UMASS LOWE

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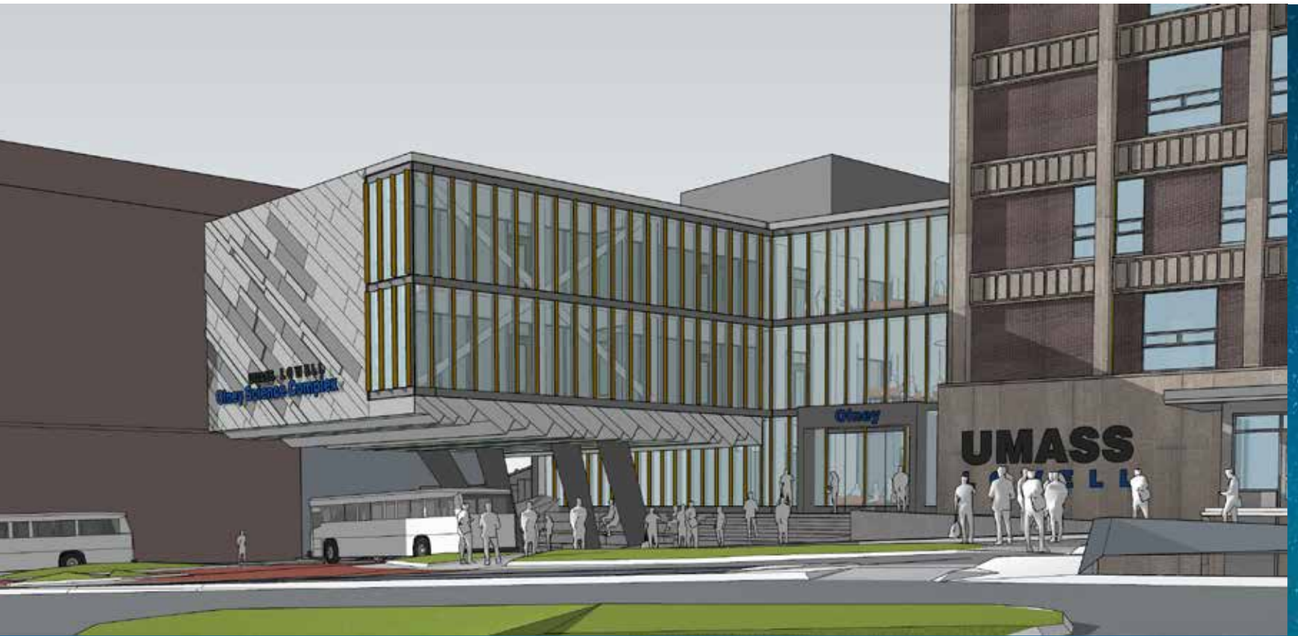
ELEMENTS OF SCIENCE



PARTING SHOT

Renovations on the Olney Science Complex are scheduled to begin this fall. The project will deliver 14 new state-of-the-art teaching labs and 10 classrooms, student collaboration spaces and other amenities, including a new cafe and landscaped outdoor space for student activities and events.

LIFT OFF!

UMass Lowell Researchers Are Bringing Space Closer to Home

UMASS LOWELL

A LETTER FROM THE DEAN

Dear Alumni, Colleagues and Friends:

It is hard to believe that it is time for a new issue of Elements of Science magazine. I remember, as if it was yesterday, when the first issue was published in 2019. Since then, we have graduated hundreds of students and enrolled hundreds more. Faculty researchers continue to push the boundaries of discovery, and our students continue to excel on campus and beyond. We have progressed on our plans to renew our classrooms and labs. However, one thing that has not changed is the dedication of the Kennedy College of Sciences faculty and staff, who work tirelessly to ensure that our students are well-prepared to face the challenges in our increasingly complex world—and to make a positive impact.

In this issue of Elements of Science, you will find stories that describe our faculty's continued work to explore, teach and innovate, and you'll learn about the immense successes of our students and alumni. You will also get a glimpse of the renovation of Olney Science Center, which is slated to begin this fall. For our alumni, these pages may bring back memories of your days on campus and perhaps inspire you to reconnect with us. Irrespective of when you left the university, UMass Lowell is your home, and you are an important part of the Kennedy College of Sciences family.

As dean, it is a privilege and an honor to serve this great college and university. I believe that together, we can successfully prepare the next generation of scientists while contributing significant discoveries that change our world for the better. I am committed to continuing to expand opportunities for all our students to succeed and to eliminating barriers that may hinder their progress in the sciences.

I hope that you will enjoy this issue of Elements of Science. As you read their stories, I think that you will agree that our faculty, students and alumni are making progress and contributing their talents to Massachusetts, the nation and the world. May the stories in this issue inspire you as they've inspired me.

We could not do what we do without your continued support.

Warm regards,

NOUREDDINE MELIKECHI, D.PHIL.
Fellow, American Association for the Advancement of Science
Fellow, Optical Society of America
Fellow, American Physical Society
Professor of Physics and Dean, Kennedy College of Sciences
University of Massachusetts Lowell

In This Issue

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Chemistry Professor Searches for New Tools to Fight Climate Change

For Asst. Prof. of Chemistry Michael Ross, burping cows and volcanic rocks could be the latest weapons for fighting climate change.

Ross has partnered with researchers at the University of Delaware and the University of Texas at Austin to investigate the potential of long-term storage of carbon dioxide emissions in basalt, a volcanic rock.

In another project, he's working with collaborators at MIT and the University of Michigan to develop a process for converting methane into butanol. The second most abundant greenhouse gas (after carbon dioxide), methane is emitted through activities that include natural gas production, coal mining, the decomposition of landfill waste and from livestock, which emit the gas when burping.

Ross recently received two awards from the initiative Scialog: Negative Emissions Science for the research proposals.

Commonly Prescribed Meds May Help Prevent Cancer, Alzheimer's

Could a drug meant to treat people with high cholesterol or blood pressure also help prevent cancer or Alzheimer's disease?

Biological Sciences Asst. Prof. Rachel Melamed is looking for answers.

Funded by a five-year grant of nearly $2 million from the National Institute of General Medical Sciences, Melamed and her research team are using existing data sources to analyze a large variety of medicines, such as statin drugs (used to lower cholesterol) and metformin (a diabetes medication). They will also use available health records to create a computational model to investigate whether people who have taken a common drug have a different risk of cancer or Alzheimer's disease compared with those who didn't take the drug.

NETFLIX BAKING SHOW A PIECE OF CAKE FOR MATH ALUM

Like a lot of people, math alum Emily Adey '15, '18 took up baking during the pandemic. But she took things up a level when she landed a spot as a contestant on Netflix's "The Big Nailed It Baking Challenge," which debuted last summer.

Adey, a resident of Littleton, Massachusetts, spent a month in Los Angeles filming the 10-episode show, which follows 10 amateur bakers vying for a $100,000 cash prize. Adey baked her way to the top five before being eliminated.

An engineering program manager for Advisor360, a Weston, Massachusetts-based software company, Adey says her math skills came in handy during the competition.

"I can follow a recipe like no other, and I think that comes from my mathematics background," she says.

Sara Aldahabi '23 is now a student at the University of Michigan School of Dentistry.

Future Doctors and Dentists Get a Boost

Students and alumni pursuing medical, dental and other advanced health degrees are getting a boost from the university's Pre-Health Advising program.

The program is headed by Carol Meyers, a teaching professor in the Department of Biological Sciences. She and faculty advisors from several departments guide participants toward the courses they need, assist in finding clinical and volunteer opportunities and connect them with admissions counselors.

This past academic year, the acceptance rate among students and alumni who applied to dental school was 100% and was 90% for those who applied to medical school.

Myers notes that the acceptance rate was around 50% just five years ago when she became director. "Now, most of them are getting into multiple schools," she says.

Virtual Reality and Robots May Improve Mobility of Children with Cerebral Palsy

A new study will evaluate whether virtual reality gaming and a roving robot can help to improve mobility in children with cerebral palsy.

Computer Science Asst. Prof. Maru Cabrera and Physical Therapy Assoc. Prof. Maggie O'Neill are researching the effectiveness of such technology with a group of children, ages 8 to 12.

The movements required in the virtual reality game and for playing a sort of moving target basketball with a robot correlate with physical therapy exercises that can improve strength, balance and coordination. In the virtual reality game, participants don headsets and try to make objects explode by moving their arms. In the game with the robot, the kids try to drop foam blocks into a basket as the robot moves it around.

The study was funded by a university seed grant.

HOT IN THE CITY

A blistering hot day is even hotter in the city, thanks to all the structures that absorb and retain heat, which is known as the heat island effect. Some cities, including Lowell, are attempting to mitigate heat islands by increasing tree cover. Along with providing shade, trees can help to cool things off by moving water from the ground into the atmosphere. Environmental, Earth and Atmospheric Sciences Asst. Prof. Joy Winbourne is conducting research into how urban environments affect trees. Winbourne has deployed sap flow sensors on trees on UML's campus and in downtown Lowell to monitor how fast water moves through trees. She is analyzing the data to understand how prolonged periods of heat and excess stormwater runoff impact water movement in trees. Her research could help planners select the best tree species for cooling off cities.

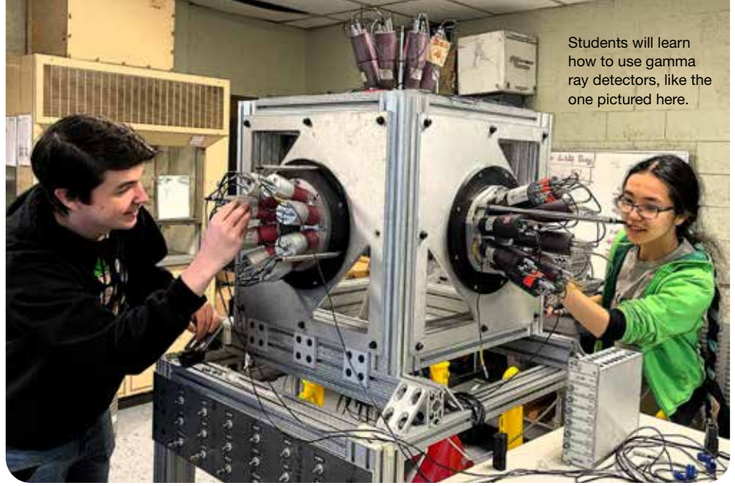
Sophomore Draws Inspiration from Personal Challenges

Sean Simoni is determined to make a difference in the world. The sophomore, who is double-majoring in biology and political science, has already made progress.

Because of his family's financial struggles, Simonini feels strongly that young people need to learn about personal finance. So, during an internship with a state representative's office, he researched and drafted a bill that would require all Massachusetts high school students to complete a financial literacy class. It's now pending before the state legislature. In January, he testified in support of the bill. His leadership and advocacy have generated headlines and media interviews.

His interest in biology also stems from a personal experience: A beloved aunt died of ALS last year. Now, he's committed to learning more about ALS and other neurodegenerative diseases.

"I'm not going to find the cure for ALS overnight, but I couldn't sleep at night if I didn't try," he says.



Students will learn how to use gamma ray detectors, like the one pictured here.

Initiative Seeks to Diversify Ranks of Nuclear Scientists

Anyone who watches "Oppenheimer" will notice two common characteristics of the nuclear scientists portrayed in the film: They're all white, and they're all male.

