related careers to his four children and eight grandchildren. For example, his oldest son, Brandford, Jr. works as an oncology rep for a bio-pharmaceutical company. Candace is a physician in Tampa who leads a company that is currently implementing COVID-19 responses to keep companies, such as Unilever, open during the pandemic. The seeds of chemistry have now manifested in the third generation as Dr. Giddings granddaughter, Nurah Koney-Laryea is a chemistry minor (Duke University, ’21).

From One Pandemic to Another, One Chemistry Alum's Journey by Dave Adams '67

This is a story about the UMass Amherst Chemistry Department, the class of 1967, the chemistry majors of the class of 1967, and me, David L. Adams, one of that class.



In the 53 years since graduation, the 21 chemistry majors of the class of '67 earned 9 PhDs, 1 MD, 6 Masters, and 4 Post-docs. They also achieved professional success in business entrepreneurship, state and federal government, management, education, consultancy, and medicine.

Fast forward to 2020, a consequential year in American history. In many respects, 1968 (the first full year following our graduation) and 2020 share many parallels. These include war, pandemic, social unrest, and a presidential election. In 1968 we had two political assassinations and a military draft. In 2020 we have societal lockdowns and economic shutdowns. The graduates of 1967 and 2020 confronted worlds that were/are, at the same time, wildly different in some ways, and yet amazingly similar in others.

The collective and individual stories of the chemistry majors of 1967 are likely similar to those of the other 107 chemistry major classes at UMass. We were a close-knit group — we had to be in order to face the challenges presented to us by Professors Chandler and Richason in general chemistry, Rausch in organic, Olver in analytical, Rowell and Smith in P-chem, and Lillya, McWhorter, and Siggia in advanced courses. They all set the bar high and we strove for excellence. This experience yielded career-long dividends.

In a scenario common for UMass students, I was the first in my family to attend college. My parents and grandparents would have prospered there, but did not have that luxury. My high school chemistry teacher, Robert Pooler, inspired me to choose chemistry as a career. I entered UMass Amherst as a freshman in September, 1963 and, along with approximately 100 other chem majors, started CHEM 3 with George Richason. We had laboratory in the basement of "New Goessmann." This is where I met my future wife, Lynne Connors. Most of us lived in the dorms. Some locals, like Chet Jablonski and Bruce Colby, commuted from home. A few were involved in fraternities, most were not. There was no down time. Chem majors had a full schedule — few electives, two or more lab sciences per semester, and classes six days a week!

That first year we experienced the Kennedy assassination on November 22, 1963. As a result, the University closed early for the Thanksgiving break. I rode home with Ken Feinberg of Brockton; he advertised for a rider on the ride board outside the ballroom of the Student Union. Ken, a world renowned arbitration attorney, and a major donor to the University, ultimately became the student speaker at our graduation.

By 1964 the number of chemistry majors had been reduced to 30 or so. The most memorable experience of our sophomore

year was organic chemistry (CHEM 51/53) with Marv Rausch. He brought us individually to the Hatch for coffee to discuss our future plans and interests. As a result, several of us began research with him in the area of organometallic chemistry during the summer after our sophomore year. The lab was in the basement at the east end of "Old Goessmann." I was very fortunate to be offered a place to stay in my classmate Bruce Colby's parent's house on Amity Street for that summer. We also listened to the radio as Cassius Clay, later Muhammad Ali, defeated Sonny Liston in 2 minutes and 12 seconds of the first round in a heavyweight championship fight in Lewiston, Maine in May of '65.

Our junior year started with the Great Northeast Blackout. At about 5:30PM on November 9, 1965, the UMass campus was hit with a complete power outage. It extended from New York to Canada, and lasted about 13 hours. We went about our business with flashlights and candles in the Hatch. The academic challenge for the junior year was P-chem and analytical. P-chem was taught by Bob Rowell and J. Harold Smith. Both were good and we fared well in that course. Analytical, taught by future U.S. Congressman John Olver, was a different story. The average of the first test was somewhere around 40. I got a 65, a terrible grade, but relatively speaking, not bad. He gave us the same test over again and the average was still only slightly higher. We also took Chemical Literature with George Oberlander. Somehow we persevered and emerged as seniors in the fall of 1966.