Decades after J. Robert Oppenheimer's time, there is still a lot of work to be done to increase diversity in the field.

The nuclear group in the Department of Physics and Applied Physics hopes to change that by exposing minority community college students to nuclear science. Led by Prof. Partha Chowdhury, the initiative is funded by a three-year, $315,000 U.S. Department of Energy grant.

This summer, several students from local community colleges will spend 10 weeks at UMass Lowell's Radiation Laboratory, gaining hands-on experience. They'll also visit a national laboratory for a research experiment and attend a national nuclear science conference.

SINGLE MOLECULE COULD LEAD TO EARLY DISEASE DETECTION

What if a device could detect a single molecule associated with cancer, providing an early alert that the disease may be present? That's the question Chemistry Asst. Prof. Juan Artes Vivancos (pictured) and his research team addressed in a project funded in part by a $300,000 National Science Foundation grant.

The researchers designed a probe to target RNA that is associated with some of the deadliest forms of cancer, such as pancreatic. Artes Vivancos says the presence of the targeted RNA sequences is like a "red flag" that could prompt additional tests for early-stage cancers.

The team's findings were published in the Nature Portfolio journal Scientific Reports.

Using the same technique, the research group also looked to detect COVID-19 by targeting RNA associated with different variants of the virus.

Those findings were published in the scientific journal Biosensors and Bioelectronics.

GAMERS, START YOUR ENGINES

Randy Cassidy '86, '90 is making it possible for anybody to experience the thrill of racecar driving without ever getting into a car.

The computer science alum is the principal software engineer for iRacing, a leading racing simulator company headquartered in Chelmsford, Massachusetts. Cassidy developed the back-end racing infrastructure of the simulator, which allows users to race on tracks that exist in the real world from the comfort of their homes. In recent years, simulated racing has become increasingly popular, and its graphics and user experience have advanced significantly.

"The education I got at UMass Lowell was instrumental to doing computer science in industry," Cassidy said during a recent campus visit in which he discussed his career and fielded students' questions.

Students Use AI to Improve Mobile Banking

Even before ChatGPT introduced artificial intelligence to the masses, computer science major Saim Siddique was well-versed in the technology.

As a first-year student, Siddique landed a research internship with Asst. Prof. Mohammad Arif Ul Alam, working on a project to root out biases in the algorithms that are the lifeblood of AI.

Then Siddique and a group of friends decided to apply their passion for AI to a real-world challenge in the university's Rist DifferenceMaker Institute Innovation Contest.

The students developed a service, called Bean Hub, that uses AI to improve the customer experience on a mobile banking app. Their pitch won the $3,000 top prize and a spot in this spring's $50K Idea Challenge.

Working with Siddique are fellow computer science students Shafaat Osmani, Ibrahim Haroon and Aiman Baig, bioinformatics major Emir Kaplan and electrical engineering major Mohammad Khan.

Students on the Bean Hub team react after winning $3,000 for their pitch to improve mobile banking.

Do Hurricanes Affect Crime Rates? Researchers Look for Answers

In the aftermath of hurricanes, flash floods and other extreme weather, attention often focuses on the damage to roads, bridges and other structures. Now, a trio of UMass Lowell professors is studying how such events affect the social fabric of several Massachusetts communities.

Environmental, Earth and Atmospheric Sciences Profs. Mathew Barlow and Juliette Rooney-Varga are collaborating with Criminal Justice Prof. Arie Perliger on the project, which was funded by a seed grant from the university's Office of Research and Innovation.

The researchers plan to gather data about crime rates, civic engagement, financial practices, trust in local authorities, and attitudes toward climate change and related environmental policies in communities affected by extreme weather.

Rooney-Varga says the information that's gathered can be used to help communities become more resilient and better prepared for such events.

LIFT OFF!

From Producing Small Satellites to Unlocking the Mysteries of Black Holes, UML Researchers Are Bringing Space Closer to Home

BY BROOKE COUPAL

On Oct. 4, 1957, a light hurtling through the night sky left Supriya Chakrabarti in awe. Then a child living in India, Chakrabarti had just witnessed the flight of Sputnik 1, the first artificial satellite to successfully enter Earth's orbit. The sight sparked his imagination, and a lifelong fascination with space took hold. During solar eclipses, Chakrabarti and his father would use a bucket of water to observe the sun's reflection as the moon passed between the Earth and the sun. Like millions of people around the world, he was transfixed by Apollo 11's July 1969 lunar landing.

By the time Chakrabarti entered graduate school in the mid-1970s at the University of California, Berkeley to pursue a Ph.D. in electrical engineering and computer science, he had set a goal of working on projects that would be launched into orbit. While such opportunities were hard to come by, Chakrabarti was determined. He ended up working on multiple space missions, including one involving the U.S. Air Force STP 78-1 satellite.

"I got to design and build things that got put into space," says Chakrabarti, who for the past 12 years has been a Kennedy College of Sciences (KCS) professor in the Department of Physics & Applied Physics. "Not too many people got those opportunities."

Thanks to scientific advances over the decades, opportunities to work in the space industry have grown. KCS faculty members are helping to break down remaining barriers to expand opportunities for space research.

"We're opening the doors to making space more accessible," says Chakrabarti, who is the director of the university's Lowell Center for Space Science & Technology (LoCSST).

'VERY SMALL PACKAGES'

When Sputnik 1 launched in 1957, the satellite weighed about 184 pounds and was the size of a basketball. Like most technologies, satellites have gotten smaller and more powerful; now, some can fit in the palm of your hand and weigh less than a pound.

"You can do useful things with very small packages, which is why there's a big push for smaller satellites," says Timothy Cook, a physics associate professor and LoCSST researcher.

UMass Lowell is making it easier to get small satellites into space through an initiative known as the Massachusetts Alliance for Space Technology and Sciences (MASTS), which is being funded in part by a two-year, $5.5 million grant from the state via the Massachusetts Technology Collaborative.

Established last year and spearheaded by Chakrabarti and Cook, MASTS offers a one stop support system for researchers and businesses looking to build and test small satellites and spacecraft components.

MASTS will provide several testing capabilities, from a vibration shaker table to test how satellites withstand space launches to an anechoic chamber for radio communication testing, according to LoCSST Senior Mechanical Engineer Jason Martel, who is overseeing the build-out of the facilities.

These efforts come at a time of rapid growth in the space industry. According to one industry estimate, the world's space economy totaled $546 billion in 2022 and is projected to grow 41% over the next five years.

"We will be the support for small companies, larger corporations, nonprofits, fellow research universities and community colleges," Cook says. "If you have an idea, we can help you turn it into reality by providing the tools to get you there."

UMass Lowell students will be involved in small satellite projects through MASTS and will receive training to help run the facilities, providing them with hands-on experience for careers in the space industry.

"The excitement that students get with the idea that something they have put their hands on is actually up in Earth's orbit doing useful science, it is now an opportunity that students are going to have with these facilities," says Jeffrey Hoffman, a former NASA astronaut and a professor of the practice of aerospace engineering at the Massachusetts Institute of Technology, which is a partner of MASTS. "MASTS will benefit not just students at UMass Lowell, but students from the whole region."

MISSION SUCCESS

Chakrabarti and his team at LoCSST are no strangers to launching a small satellite into space. On Aug. 29, 2021, a 9-pound satellite built by more than 100 students over five years went aloft aboard a SpaceX Falcon 9 rocket from NASA's Kennedy Space Center. Less than two months later, it was successfully released into orbit from the International Space Station.

Students involved in the mission, known as Science Program Around Communications Engineering with High Achieving Undergraduate Cadres, or SPACE HAUC for short, worked on every aspect of the satellite, from building the hardware to designing an antenna that would allow for communication between the satellite and a ground station located on the rooftop of Olney Hall on UMass Lowell's North Campus.

Susanna Finn served as the deputy principal investigator of SPACE HAUC and worked as a mentor to the students. She came to UMass Lowell as a postdoctoral researcher in 2014 before becoming a research scientist for LoCSST. She is currently a program scientist for NASA's Heliophysics Division, where she will remain for up to three more years before rejoining LoCSST.

"SPACE HAUC was a really small satellite, so the students had to design in this very compact and lightweight format, which is part of what made it such a good learning experience," Finn says. "Students had to think about all these restrictions and challenges and make it work."

Supriya Chakrabarti, director of the university's Lowell Center for Space Science & Technology.

Sciences Dean Helps NASA's Rover Unlock the Secrets of Mars

BY EDWIN L. AGUIRRE

How did Mars form? Did liquid water exist long enough on the Martian surface to potentially support the development of microbial life?

These are just some of the questions that NASA hopes to answer as its most sophisticated robotic rover, named "Perseverance," explores the red planet.

Kennedy College of Sciences Dean and Physics Prof. Noureddine Melikechi is a member of the science team for SuperCam, one of the main instruments onboard Perseverance that is used to conduct laser experiments on the Martian surface.

The SUV-sized rover successfully landed in 2021 inside Jezero Crater, a 28-mile-wide, dried-up impact basin located in the Martian northern hemisphere. Around 3.5 billion years ago, a river flowed into the crater, depositing mud, sand, gravel and other sediments.

Scientists believe the crater's ancient deposits could have accumulated and preserved organic compounds and other potential evidence of microbial life.

SuperCam uses a technique called laser-induced breakdown spectroscopy, or LIBS, to examine the chemical and mineral composition of Martian rocks and soils by zapping them with a powerful infrared laser.

It fires intense laser pulses at distant rocks, boulders or sediments, heating a spot on them to around 18,000 degrees Fahrenheit. A spectrometer records the light emitted by the vaporized cloud of materials. The data is then transmitted to Earth for analysis. SuperCam has already helped Perseverance to make some groundbreaking discoveries: An analysis of the instrument's data revealed that massive flash floods once inundated Mars. SuperCam also showed that instead of sedimentary rocks, which one would expect from river delta and lake-bed deposits, Jezero Crater's rocks are largely made up of igneous rocks, which are formed from molten volcanic material. Melikechi co-authored a paper in the journal Science Advances last year that announced the volcanic history of Jezero Crater.

In addition to Melikechi, the SuperCam science team includes dozens of researchers from Los Alamos National Laboratory, the U.S. Geological Survey, NASA s Jet Propulsion Laboratory, Caltech, Johns Hopkins University and other institutions.

Sunip Mukherjee '23 studies visible light emissions from the ionosphere using a spectroscopic imager at LoCSST.

With the launch of SPACE HAUC, Chakrabarti came up with an idea for a new satellite called Chickadee. SPACE HAUC was sent into orbit by a launcher developed by Nanoracks, a provider of commercial space services. The launcher holds several satellites, and when it's filled, a space the size of a full-grown black-capped chickadee (the Massachusetts state bird, which weighs a half-ounce and is about six inches long) remains empty. Through MASTS, Chakrabarti and Nanoracks are teaming up to develop a satellite to fit in that space.

"My goal is for Chickadee to be used at universities and high schools, allowing more students to get involved with experiments in space," Chakrabarti says. "That will help bring more students into the STEM field."

The small satellite could also be a more affordable option for companies looking to test their instruments or technology in space.

BEYOND SATELLITES

In addition to developing small spacecraft, LoCSST researchers have conducted multiple space missions to address big questions about the cosmos.