During our demanding senior year most of us lived off campus. I was married and lived in Easthampton, then moved on to a third floor apartment at 35 Kendrick Place in Amherst at \$75/month. Almost all of us were involved in research and many were enrolled in the Honors Program. We took a variety of courses including Advanced Organic with Earl McWhorter, Qual and Theoretical Organic with Peter Lillya, Advanced Physical with J. H. Smith, Advanced Inorganic with Smith or Ron Archer, and Advanced Analytical with Sid Siggia. A major highlight of my senior year was having my first published research paper "The Clemmensen Reduction of Benzoylferrocene," with my Senior Honors advisor Marv Rausch.

The class of 1967 graduated on Sunday, June 4, 1967 in the new Warren McGuirk Alumni football stadium. On that hot day Massachusetts Governor John Volpe gave the commencement address and Ken Feinberg gave the student address. This was the first student address at a UMass Amherst graduation. Another first was the use of the University Mace, a gift from our class, to lead the platform party into commencement. The chemistry graduates included Phi Beta Kappas, Fulbright Scholars, Honors Program graduates, Phi Kappa Phis, Magna Cum Laude and Cum Laude graduation honors, and published authors.

During fall, 1966 and spring, 1967 many in our class applied to graduate schools. I was accepted at UMass and UConn, and rejected at Harvard. I ended up at UConn because they offered more money, and I was able to work with the newly appointed department head, Wyman R. Vaughan. There were definite perks associated with working with the boss. I chose to become an organic chemist due to the influence of my UMass mentors Rausch, Lillya, and McWhorter. I was extremely well prepared and actually

transferred three courses from UMass to UConn — a twofer! I earned my MS degree in 1969 and PhD in July, 1971. I had allowed myself four years to finish grad school, given that I had a family with two children. I finished with a month to spare! My doctoral thesis dealt with non-classical carbocations in the norbornane series using the then newly discovered technique of NMR lanthanide shift reagents. While at UConn I was inducted into the Sigma Xi and Phi Lambda Upsilon academic fraternities. It was at UConn in 1968/69 that the Hong Kong flu pandemic hit the US, killing an estimated 100,000 people. Since the US population was 200 million at that time, this would be equivalent to 165,000 deaths today.

After graduate school I accepted a post-doc instructorship with Phil Skell at Penn State University. While at PSU, my research was in the field of metal atom chemistry at very low pressures. I did enjoy this, but quickly learned that my career interests heavily leaned toward teaching.

From 1972 to 1999 I taught chemistry at North Shore Community College in Beverly, Salem State College in Salem, Bradford College in Haverhill, and Babson College in Wellesley, all in Massachusetts. At Babson, I was awarded the Douglass Chair in Science and granted tenure, and seemed well on the way to fading away into tenured obscurity. During this time daughter Eileen graduated from UMass Amherst in mathematics, further earning her master's degree in 1990.

In 1990 one of my friends from the chemistry class of 1966, Don Ciappenelli, offered me the opportunity to teach organic at the Harvard Extension School. Of course I said Yes! Who could resist teaching organic at the university where the faculty directory looked like a list of current and future Chemistry Nobel Laureates! I did not remind them of my grad school rejection, but my appointment brought some sort of closure to that. In 1995 I was awarded the Shattuck Excellence in Teaching Award. I will forever be grateful for the Harvard experience. Thanks, Don!

In 1992 Lynne and I attended the 25th reunion of the class of 1967 at UMass. We had a good time, but the attendance of chemistry majors was miniscule. I committed myself to tracking down those 21 stalwarts from 1967 and organizing a 30th reunion in 1997. To do this I rekindled my relationship with George Richason, who kept meticulous records on every graduate since who knows when. In the end we had a great 30th reunion. About 10 grads returned and the Department Head at the time, Lila Gierasch, gave us all "UMass Makes Great Chemistry" T-shirts. I still have mine!

Around this time I published a research paper on Metal Hydrides, Inc., a former company in Danvers, MA, and its role in the development of the atomic bomb as part of the Manhattan Project. As part of this effort I had arranged for a sabbatical at Oak Ridge National Laboratory in Tennessee. One day Lila Gierasch called and offered me the opportunity to take my sabbatical at UMass teaching non-majors organic chem in the Spring, 1998. Of course I accepted, so Lynne and I packed our bags and headed to a condo in South Amherst. It was wonder-

ful being in the classroom at my Alma Mater, even better than Harvard! I also undertook a serious exploration of the history of the UMass Chemistry Department. This effort resulted in several departmental seminars on that topic and a 250+ page history now in the Special Collections and University Archives section of the University Library.



Lila Geirasch, George Richason, Carl Allen, and Dave Adams in 1998.

In the fall of 1998 Lila unexpectedly called again, mentioning an open position. Long story short — I spent 10 ½ terrific years teaching chemistry at UMass Amherst, enjoying every

day of it. I had an opportunity to be colleagues with many of my former professors, and met many dedicated and serious chemistry majors along the way. I taught the Honors General and Organic courses during the early years, and was Undergraduate Program Coordinator for several of those years. I revived undergraduate honors and awards within the department. I still fondly recall receiving the ACS Connecticut Valley Outstanding Student Award in 1967 and how much that meant to me at the time. I also researched and published a paper on the chemical genealogy of the department. Overall I published 52 professional papers, mostly in chemical education. I rekindled interest in the Metawampe Hike and Dinner (see the Fall, 2019 Goessmann Gazette). We held the 100th hike in 2009.

My time in the classroom culminated with the award of the UMass Amherst University Distinguished Teaching Award in 2004. I should add that chemistry faculty have won this award 12 times since its inception in 1962, the second highest departmental number at the University (English is first by two). The only other chemistry alumnus to win this award was George Richason, class of 1937. In 2008 Lynne and I researched and published a fully referenced book on UMass Amherst history titled *Massachusetts Memories: UMass Amherst History*.

I retired in December, 2009 and have so far enjoyed 11 years traveling, pursuing philately, reading (mostly fiction), completing home projects, visiting family and friends, and spending time in Wellfleet, MA.

At the 50th reunion of the class of 1967 in 2017, three chemistry majors returned for a great time. Some of our group have passed on, a few are still working, and most, like me, are enjoying retirement. And, just like 1968, the nation will find its way through the coronavirus pandemic, protests, and political woes. Our UMass education prepared us not only for chemistry, but change itself. For the only constant in this world is change. Finally, the third generation of Adams', our grandson Brady, matriculated at UMass in the fall of 2019 but had his first year interrupted by the coronavirus. History repeats itself!

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"Being awarded the JFB Research Fund allowed me to continue working in the Farkas lab over the summer and further enhance my research skills. Not only was it an educational experience, it allowed me to gain a closer relationship to all the members of the Farkas Lab, as well as other research group members."

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Congratulations, Dick Stein, on 70 years at UMass!

In February 1950, Prof. Richard (Dick) Stein joined the UMass Chemistry faculty as an Associate Professor. He carried out pioneering studies developing and using rheo-optical techniques to study orientation and phase transitions in amorphous, crystalline and liquid crystalline polymers. He also developed the university's first advanced physical chemistry courses in quantum mechanics, statistical mechanics and polymer science.

Dick became Commonwealth Professor, and in 1961 he founded both the Polymer Research Institute and the Research Computing Center. In 1980, the chemistry department awarded him the Charles A. Goessmann Chair in Chemistry (he's currently the Emeritus Goessmann Professor in Chemistry). Later in the 1980's he was involved in establishing and obtaining funding for the Silvio O. Conte Center for Polymer Research. Among his many honors, Dick is a member of the National Academy of Sciences, the National Academy of Engineering, and the American Academy of Arts and Sciences.