Finn and other LoCSST researchers built an instrument, known as the Limb-imaging Ionospheric and Thermospheric Extreme Ultraviolet Spectrograph (LITES), to gain better insight into the Earth's upper atmosphere–specifically the ionosphere and the thermosphere. LITES launched in February 2017, and was mounted on the International Space Station. With the station orbiting the Earth 16 times every 24 hours, LITES collected a lot of data.

"It allowed us to get a more complete picture of the upper atmosphere," Finn says.

LoCSST is also on the hunt for planets outside of our solar system. The latest iteration of its planet-seeking telescope project is known as the Planetary Imaging Coronagraph Testbed Using a Recoverable Experiment for Debris Disks, or PICTURE-D for short. The telescope, the fourth in a series, consists of an instrument called a coronagraph that can block out light from stars so that dimmer objects, such as planets, can be seen. PICTURE and PICTURE-B were launched via sounding rockets, while PICTURE-C made its way to the stratosphere via a helium balloon that was roughly the size of a football field.

Once ready, PICTURE-D will be launched using the same balloon system, as this gives researchers about 12 hours to collect data as opposed to using a sounding rocket, which typically stays in space for only five to 20 minutes.

"There might be a planet like Earth orbiting a star that's like the sun, and if so, we'd like to find it someday," says Christopher Mendillo, the principal investigator of PICTURE-D and a LoCSST assistant research professor.

Sunip Mukherjee '23 assisted with the PICTURE projects as well as other LoCSST space missions while a physics Ph.D. student at UMass Lowell. He is continuing his work there as a postdoctoral researcher.

"I don't think there are too many places in the world that offer experiences like this," he says. "I want to be at LoCSST as long as I can."

continued on next page

THREATS OF SPACE WEATHER

UMass Lowell may make it easier for people to build and launch spacecraft, but a looming threat remains—space weather.

"Inclement space weather triggered by massive storms on the sun has increasingly become a threat to our modern space-based technology infrastructure," says Physics Prof. Paul Song (pictured below), director of UMass Lowell's Space Science Laboratory.

For instance, in February 2022, nearly 40 of SpaceX's Starlink satellites burned up during a geomagnetic storm, in which eruptions from the sun's surface caused disturbances in Earth's magnetic field.

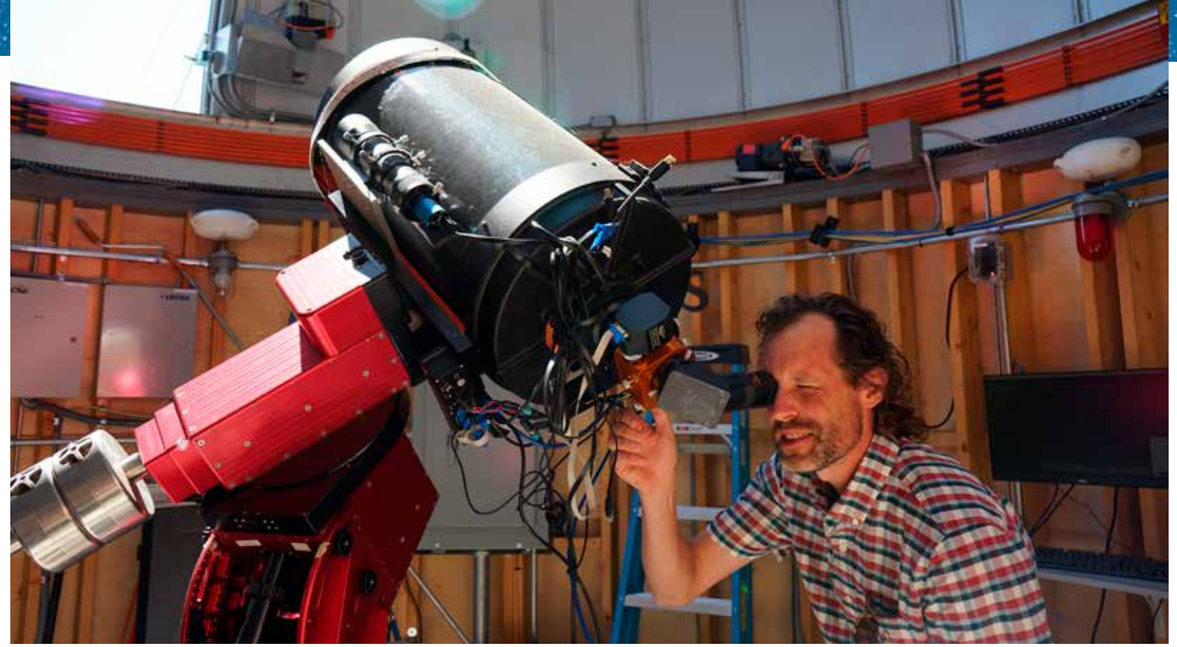
To help predict such occurrences, Song is working to develop a better understanding of space weather. He has created a computer model of the solar atmosphere, which provides greater insight into the physical processes that affect the formation of space weather. Song and his research team have also developed and tested new technologies to remediate the impacts of space weather on satellites.

One major phenomenon that emanates from the sun's upper atmosphere, known as the solar corona, is solar wind. Solar wind can lead to geomagnetic storms when its charged particles seep through Earth's magnetic field. Physics Assoc. Prof. Ofer Cohen focuses his research on the solar corona and how it behaves to better predict space weather events. Like Song, Cohen uses computer simulations.

"Sometimes, doing an actual experiment is really expensive or it may be unrealistic, so putting together computer models gives us a simulated experiment where we can control the conditions to gain more knowledge on how space works," Cohen says. "The simulations can also help inform the designs of future space missions, because we know what to expect."

Cohen's goal is to gain enough information about the solar corona's behavior so that space weather forecasts can be pinpointed to a time and place.

"We want to get to a resolution where we can say, 'At this time, satellites above Japan may be impacted by space weather for half an hour,'" he says.



BLACK HOLES AND MORE

Physics Assoc. Prof. Silas Laycock (pictured above), who oversees the UMass Lowell Schueller Observatory, is interested in a different type of space wind—stellar wind, specifically in X-ray binaries.

X-ray binaries consist of a collapsed star, such as a black hole, neutron star or white dwarf, that orbits around an ordinary or massive star. Just like the sun, ordinary and massive stars release streams of charged particles, known as stellar winds. The nearby collapsed star captures a portion of the stellar wind and subsequently produces X-rays.

X-ray binaries can provide a better understanding of the physics of very dense objects. Black holes, neutron stars and white dwarfs are all extremely dense.

"This information is really useful for something like building a nuclear fusion reactor," says Laycock.

One X-ray binary that has caught the attention of Laycock and his research team is IC 10 X-1, which consists of a black hole and a massive star located in a starburst galaxy more than 2 million light-years away. The group has been analyzing the interaction between the stellar winds of the massive star and the X-rays coming from the black hole in an effort to accurately measure the properties of each object.

Ph.D. student Nicholas Sorabella '21 created a computer model that can be used to discover black holes, neutron stars and white dwarfs in binary systems, as well as to estimate their parameters, such as mass and radius.

The tool models multiple astrophysical effects, including gravitational self-lensing, in which a black hole acts as a magnifying glass when passing in front of a star, causing the star to appear brighter from our perspective. A peak in light could indicate that a black hole or other dense object is present.

Sorabella, who received an award for his work through NASA's Future Investigators in NASA Earth and Space Science and Technology program, plans to make the tool available to the public.

"It is an easy-to-use tool designed for someone who has very little coding knowledge," he says. "The tool will give citizen scientists the opportunity to find potential black holes and other compact objects."

From designing small satellites to finding black holes, Sorabella and other UMass Lowell researchers are bringing space closer to more people, whether students in a high school science class, a curious backyard stargazer or a startup enterprise looking to conduct research in space.

"We are trying to inspire people to take an interest in space exploration, just like Sputnik 1 did for me all those years ago," Chakrabarti says.

An Explosive Experience

Physics Students Get Paid for Supernova Research

A long time ago in a galaxy far, far away (21 million light-years, to be exact), a star with a mass at least eight times larger than the Earth's sun exploded.

Known as a supernova, the explosion occurred after the star, located in the Pinwheel Galaxy, ran out of nuclear fuel and collapsed. Japanese astronomer Koichi Itagaki first discovered the supernova in May 2023, sending aspiring and professional scientists from around the world on a mission to gain a better understanding of the rare phenomenon.

Three of those aspiring scientists are UMass Lowell undergraduates.

Funded by the Kennedy College of Sciences' Science Discoveries program, physics majors Jacob Medin, Ian Davis and Jordan Orenberg (left to right in photo below) spent the summer following their first year of college studying the supernova.

Under the guidance of Physics Assoc. Prof. Silas Laycock and with help from Physics Ph.D. student Sayantan Bhattacharya '21, the trio learned how to operate the UMass Lowell Schueller Observatory, allowing them to capture images of the supernova using the powerful telescope housed inside.

The students also partnered with the nonprofit organization Amateur Telescope Makers of Boston to receive additional images of the supernova. From there, they uploaded the photos into AstroImageJ, a software used for data analysis of astronomical photos.

Over three months, they tracked the magnitude of the supernova by examining its descending brightness and temperature. The data they collected is publicly available through the American Association of Variable Star Observers, a nonprofit organization of astronomers interested in stars that change in brightness.

"It's very cool to help with the understanding of supernovas and contributing that data to the world," Orenberg says.

THE WORLD IN A GRAIN OF SAND

Geoscientists Study Clues to Understand How the Earth Evolved

BY KATHARINE WEBSTER

The mysteries of Earth's evolution are locked inside rocks, from volcanic magma to frozen sediments and grains of sand. And UMass Lowell geoscientists hold some of the keys.

Assoc. Profs. Kate Swanger and Richard Gaschnig and Prof. Nelson Eby go river deep and mountain high in their quest to understand Earth's climate and history dating as far back as billions of years ago.

Their research even yields insights into other planets and their potential to support life, as well as space phenomena like quasicrystals—crystals that do not follow the ordinary rules of symmetry.

Just as important, their work offers unique opportunities for hands-on research to students in the Department of Environmental, Earth and Atmospheric Sciences. From undergraduates pursuing the geoscience option within environmental science to Ph.D. students in the new Earth System Science Program, UMass Lowell students have done research in places as far-flung as Antarctica and as close to campus as the White Mountains of New Hampshire.

"It's science for the pure sake of learning," says Swanger, who analyzes changes to Antarctica caused by fluctuations in Earth's climate. "A lot of advances in technology occur because of this kind of pure, basic science."

Here are some of the fundamental questions that their research is addressing.

ROCK GLACIERS AND MELTWATER IN ANTARCTICA

Swanger is a geomorphologist and paleoclimatologist who seeks to understand how natural ice ages and warmer periods over the past 5 million years affected Antarctica's landscape, as a baseline for understanding how recent climate change is altering and will continue to alter that continent.

"I map glacial deposits—when was the ice sheet bigger, when were glacial periods longer—trying to tie that to the climate signal," says Swanger, a member of the university's Climate Change Initiative.

While much current research is focused on the alarming melt rate and breakage of the West Antarctic ice sheet, Swanger studies the McMurdo Dry Valleys, a mountainous region that is mostly free of surface ice but has plenty of ice underground.

She's especially interested in rock glaciers, which include glacial flows that have a pure ice core covered by a layer of sand, gravel and rock debris and "talus glaciers" that consist of rock fragments and sediment bound together by ice. She also examines the permafrost layer, soil that remains frozen for years on end, as well as sediments left behind by melting glacial ice.

The permafrost and rock glaciers in the McMurdo Dry Valleys potentially encapsulate millions of years of climate history, "so studying these landforms could provide a better understanding of glacier fluctuations and long-term climate trends," Swanger says.

In the past few years, Swanger has been examining meltwater streams. In one study, she found that streams that have formed in the last 12,000 years, since the end of the last ice age, increase the melt rate of ice-core rock glaciers that formed 100,000 years ago. That melt rate has accelerated during recent hot summers, she says. In contrast, the streams can both melt talus glaciers and rebuild them by depositing new sediment and ice, she found.

"In the Dry Valleys, there is evidence of increased melting of glaciers and permafrost during the past two decades, a response to modern climate change that is potentially different from other warm intervals further in the past," she says.

Under her latest National Science Foundation grant, Swanger and second-year Ph.D. student Mika Bighin are mapping and dating active and dry streams that have fed lakes in the McMurdo Dry Valleys over the past 100,000 years. They will visit Antarctica next summer to collect samples; meanwhile, they are learning, with help from Gaschnig and Ph.D. student Ericka Boudreau '20, '22, how to analyze zircon in stream and lake-bed sediments.

"We find the ratio of uranium and lead isotopes in the zircon to see how old it is," explains Bighin. "Then we can try to match it up with different locations it might have come from, like rocks in the valley walls or rocks transported by ice sheets."

CONTINENTAL RIFTS AND PLATE TECTONICS

Gaschnig is a geochemist who focuses on the deep history of Earth's crust, especially the formation of the continents and supercontinents through the movement of tectonic plates. He is particularly interested in how the western United States was formed.

Under grants from the National Science Foundation, he and his students collect samples at the continents' edges, failed and future continental rifts, and features resulting from plate tectonics, including volcanoes and mountain ranges. His work has taken him to China, South Africa, Namibia and Canada. Stateside, he has led undergraduates on field research to Idaho, Montana and Oregon.

Using a combination of laser ablation and mass spectrometry, they analyze sands and rocks for microscopic mineral signatures that suggest, for example, that California was once connected to Australia and Massachusetts adjoined Morocco.

"If you find sediments in North America, like sandstone, each one of those sand grains has potentially a unique history," Gaschnig says. "A certain fraction are special minerals that originally formed

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"IT'S SCIENCE FOR THE PURE SAKE OF LEARNING. A LOT OF ADVANCES IN TECHNOLOGY OCCUR BECAUSE OF THIS KIND OF PURE, BASIC SCIENCE."

—KATE SWANGER

Assoc. Prof. Kate Swanger looks inside an X-ray diffractometer, which analyzes the structure of crystals.

Clockwise from top: Assoc. Prof. Richard Gaschnig collects samples of an ancient glacial deposit in South Africa; Prof. Nelson Eby at the Trinity site.

ɔm magma, which we can date. Then we can look for rocks another continent that might match."

Boudreau, who has been doing research with Gaschnig since she was an undergraduate, used those techniques to show that a little section of what is now southwestern Oregon was once part of Baja California. It's one of the best examples of geochemistry confirming earlier paleomagnetic research that indicates the Pacific and North American tectonic plates have moved vast distances over hundreds of millions of years.

Although relatively recent volcanic activity along the West Coast had overwritten much of the chemical record, Boudreau and Gaschnig overcame that handicap by analyzing zircon and other key minerals in sand from the Oregon coast. Zircon originally forms in magma under extremely hot temperatures and is preserved when that magma cools and crystallizes into granite.

When granite erodes, it releases the zircon into rivers as tiny sand grains that can travel thousands of miles. The isotopes within the zircon provide a unique signature and time stamp for when the zircon and its source rock solidified, and other chemical elements can help to confirm the rock's age and origins, Boudreau says.

"Monazite can form under really low-temperature conditions, when sand is becoming a sandstone, and with rutile (the most common form of titanium dioxide found in nature), you can figure out the specific temperatures that it forms at," she says. "Each of these different minerals tells a part of the story of this one rock."

Gaschnig's research into the geological history of the crust, which evolved starting 3 billion years ago from the dense rock still found on the ocean floor into less dense rocks that make up most of the continents, also could help scientists determine whether other exoplanets have the potential to support life. "Without plate tectonics, you probably can't have continents and a stable climate that would support life," he says.

BREAKTHROUGHS COULD HELP NUCLEAR FORENSICS

Eby is an all-purpose geochemist and "geo-detective" who enjoys historical projects, such as analyzing the radioactive, glassy materials that formed during the Trinity atomic bomb test.

He also does research on alkaline rock, which contains high ratios of rare earth metals, which are increasingly used in green technologies. Rare earth metals are scarce and difficult to find in the natural environment, but Eby's research is helping to crack the code of the ingredients and conditions that form them.

"I'm just curious about everything," he says.

His students benefit from that curiosity. On a wintry Friday afternoon, three undergraduate research assistants—seniors Lily Evans, Dennis van Maaren and Francis O'Brien, who are all on track to earn master's degrees in environmental geoscience through the Bachelor's-to-Master's Program—accompanied Eby as he sent a sample of slag from ancient Japanese copper smelters through the university's research reactor. Then they trooped back up to his lab and watched while he measured the half-life of various isotopes to determine the slag's mineral composition.

"I find minerology really interesting, and this is a good opportunity to learn about research," says van Maaren, who wants to join a research lab and apply to Ph.D. programs after completing his master's.

The smelters, Eby and the students explain, were in continuous use for about 1,500 years, refining copper from ore in nearby mines. Recently, a historian at Princeton University asked Eby to try and determine the provenance of various slag samples to aid his understanding of Japan's industrial history.

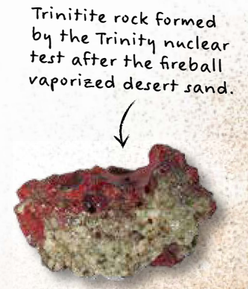
Eby has made a career of finding answers to such questions, employing various geochemical techniques. Recently, he helped to analyze a rock formed by the Trinity nuclear test after the fireball vaporized desert sand, the iron test tower and copper transmission lines connected to scientific recording instruments. The blast vapor cooled and rained down as a radioactive glass, which was then dubbed "trinitite."

A 20-faced crystal found in a copper-rich sample of red trinitite is the first known instance of a man-made quasi-crystal, but it resembles some quasi-crystals found in meteorites, says Eby, who figured out the approximate temperature that led to the novel crystal's formation, based on his previous research into atomic glasses.

Quasicrystals have potential industrial applications, but Eby is just as interested in how trinitite can reveal the origins of the radioactive material in the explosion that created it, thus helping in future nuclear forensic investigations. "Should a bad actor detonate an atomic device, the products of the blast can be used to determine the bomb maker," he says.

"I'M JUST CURIOUS ABOUT EVERYTHING."

—NELSON EBY



Ph.D. student Brooke Sienkiewicz, a member of Asst. Prof. Sarah Gignoux-Wolfsohn's research team, examines corals off the coast of Belize.

UNDER The SEA

A Biology Professor's Research into Corals and Oysters Sheds Light on Climate Change and Infectious Diseases

BY BROOKE COUPAL

STANDING ON THE SIDE OF A BOAT and donning a wetsuit, fins and an air tank, Sarah Gignoux-Wolfsohn gets ready to jump into the Caribbean Sea.

It's a plunge that the biological sciences assistant professor has taken roughly 500 times, but the thrill of exploring underwater never gets old.

"It's like being in another world," says Gignoux-Wolfsohn, a certified scientific diver who studies corals and oysters. "It's very quiet and serene underwater."

Gignoux-Wolfsohn's fascination with the ocean began at an early age. Growing up in Philadelphia, her family would take trips to beaches in New Jersey and Maine.

"My mom always talks about how I would get excited to look at tide pools and would pick up every rock to see what's underneath," she says.

After getting bachelor's degrees in biology and French at Wesleyan Univer sity, Gignoux-Wolfsohn went on to pursue a Ph.D. in ecology, evolution and marine biology at Northeastern University, where she first got involved in coral research and diving. She briefly switched to researching bats as a postdoc-toral associate at Rutgers University, but soon found herself back in the ocean studying oysters as a postdoctoral fellow at the Smithsonian Environmental Research Center in Maryland.

"I realized that I really like working in the ocean," she says. "I like doing marine fieldwork."

Gignoux-Wolfsohn brought her coral and oyster research to UMass Lowell when she joined the Kennedy College of Sciences faculty in September 2022. Her projects focus on the persistence of corals and oysters amid climate change and the increasing threat of infectious diseases.

"Oysters and corals have such a big effect on the marine ecosystem," she says. "It's important for us to study them and understand their resiliency to climate change and diseases."

DISEASE PREVENTION

From giant sea turtles to baby clownfish, more than a million aquatic species rely on corals for survival.

Corals are invertebrates belonging to the same group of marine creatures as jellyfish and sea anemones. Healthy coral reefs provide a habitat and feeding ground for marine animals, while also protecting coastlines from storms by acting as a buffer.

For the past decade, corals in the Caribbean have been under attack by stony coral tissue loss disease. The disease, which was first reported off the coast of Florida in 2014, causes lesions to develop on coral. The lesions spread across the coral's surface until no living tissue remains.

While the cause of the disease remains unknown, Gignoux-Wolfsohn and a team of researchers are working to develop a probiotic treatment that will protect corals from the disease. The Coral Research & Development Acceler ator Platform awarded the team a grant of roughly $1.5 million for the project, with $323,000 going to UMass Lowell.

"In a lot of places, people have been treating corals with antibiotics once they get the disease, which is not an ideal solution because you're only treating them once they show disease signs," Gignoux-Wolfsohn says. "The idea with probiotics is that we could treat corals before they're exposed to the disease and hopefully make them healthier."

In the turquoise waters off the coast of San Andrés, a Colombian island, the researchers are searching for healthy corals among those infected by the disease. Caroline DeSouza, a senior and Honors College student majoring in biological sciences and economics, is helping with the search.

"I knew people traveled for work, but I never saw myself doing that," says DeSouza, who joined Gignoux-Wolfsohn's lab during her junior year. "It's incredible getting this opportunity. I'm so excited by the work that we're doing."

DeSouza and other researchers are bringing fragments of the healthy corals back to Gignoux-Wolfsohn's lab on campus, where she is investigating which bacteria are abundant on the corals. Her findings will be provided to her collaborator at the University of North Carolina Wilmington, Asst. Prof. Blake Ushijima, who will develop a probiotic using the bacteria found on the healthy corals.

In partnership with the Perry Institute of Marine Science, the Blue Indigo Foundation, CORALINA (the Corporation for the Sustainable Development of the Archipelago of San Andres, Providencia and Santa Catalina) and the ECOMARES Foundation, the researchers plan to apply the probiotic to corals to see if it protects them from the disease.

Gignoux-Wolfsohn says preventing stony coral tissue loss disease is crucial, especially as ocean temperatures rise as a result of climate change.

"Climate change is clearly making the corals more stressed, and when the corals are more stressed, they are more susceptible to disease," she says.

CORAL BLEACHING

During the summer of 2023, global ocean temperatures hit a record high. Off the coast of Florida, water temperatures climbed above 100 degrees, while the Caribbean Sea recorded temperatures in the high 90s.

The stress induced by the steamy temperatures led to coral bleaching, in which corals expel the algae living in their tissues, causing them to turn white. Bleached corals can recover, but they are more susceptible to disease and death.

Gignoux-Wolfsohn teamed up with Lauren Fuess, an assistant professor at Texas State University, to assess links between coral bleaching and disease. Their research is being funded by a nearly $200,000 grant from the National Science Foundation.

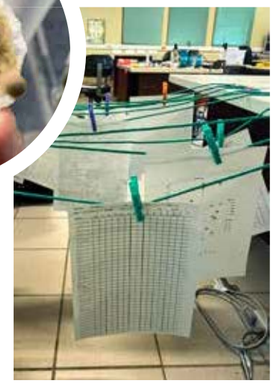
The researchers are focusing their project off the coast of Belize, where they have been monitoring corals since 2019 in collaboration with Leah Harper, a scientist with the Smithsonian's Marine Global Earth Observatory.

"We have all this historical data about these corals," Gignoux-Wolfsohn says. "We are continuing to go down once a month to check on the corals to see which ones are recovering from bleaching and which ones have died."

Applied biology Ph.D. student Brooke Sienkiewicz is taking part in the Belize field research after becoming a certified scientific diver with Gignoux-Wolfsohn's help.

"This is my first diving research experience, which is really exciting," Sienkiewicz says. "I've been wanting to get a scientific diver certificate forever, so having Prof. Gignoux-Wolfsohn organize and fund it was amazing."

Samples of the bleached coral are being brought back to Gignoux-Wolfsohn's lab, where Sienkiewicz, scientist Felicia Aronson and others are analyzing the differences between corals that survived and those that died. The team will continue to monitor surviving corals in Belize to see if bleaching makes them more vulnerable to stony coral tissue loss disease, which reached the country in 2021.



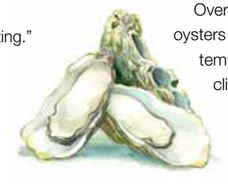
Clockwise from top: Asst. Prof. Sarah Gignoux-Wolfsohn surveys healthy corals off the coast of the Cayman Islands; Gignoux-Wolfsohn, center, collects oysters from the Chesapeake Bay in Maryland; data sheets dry following a dive off the coast of Panama. Insets: The inside of an oyster; bleached coral off the coast of Belize.

RESILIENT OYSTERS

Corals have proven to be highly sensitive to climate change, unlike oysters, another marine invertebrate.

"Oysters are like the opposite of corals," Gignoux-Wolfsohn says. "They are super-resilient."

Gignoux-Wolfsohn and a team of researchers from UMass Dartmouth and the Chesapeake Biological Laboratory (CBL) in Maryland are studying oysters' resiliency to climate change while looking at ways to make them more adaptable. The National Science Foundation awarded the researchers a grant of nearly $1.3 million for the project, with more than $500,000 going to UMass Lowell.



Over four years, the researchers plan to expose oysters from the Chesapeake Bay to warmer water temperatures and decreased oxygen, two common climate change stressors. The experiment, which is scheduled to start this summer, will take place in a large-scale quarium system at CBL. Biological sciences sophomore Logan Laurent and master's student Julia McDonough will be traveling to Maryland to assist with the study.

> "**Oysters and corals** *have such a big effect on the marine ecosystem. It's important for us to study them and understand their resiliency to climate change and diseases."*
>
> —SARAH GIGNOUX-WOLFSOHN

The researchers' goal is to expose the oysters to the common climate change stressors multiple times over their lifespan to see if early exposure primes them to be more resilient when exposed to those stressors again.

"If we can help make oysters more resilient, then farmers will experience even fewer losses," Gignoux-Wolfsohn says. "Oyster aquaculture is beneficial because oysters clean the water (by filtering out algae)."

Oysters also build reefs, similar to corals, that protect the coastline and provide homes for other aquatic species.

To further protect the aquaculture industry and coastal communities, Gignoux-Wolfsohn is assisting with a research project that looks to use biosensors to detect bacterial and viral pathogens that can lead to diseases. The project, which received $1 million in funding from the National Science Foundation, is spearheaded by UMass Lowell Electrical Engineering Prof. Yan Luo.

As an extension of the project in the Chesapeake Bay, Gignoux-Wolfsohn is also working with UMass Lowell Biological Sciences Asst. Prof. Teresa Lee to study how early-life stress on oysters affects how their genes function. UML's Office of Research and Innovation is funding the work with a $15,000 internal seed award.

Gignoux-Wolfsohn says it's gratifying that her passion for the underwater world has guided her into research that could protect and strengthen two vital marine species.

"It sounds cliché, but I love the ocean," she says. "The marine ecosystem is extremely important, and being in the water makes me feel more connected to it."

JANET SIMPSON BENVENUTI '77, '82:

SCIENTIST AND BUSINESS LEADER BECOMES A FAMILY HEALTH ADVOCATE

BY KAREN ANGELO

Looking back on her career, Janet Simpson Benvenuti '77, '82 thinks of her life in 10-year increments.

"In my 20s, I focused on my education and establishing my career," says Benvenuti. "I worked as a scientist while earning two graduate degrees."But then life happened."

Decades later, she is far removed from the lab bench. An outspoken family health advocate, Benvenuti has spent the past 20 years working to strengthen health and elder care in the United States, advising business and clinical leaders, supporting entrepreneurs and offering coaching to adults struggling to understand how best to support their aging relatives.

The youngest of five siblings, Benvenuti grew up in Woburn, Massachusetts. She followed her two older brothers and enrolled at UMass Lowell. A first-generation college student, Benvenuti majored in chemistry.

"As one of the few female chemistry majors at the time, I was never intimidated," she says. "I was mentored by faculty who were actively interested in my work and career. That personal attention built my confidence as a scientist."

After graduating, Benvenuti worked for Textron on projects for the U.S. Department of Defense, held a security clearance and supervised an analytical chemistry laboratory. While working at Textron, she returned to UMass Lowell to earn a master's degree in chemistry, using the university's nuclear reactor to study coal combustion.

"At Textron, I discovered I enjoyed leading people, so I set out to learn more about the business aspects of running a company," she says. "To my complete surprise, I was admitted to Harvard Business School."

By age 29, with two chemistry degrees and an MBA in hand, Benvenuti's second chapter was about to begin.

She joined Bristol Myers Squibb (BMS), the global pharmaceutical company, as corporate director of quality and productivity, organizing global project teams to improve business performance. Selected by President George H.W. Bush as one of the inaugural members of the Malcolm Baldrige Commission, whose mission was to promote America's competitiveness, she traveled across the country showing business leaders how to systematically improve service or product quality.

After the birth of her first child, Benvenuti realized that staying on the traditional corporate path with international travel and limited child care choices was not the life she wanted. She left her job and set up a virtual consulting business, helping companies improve profitability and manage change.

When she was in her early 40s, Benvenuti's father was diagnosed with throat cancer. Her parents were in Massachusetts, and Benvenuti was living in New Jersey. Her father recovered, but his illness and her mother's heart disease and dementia prompted a move north.

"I became legally responsible for both parents when my children were 6 and 3 years old," she says. "I was completely unprepared for the world of elder care, and I knew there were millions of people like me in the same situation. After my parents passed away, I decided to share what I learned and see how I might positively impact other people's lives."

In 2004, Benvenuti launched the Circle of Life Partners, which provides customized education programs for employers, universities, professional organizations and communities on how to "navigate the aging journey." She networks with organizations that help family caregivers, speaks publicly about how to care for older relatives and is vocal about the need for employee benefits such as family leave.

She also serves on the Kennedy College of Sciences advisory board. Reflecting on the winding path of her life and career, Benvenuti challenges students to follow their interests and be open and flexible.

"Having both technical and business degrees created opportunities for me," she says. "I was not locked into any one company or any one career path. I deeply appreciate the education I got at UMass Lowell and the faculty mentors who gave me the confidence to make career choices that were right for me."

OMAR HODA '93

AFTER BENEFITING FROM MENTORS' HELP, HODA GIVES BACK

BY KATHARINE WEBSTER

Omar Hoda '93 was born in Pakistan, but his father worked in the airline business, and his family migrated among countries.

Hoda has also migrated between careers, from software engineering to management consulting at Deloitte, where he is a partner. It's been a gratifying journey, thanks to mentors at UMass Lowell and beyond.

When Hoda was a child, his family moved to Malaysia and then to Malta, as his parents were searching for better economic opportunities for their three children. His older sister came to New England for college, and Hoda followed suit. His younger sister wasn't far behind.

"As an international student, you choose a college in the U.S. by saying, 'where is someone I know?' And then you draw a radius around that," he says.

UMass Lowell was "affordable and accessible" and had a strong computer science department, Hoda says. He stretched his college budget further by sharing an inexpensive off-campus apartment with two other students and getting a job washing dishes at a campus cafeteria. "I was like, 'They pay me and I get free food?'" he says. "Free food was a win."

Hoda threw himself into his studies and graduated in three years. At first, though, he struggled in an educational system that was so different from what he'd known. One computer science professor, Jesse Heines, would give a flawless assignment a 90%; to rate an A, a student had to earn "style points" for innovation or creativity, Hoda says.

"As a foreign student, I wanted to be told what to do. And Prof. Heines wanted me to think about how to get from 'You did what I told you' to 'Wow!'" Hoda says. "That was a foundational lesson for me."

Hoda soon became one of the founding officers of the campus chapter of the Association for Computing Machinery. Jim Canning, then professor and chair of computer science, mentored the students and helped them find money to host coding competitions. Hoda says the communication and leadership skills he developed at the time got him where he is today.

After graduation, Hoda took a job with a startup networking company. Within a couple of years, he began studying for his master's degree in computer science at Boston University at night. He also got a promotion to manager—and realized he wanted to hone his leadership skills.

Shortly after Hoda obtained his green card, he married, and he and his wife both returned to school. She earned a law degree; Hoda studied for an MBA at Babson College. While there, he got a business consulting internship at Booz Allen and loved it.

> "Prof. Heines wanted me to think about how to get from 'You did what I told you' to 'Wow!' That was a foundational lesson for me."
>
> —OMAR HODA

Degree in hand, Hoda took a consulting job with Adventis for a couple of years and then moved to Monitor Group, a strategy consultancy based in Cambridge. Soon after Deloitte Consulting acquired Monitor Group in 2013, Hoda rose to partner.

Hoda focused on the industrial and manufacturing sectors, and he now specializes in the automotive industry. His computer science background has proved invaluable as he helps manufacturers navigate rapidly evolving technologies, including the transition to the autonomous and electric vehicles.

On his 50th birthday, Hoda decided it was time to look back on his journey—and to give back. For the past two years, he has served on the executive board of the Automotive Hall of Fame. At UMass Lowell, he donates to the Strive Food Pantry because he's aware of how much he would have struggled without his campus dishwashing job. He also serves on the Kennedy College of Sciences advisory board, aiming to help a school that was critical to his success.

"I reflect on where I am now, and it's just a world away from where I started. I'm so grateful for my time at UMass Lowell and the lessons that I still carry with me," he says.

GINIKA OKOLI ’24

AN INTERNSHIP WITH AN ICONIC BRAND OPENS UP NEW CAREER PATH FOR MATH MAJOR

BY BROOKE COUPAL

Ginika Okoli landed a sweet internship for the summer before her senior year.

The mathematics major worked in Newark, New Jersey, as a data analytics intern for Mars Inc., manufacturer of Snickers, M&M’s, Skittles and dozens of other food and pet products.

“They made me feel so included, welcomed and important,” Okoli says of the company, which did $45 billion in sales in 2022.

During the three-month paid internship, which also provided free housing and transportation, Okoli analyzed the company’s return on investment for social media advertisements and other campaigns. Using the programming language Python, she created a computer model to predict future ROI for Mars, based on current trends.

“I learned a lot because I don’t have a computing background,” says Okoli, who enrolled in a programming course when she returned to campus to further develop her coding skills.

On campus, Okoli, whose parents emigrated from Nigeria, is active in the Association of Students of African Origin and the National Society of Black Engineers. She is also a member of UTeach, an undergraduate teacher preparation program for STEM majors. Through the program, she has gotten teaching experience at Lowell High School and Lowell’s Stoklosa Middle School.

“My biggest thing is making students feel that they’re welcomed in STEM spaces, especially students of color,” she says.

The Mars internship gave Okoli the opportunity to explore a different career path. Now she’s considering getting a master’s degree in statistics.

“I have a new outlook on math,” she says. “There’s so much potential with my future degree.”

ALBERT FARAH ’24

A DESIRE TO MAKE SPACE TRAVEL FASTER AND EASIER IS A MOTIVATING FORCE

BY BROOKE COUPAL

Albert Farah has been interested in space since childhood, so he originally enrolled at UMass Lowell as a mechanical engineering major with a goal of pursuing a career in the aerospace industry.

“I wanted to make space travel a lot faster and easier,” he says.

However, his interests gravitated toward physics, so he switched his major during his first year of college.

“I realized that I really enjoy theoretical physics,” says Farah, who added a dual degree option in mathematics during his sophomore year.

Farah reached out to theoretical cosmology expert and Physics Assoc. Prof. Nishant Agarwal about potential research opportunities. Agarwal recommended that he take courses in quantum mechanics and mathematical physics before joining his research group—advice Farah was grateful to receive.

“If I had rushed into his research without taking those courses, I would have been discouraged, because I would not understand the work,” Farah says.

Farah eventually joined Agarwal’s research group and got a stipend from the Kennedy College of Sciences to conduct research on the dynamics of quantum field theories. He presented his work at an American Physical Society conference in Minneapolis.

Last summer, Farah got additional funding from the college for a research project on quantum chaos that he had proposed.

“What these experiences have given me is the ability to ask relevant questions independently,” says Farah, who plans to pursue a career in research. “And it was pretty cool to secure funding for my projects through the college.”

BY KATHARINE WEBSTER

NEW CENTER FOCUSES ON INFECTIOUS DISEASES

Will Train Life Sciences Workers in Massachusetts

The new Center for Pathogen Research and Training supports research collaborations among faculty across the UMass Lowell campus who study microbes and infectious diseases—and it will soon train life sciences workers, says Chemistry Prof. Mingdi Yan (inset), the center’s director.

“There’s a shortage in the workforce in the Massachusetts life sciences, biotech and pharmaceutical industries,” says Yan. “There is really a need to train students and workers.”

The center recently won a $734,000 grant from the Massachusetts Life Sciences Center to buy equipment for a state-of-the-art laboratory, opening in the fall, that will support both teaching and research. Center faculty are offering a five-course graduate certificate in diagnostics and management skills, and they hope to incorporate the certificate into the undergraduate curriculum. The laboratory can also be used for focused, short-term classes for companies that need to train workers in a new diagnostic technique.

With dangerous infectious diseases on the rise around the world, such a center had been under discussion for several years among faculty in the sciences, health sciences and engineering. But COVID-19 showed how urgent the need was, says Yan, who researches alternative treatments for multidrug-resistant pathogens.

“COVID was the catalyst,” she says. “If we have another pandemic and there’s a need to train the workforce in a short time, we will have that capacity.”

Yan says the center is also working to foster research collaborations among faculty—21 researchers across eight departments in the three colleges—with diverse areas of expertise, from epidemiology to biomedical engineering. “There are more and more issues that cannot be solved by a single investigator or a single discipline,” she says.

For example, Biology Assoc. Prof. Frederic Chain, an associate director of the center, uses bioinformatics to analyze genomes. He and Environmental Engineering Assoc. Prof. Sheree Pagsuyoin were already collaborating when the COVID-19 pandemic struck, and they quickly put together a team of UML researchers to analyze sewage and wastewater for markers of the virus, to predict community outbreaks. That work led to a $660,000 international research award, in collaboration with Northeastern University faculty, to develop wireless sensors that can detect the virus in both wastewater and the air.

Recently, the same UML group, with the addition of Asst. Prof. of Biology Sarah Gignoux-Wolfsohn, plus an environmental monitoring firm and faculty from Northeastern and another university, was awarded a $1 million National Science Foundation grant to develop similar sensor technology that can detect pathogens affecting fish and shellfish farmed in seawater. The new lab will help with the training and commercialization aspects of that research, Chain says. (See related story on page 16)

“The Center for Pathogen Research and Training gives us an opportunity to come together as a larger team,” Chain says. “I see it as a launching board for bigger, greater things.”

The impetus for the training program and laboratory grant came from Gregory Chiklis ’92, CEO and chief scientific officer of MSN Diagnostics, says Yan. Chiklis, who serves on the center’s external advisory board, says many diagnostics and life sciences lab managers are aging out of the workforce, and companies are seeking younger workers with science degrees who also have some management skills.

“The certificate will give them some practical skills that you don’t normally get in college,” Chiklis says. “It will give them that upward mobility—and help industry at the same time.”

‘MEET THEM WHERE THEY ARE’

Students’ Math Skills Have Slipped Since the Pandemic. Assoc. Teaching Prof. Roser Giné Is Working to Change That.

BY ED BRENNEN

Whenever Roser Giné needed help with her math homework as a child, she turned to a world-renowned research mathematician who had a major influence on modern probability theory and statistics: her late father, Evarist.

“He had this clear way of explaining things to me. He emphasized the elegance of mathematics, always showing me why something was true,” recalls Giné, whose father’s work took the family from their native Catalonia to Venezuela and ultimately to the United States. “I always wanted to be like him. He is the primary reason why I became interested in mathematics.”

As an associate teaching professor of Mathematics and Statistics, Giné shares her love of trigonometric integrals and multivariable functions with students in her Calculus II and III courses.

Giné’s expertise is in mathematics education—a field in which she holds a master’s degree from Harvard and a doctorate from UMass Boston. Accordingly, she teaches a pair of courses designed for future math educators: Teaching College Mathematics (for graduate teaching assistants) and Functions and Modelling (for students in the UTeach program who want to become math teachers at the secondary level).

“We have a wonderfully diverse student population that I really value, and I love this department, where I’m given the room to explore what I’m passionate about,” says Giné, who joined the department full time in 2020. She had been an adjunct since 2011, when she began teaching in UML’s former Graduate School of Education.

Like math educators across the country, Giné has noticed a decline in proficiency in recent years.

“Our students are coming in with gaps in their learning,” says Giné, whose calculus courses are required for students majoring in not only mathematics, but also engineering and computer science.

According to the National Assessment of Educational Progress, aka “The Nation’s Report Card,” math scores for 13-year-olds fell nine points, from 280 to 271, between the 2019-20 and 2022-23 school years—the largest-ever decline in the assessment’s half-century history.

Giné, who taught high school math for 12 years in the Massachusetts communities of Roxbury, Framingham and Fitchburg, sat down to discuss efforts to improve math education.

Q. What is your department doing to address the gap in student learning since the pandemic?

A. Our chair, Ravi Montenegro, in collaboration with several faculty members, created a precalculus sequence because we felt that students, especially during and after the pandemic, were not as successful jumping right into Calculus I. We also changed the minimum Advanced Placement Calculus score required to get into Calc I and II. Historically, we took students who scored 3 or above on the AP test. But they were not prepared for Calc I or II, so now they have to score a 4 or a 5.

Q. What are you seeing in your classroom in terms of math proficiency?

A. I’m concerned about some of the gaps in learning that students are experiencing—and that is not because of the lack of quality education at any level. It’s easy to say, ‘Well, their teachers aren’t doing enough.’ But I don’t think that’s true. I would not put blame at any one educational level. It may be because of the pandemic, but I don’t have research to back that up. It just seems like we place less and less importance on learning mathematics. Whether or not it is something that you end up using in your career, mathematics helps you develop your mind and think critically, which is valuable and powerful. But there are a lot more distractions for students today. I’m very aware, for instance, that there are multiple students in my class that have their phones out. I don’t know why they’re reliant on technology, but it’s everywhere. So, how do we turn that technology into productive ways of learning?

Q. How are you using technology?

A. I’m trying to create resources for my students that go beyond what we can do in the classroom. The calculus sequence can be more project-based, but you have to cover a lot of material, which means that sometimes I have to lecture a lot more than I think is productive. My response to that has been creating resources that students can access outside of class. A lot of the dynamic applets that I use in class are posted on Blackboard so that students can play around with them. I also created a YouTube channel where I’ve made a series of videos that help a lot. (https://www.youtube.com/@calculusvideosUML).

Q. You do a lot of work outside of the classroom to promote math education. Can you share some of those efforts?

A. I created a math education speaker series when I was in the Graduate School of Education that I have revived. Once a semester, I invite math educators from local schools to talk about their research and teaching methods. Two years ago, I had somebody talk about Babylonian mathematics (developed in Mesopotamia around 4000 B.C.E.), which was really interesting. Carly Briggs, an assistant teaching professor in our department, spoke last spring about team-based learning that she does in her classroom. I also lead panel discussions at local high schools, where I bring professors and students to talk about programs at UMass Lowell. It helps me connect with schools and lets high school students learn about UMass Lowell.

Q. What do you want students who may have fallen behind in math to know?

A. Whatever the reasons for the gaps that they’re experiencing, our job as faculty is to make sure that they are supported, that we meet them where they are and that we don’t discourage them. We need to communicate to them that they can learn mathematics if that is something that they might be interested in. But we also have to make changes within the classroom, because if we just repeat the same thing that did not work for students the first time, it’s not going to work the second time. We have to fill in the gaps, of course, but repetition does not necessarily lead to deeper understanding. It’s up to us to think about how to teach in a way where students can be more successful, more engaged and more invested. And that’s work that we should all do all the time.

Grants and Awards:

ASST. PROF. REZA AHMADZADEH, *Miner School of Computer and Information Sciences,* received:

- A $60,000 award from Amazon, Greater Boston Tech Initiative, for the project "Extension to Human-to-Robot Skill Transfer for Supervisory Control of Dexterous Manipulation."
- An Office of Naval Research grant of $1,663,381 wfor the project "Long-Term Underwater Autonomy for Surveillance and Manipulation."
- A National Science Foundation (NSF) Faculty Early Career Development Program award of $499,164 for the project "CAREER: Robot Learning of Complex Tasks via Skill Reusability and Refinement."

PROF. MATHEW BARLOW, *Department of Environmental, Earth & Atmospheric Sciences,* was appointed to the state's new Climate Science Advisory Panel. The panel will provide expertise on statewide climate science and guidance to inform state and local climate adaptation planning and projects.

PROF. JEROME DELHOMMELLE, *Department of Chemistry,* received:

- A $577,047 award from the Department of Energy, Basic Energy Sciences, for the project "Energy-efficient self-assembly and swarm behavior in active matter."
- A $472,244 National Science Foundation, Division of Chemistry award for the project "CAS: Collaborative Research: Design, Characterization, and Modeling of Metal Nanoclusters Electrocatalysts linked to three-dimensional graphene," as co-PI with K. Chow (PI) and M. Yan (co-PI).

ASST. PROF. NICOLAI KONOW, *Department of Biological Sciences,* received a $2,152,855 grant from the National Institutes of Health for his four-year project "Muscle mass: a critical but missing component in muscle modeling and simulation," as co-PI.

ASST. PROF. RACHEL MELAMED, *Department of Biological Sciences,* received an award from R35 Maximizing Investigators Research Activity for the project "Integrating genetics and health records to discover common drug effects on cancer and dementia."

SPOTLIGHT
NEW FACULTY

JEREMY SALAPEK PHOTOGRAPHY

JEFFREY BASARA
Professor and chair, Department of Environmental, Earth and Atmospheric Sciences

Research Interests: The complex, integrated processes across weather, climate, water and ecosystems with specific attention on precipitation extremes and associated impacts

EMILY GUNAWAN
Assistant Professor, Department of Mathematics and Statistics

Research interests: Algebraic combinatorics, quiver representations, cluster algebras

SURI SARANATHAN IYER
Professor and chair, Department of Chemistry

Research Interests: Synthetic chemistry, pathogen glycobiology, assay development, biosensors

SAMANTHA REIG
Assistant Professor, Miner School of Computer & Information Sciences

Research Interests: Artificial intelligence (AI) embodiment in socially complex interactions, robot re-embodiment, personalized experiences with AI agents in services and designing for human-AI teaming in space

INDRAYANI WAGHMARE
Assistant Professor, Department of Biological Sciences

Research Interests: Drosophila genetics, cell and developmental biology

PROF. VIKTOR PODOLSKIY, *Department of Physics & Applied Physics,* received a $375,000 grant from UT Austin (NASA) for his project "Ultra-Compact Machine-Learning-Driven Platform for Room Temperature Mid-Wave Infrared Remote Sensing."

ASST. PROF. JAMES REUTHER, *Department of Chemistry,* received:

- An $8,000 award from the Peter E. and Anna Giants KCS Endowed Fund for Advanced Research for the project "Recyclable and Upcyclable Polyurethane Vitrimer Foams for Sustainable Footwear."
- A $50,000 award from the United States Geological Survey Water Resources Research Center for the project "Tailorable, Dynamically-Crosslinked Polymer Adsorbents for Targeted Per- and Polyfluoroalkyl Substance Capture and Release."
- A $254,939 award from the HEROES ASPIRE II Project Call – U.S. Army DEVCOM Soldier Center for the project "Passive HOT (Heating by Optical Transduction) Textiles for Artic Resilience."
- A $623,377 award from the HEROES Footwear Congressional Project Call – U.S. Army DEVCOM Soldier Center for the project "Novel Lightweight, Multi-Density Polyurethane Outsoles for Army Hot Weather Boot Development."

ASST. PROF. MICHAEL ROSS, *Department of Chemistry,* received two high-profile foundation grants from the Research Corporation for Science Advancement, the Alfred P. Sloan Foundation and the ClimateWorks Foundation, and was named to the Nanoscale Horizons Community Board.

PROF. ERNO SAJO, *Department of Physics & Applied Physics,* received an award for Best in Physics Paper, "Radiography Employing High Energy Current (HEC) of Megavoltage X-Rays," at the 65th annual meeting of the American Association of Physicists in Medicine in Houston, Texas in July 2023.

ASST. PROF. NATALIE STEINEL, *Department of Biological Sciences,* received a $746,756 award from the Mass Life Science Center, Workforce Development Capital Grant. **PI:** Mingdi Yan **co-PIs:** Natalie Steinel, Dionysios Christodouleas, Matthew Gage, Yanfen Li

Publications

ASST. PROF. REZA AHMADZADEH, *Miner School of Computer and Information Sciences:*

- **"The Effect of Performance-Based Compensation on Crowdsourced HRI Experiments,"** Zahra. R. Khavas, Monish. R. Kotturu, Russel Perkin, S. R. Ahmadzadeh, P. Robinette, Journal of Software.
- **"Influence of Team Interactions on Multi-Robot Cooperation: A Relational Network Perspective,"** Yasin Findik, Hamid Osooli, Paul Robinette, Kshitij Jerath, S. Reza Ahmadzadeh, In Proc. International Symposium on Multi-Robot and Multi-Agent Systems.
- **"Impact of Relational Networks in Multi-Agent Learning: A Value-Based Factorization View,"** Yasin Findik, Paul Robinette, Kshitij Jerath, S. Reza Ahmadzadeh, In Proc. 62nd IEEE Conference on Decision and Control.
- **"Design and Evaluation of a Bioinspired Tendon-Driven 3D-Printed Robotic Eye with Active Vision Capabilities,"** Hamid Osooli, Mohsen I. Raghaghi, S. Reza Ahmadzadeh, In Proc. 20th International Conference on Ubiquitous Robots.
- **"Confidence-Based Skill Reproduction Through Perturbation Analysis,"** Brendan Hertel, S. Reza Ahmadzadeh, In Proc. 20th International Conference on Ubiquitous Robots.
- **"The Effect of Performance-Based Compensation on Crowdsourced HRI Experiments,"** Zahra R. Khavas, Russell Perkin, S. Reza Ahmadzadeh and Paul Robinette, In Proc. 9th International Conference on Automation, Robotics, and Applications.
- **"Human Trust After Drone Failure: Study of the Effects of Drone Type and Failure Type on Human-Drone Trust,"** Zahra R. Khavas, Amin Majdi, S. Reza Ahmadzadeh, Paul Robinette, In Proc. 20th International Conference on Ubiquitous Robots.
- **"Contextual Autonomy Evaluation of Unmanned Aerial Vehicles in Subterranean Environments,"** Ryan Donald, Peter Gavriel, Adam Norton and S. Reza Ahmadzadeh, In Proc. 9th International Conference on Automation, Robotics, and Applications.
- **"Validating Drone Trust Testing in Navigation Deviation Cases in Simulation,"** Zahra Rezaei Khavas, Edwin Meriaux, Amin Majdi, Paul Robinette, In Social Robot Navigation: Advances and Evaluation Workshop at IEEE/RSJ International Conference on Intelligent Robots and Systems.
- **"Collaborative Adaptation: Learning to Recover from Unforeseen Malfunctions in Multi-Robot Teams,"** Yasin Findik, Paul Robinette, Kshitij Jerath, S. Reza Ahmadzadeh, In MADGames workshop at IEEE/RSJ International Conference on Intelligent Robots and Systems.
- **"A Multi-Robot Task Assignment Framework for Search and Rescue with Heterogeneous Teams,"** Hamid Osooli, Paul Robinette, Kshitij Jerath, S. Reza Ahmadzadeh, In Advances in Multi-Agent Learning - Coordination, Communication, and Control Workshop at IEEE/RSJ International Conference on Intelligent Robots and Systems.
- **"DECISIVE Benchmarking Data Report: sUAS Performance Results from Phase I,"** Adam Norton, S. Reza Ahmadzadeh, Kshitij Jerath, Paul Robinette, Jay Weitzen, Thanuka Wickramarathne, Holly Yanco, Minseop Choi, Ryan Donald, Brendan Donoghue and others, arXiv preprint.

ASST. PROF. JUAN ARTES VIVANCOS, *Department of Chemistry:*

- **"Electrical conductance in individual single-stranded RNA oligonucleotides,"** S. Chandra, K G. G. Pattiya Arachchillage+, E. Kliuchnikov, F. Maksudov, A. Castillol, K. Marx, V. Barsegov*, and J. M. Artes Vivancos*, Scientific Reports.
- **"A single-molecule electrical biosensor for COVID-19," K G. G. Pattiya Arachchillage+,** S. Chandra+, A. Williams+, S. Rangan~, P. Piscitellil, L. Florencel, S. G. Gupta~, and J. M. Artes Vivancos*, Biosensors and Bioelectronics.
- **"A single-molecule electrical biosensor for electrical detection of KRAS mutations and cancer screening,"** K G. G. Pattiya Arachchillage+, S. Chandra+, S Rangan~, A. Castillol, and J. M. Artes Vivancos*, Scientific Reports.
- **"Perceptions of changes in the environment produced by the COVID-19 pandemic across the Northern Hemisphere: implications for environmental protection policies,"** N Hidalgo, A Picornell, S Reyes, G Circella, H Ribeiro, AE Bates, J Rojo, PB Pearman, JM Artes Vivancos, S Nautiyal, FQ Brearley, J Pereña, M Ferragud, A Monroy-Colín, JM Maya-Manzano, JMA Sènami Ouachinou, AE Salvo-Tierra, C Antunes, M Trigo-Pérez, T Navarro, P Jaramillo, J Oteros, A Charalampopoulos, Ol Kalantzi, H Freitas, J Ščevková, M Zanolla, A Marrano, O Comino, JJ Roldán, AF Alcántara and A Damialis (International collaboration), Env. Impact Assessment.

continued on next page

PROF. JEROME DELHOMMELLE, *Department of Chemistry:*

- **"Microswimmers Under the Spotlight: Interplay Between Active and Passive Agents,"** Desgranges, C.; Ferrari, M.; Chaikin, P. M.; Sacanna, S.; Tuckerman, M. E. and Delhommelle, J., Soft Matter.
- **"A Graphical Fingerprint Assisted Machine Learning Method for Retrieving Elastic Moduli from Resonant Ultrasound Spectroscopy,"** Liu, J.; Zhao, X.; Zhao, K.; Goncharov, V. G.; Delhommelle, J.; Lin, J. and Guo, X., Sci. Rep.

ASSOC. PROF. RICHARD GASCHNIG, *Department of Environmental, Earth & Atmospheric Sciences:*

- **"Age and Origin of Early Cretaceous Magmatism in the Southernmost Omineca Belt, Northern U.S. Cordillera,"** Gaschnig, R.M., Lewis, R.S., Vervoort, J.D., GSA Bulletin.
- **"Halogen (F, Cl, Br, and I) Concentrations of the Upper Continental Crust Through Time as Recorded in Ancient Glacial Diamictite Composites,"** Han, P.-Y., Rudnick, R. L., He, T., Marks, M. A. W., Wang, S.-J., Gaschnig, R. M., and Hu, Z.-C., Geochimica et Cosmochimica Acta.
- **"Cerium Geochemical Composition in the Upper Continental Crust Through Time: Implications for Tracing Past Redox Environment,"** Li, W., Nakada, R., Takahashi, Y., Gaschnig, R.M., Hu, Y., Shakouri, M. and Liu, X-M., Geochimica et Cosmochimica Acta.
- **"Vanadium Isotope Evidence for Emergence of Felsic Crust After 3 Billion Years,"** Tian, S., Ding, X., Qi, Y., Wu, F., Yue, C., Gaschnig, R.M., Xiao, Z., Lv, W., Rudnick, R.L. and Huang, F., Proceedings of the National Academy of Sciences.

PROF. JAMES HEISS, *Department of Environmental, Earth & Atmospheric Sciences:*

- **"Groundwater discharge and saltwater-freshwater mixing in a mangrove wetland over tidal cycles: a field and modeling study,"** Peng, K., J.W. Heiss, X. Xie, L. Yan, Y. Deng, Y. Gan, Q. Li and Y. Zhang, Journal of Hydrology.
- **"Isotopic and Spectral Signatures Unravel the Sources, Preservation and Degradation of Sedimentary Organic Matter in the Dongzhai Harbor Mangrove Estuary, Southern China,"** Lu, Y., X. Xie, J.W. Heiss, K. Peng, Y. Deng, Y. Gan, Q. Li and Y. Zhang, Journal of Hydrology.

ASST. PROF. HWAI-CHEN GUO, *Department of Biological Sciences:*

- **"Structure-guided Discovery of Aminopeptidase ERAP1 Variants Capable of Processing Antigens with Novel PC Anchor Specificities,"** Pande, S. and Guo, H.-C., Immunology.

ASSOC. PROF. ARCHANA KAMAL, *Department of Physics & Applied Physics:*

- **"Strong Parametric Dispersive Shifts in a Statically Decoupled Multi-qubit Cavity QED System,"** T. Noh, Z. Xiao, K. Cicak, X. Y. Jin, E. Doucet, J. Teufel, J. Aumentado, L. C. G. Govia, L. Ranzani, A. Kamal and R. W. Simmonds, Nature Physics.
- **"Modular Tunable Coupler for Superconducting Qubits,"** D. L. Campbell, A. Kamal, L. Ranzani, M. Senatore and M. LaHaye, Physics & Applied Physics.

ASST. PROF. NICOLAI KONOW, *Department of Biological Sciences:*

- **"Introduction: Food Processing and Nutritional Assimilation in Animals,"** Laird M., Kang V., Ross C.F. and Konow N., Phil. Trans. R. Soc. B.
- **"Do Salamanders Chew? An XROMM Analysis of Ambystomatid Intraoral Feeding Behaviors,"** Spence M., Rull-Garza M., Roba Y.T. and Konow N., Phil. Trans. R. Soc. B.
- **"Using Salamanders as Model Taxa to Understand Vertebrate Feeding Constraints During the Devonian Water-to-land Transition,"** Schwarz D., Heiss E., Pierson T., Konow N. and Shoch R., Phil. Trans. R. Soc. B.
- **"Rhythmic Chew Cycles with Distinct Fast and Slow Phases are Ancestral to Gnathostomes,"** Richard B.A., Spence M., Rull-Garza M., Roba Y.T., Schwarz D., Ramsay J.B., Laurence-Chasen J.D., Ross C.F. and Konow N., Phil. Trans. R. Soc. B.

PROF. BENYAN LIU, *Miner School of Computer & Information Sciences:*

- **"Profiting from High Frequency Market Psychology Data with Deep Learning,"**Jiancheng Shen, Jia Wang, Hongwei Zhu, Yu Cao and Benyuan Liu, Lecture Notes in Business Information Processing.
- **"Automatic Disease Detection in Endoscopy with Light Weight Transformer,"** Zhang Zhang, Qilei Chen, Shuijiao Chen, Xiaowei Liu, Cao Yu, Benyuan Liu and Honggang Zhang, Elsevier Smart Health Journal.
- **"Deep Learning for Gastric Location Classification: an Analysis of Location Boundaries and Improvements through Attention and Contrastive Learning,"** Chenxi Zhang, Alexander Ding, Zhehong Fu, Jing Ni, Zinan Xiong, Qilei Chen, Cao Yu, Benyuan Liu, Shuijiao Chen and Xiaowei Liu, Elsevier Smart Health Journal.
- **"A Greedy Algorithm-Based Self-Training Pipeline for Expansion of Dental Caries Dataset,**"Xizhe Wang, Zhang Zhang, Jing Guo, Peng Zhang, Qilei Chen, Yu Cao, Xinwen Fu and Benyuan Liu, IEEE Healthcom.
- **"A CNN-Based Disease Detection Framework for Wireless Capsule Endoscopy Videos,"** Xizhe Wang, Zhang Zhang, Qilei Chen, Yani Yin, Guanghui Lian, Shuijiao Chen, Xiaowei Liu, Yu Cao and Benyuan Liu, IEEE Healthcom.
- **"MLMSA: Multi-Level and Multi-scale Attention for Lesion Detection in Endoscopy,"** Zhang Zhang, Xizhe Wang, Shuijiao Chen, Xiaowei Liu, Qilei Chen, Yizhe Zhang, Yu Cao and Benyuan Liu, IEEE Healthcom.
- **"DeepPsych: Harnessing Market Psychology with Deep Learning,"** Jiancheng Shen, Hongwei Zhu, Jia Wang and Benyuan Liu, International Conference on Information Systems.
- **"A Deep Learning Framework with Pruning RoI Proposal for Dental Caries Detection in Panoramic X-ray Images,"** Xizhe Wang, Jing Guo, Peng Zhang, Qilei Chen, Zhang Zhang, Yu Cao, Xinwen Fu and Benyuan Liu, International Conference on Neural Information Processing.
- **"Modeling the Risk of Truck Rollover Crashes on Highway Ramps Using Drone Video Data and Mask-RCNN,"** Zubin Bhuyan, Qilei Chen, Yuanchang Xie, Yu Cao and Benyuan Liu, IEEE International Conference on Intelligent Transportation Systems.

ASST. PROF. RACHEL MELAMED, *Department of Biological Sciences:*

- **"Development and Application of an Evidence-based Directed Acyclic Graph to Evaluate the Associations Between Metal Mixtures and Cardiometabolic Outcomes,"** Emily Riseberg , Rachel Melamed, Katherine James, Tanya Alderete and Laura Corlin, Epidemiologic Methods
- **"Reduction of Phosphorylated Tau in Alzheimer's Disease Induced Pluripotent Stem Cell-Derived Neuro-Spheroids by Rho-Associated Coiled-Coil Kinase Inhibitor Fasudil,"** Journal of Alzheimer's Disease.
- **"Associations Between Natural Language Processing–Enriched Social Determinants of Health and Suicide Death Among US Veterans,"** JAMA Network Open.

ASST. PROF. JAMES REUTHER, *Department of Chemistry:*

- **"Multi-Responsive Nanogels with Tunable Orthogonal Reversible Covalent (TORC) Core-Crosslinks for AND-Gate Controlled Release,"** S. Tafazoli, A. Shahrokhinia, S. Rijal, J. Garay, R.A. Scanga and J.F. Reuther, Polymer Chemistry.
- **"Low-Loss Dielectric Ink for Printed Radio Frequency and Microwave Devices,"** Y. Piro*, C. Areias, A. Luce, M. Michael, P. Biswas, O. Ranasingha, J.F. Reuther, S. Trulli and A. Akyurtlu, ACS Appl. Mater. Interfaces.
- **"Asymmetric Polymerization-Induced Crystallization-Driven Self-Assembly of Helical, Rod-Coil Poly(Aryl Isocyanide) Block Copolymers,"** R.A. Scanga, A. Shahrokhinia, J. Borges, S.H. Sarault, M.B. Ross and J.F. Reuther, J. Am. Chem. Soc.
- **"Oxime-Functionalized, Non-Woven Nanofabrics for Rapid, Inexpensive Nerve-Agent Decontamination,"** P. Biswas, D.B. Shuster, B. Sonmez Baghirzade, R.A. Scanga, S.A. Harris, C.N. Tran, O.G. Apul and J.F. Reuther, ACS Appl. Nano Mater.
- **"Accessibility of Adsorption Sites for Superfine Powdered Activated Carbon Incorporated into Electrospun Polystyrene Fibers."** B. Sonmez Baghirzade, P. Biswas, J.F. Reuther and O.G. Apul, Chem. Eng. J.
- **"Trehalose-Grafted Glycopolymer: Synthesis via the Staudinger Reaction and Capture of Mycobacteria,"** S.A. Wijesundera, S.H. Liyanage, P. Biswas, J.F. Reuther and M. Yan, Biomacromolecules.

ASST. PROF. MICHAEL ROSS, *Department of Chemistry:*

- **"Plasmon manipulation by post-transition metal alloying,"** Fonseca Guzman, M.V.; King, M. E.; Mason, N.L.; Sullivan, C.S.; Jeong, S. and Ross, M.B., ChemRxiv.
- **"Accurate Computational Design of 3D Protein Crystals,"** Li, Z.; Wang, S.; Nattermann, U.; Bera, A.K.; Borst, A.J.; Yaman, M.Y.; Bick, M.J.; Yang, E.C.; Sheffler, W.; Lee, B.; Seifert, S.; Hura, G.L.; Nguyen, H.; Kang, A.; Dalal, R; Lubner, J.M.; Hsia, Y.; Haddox, H.; Courbet, A.; Dowling, Q.; Miranda, M.; Favor, A.; Etemadi, A.; Edman, N.I.; Yang, W.; Weidle, C.E.; Sankaran, B.; Negahdari, B.; Ross, M.B.; Ginger, D.S. and Baker, D., Nature Materials.
- **"Engineering Bimetallic Interface and Revealing the Mechanism for CO2 Electroreduction Reaction to C3+ Liquid Chemicals,"** Xu, Y; Ross, M.B.; Xin, H. and Che, F., Cell Rep. Phys. Sci.
- **"Strategies for Multi-step CO2 Upgrading and Valorization,"** Nagarajan, P., Augustine, I. J. and Ross, M.B., Cell Rep. Phys. Sci.
- **"Synthesis of Gold-tin Alloy Nanoparticles with Tunable Plasmonic Properties,"** Branco, A., Mason, N., Dawes, S. and Ross, M.B., STAR Protocols.
- **"Asymmetric Polymerization-induced Crystallization-driven Self Assembly of Helical, Rod-coil Poly(aryl isocyanide) Block Copolymers,"** Scanga, R.; Sharokhinia, A.; Borges, J.; Ross, M.B. and Reuther, J.F., J. Am. Chem. Soc.

ASST. PROF. CHRISTOPHER SKINNER, *Environmental, Earth & Atmospheric Sciences*:

- **"North Atlantic Meltwater During Heinrich Stadial 1 drives Wetter Climate with More Atmospheric Rivers in Western North America,"** Oster J, Macarewich S, Lofverstrom M, de Wet C, Montañez I, Lora JM, Skinner CB and Tabor C, Science Advances.
- **"The Contribution of Precipitation Recycling to North American Wet and Dry Precipitation Extremes,"** Skinner CB, Harrington TS, Barlow M and Agel L, Environmental Research: Climate.
- **"The hydrologic cycle and atmospheric rivers in CESM2 simulations of the Last Glacial Maximum,"** Lora JM, Skinner CB, Rush W and Baek S, Geophysical Research Letters.
- **"Atmospheric river contributions to ice sheet hydroclimate at the Last Glacial Maximum,"** Skinner CB, Lora JM, Tabor CR and Zhu J, Geophysical Research Letters.

Student Success

ADAM BOEY, *Department of Physics & Applied Physics,* presented "Minor Actinide and Lanthanide Chromatographic Separations Using Synergistic Extractions" at the 68th Annual Meeting of the Health Physics Society.

RIDHITA BORHAN, *Department of Physics & Applied Physics,* presented "Exploring Radiation Effects on Extraction Chromatographic Materials" at the 68th Annual Meeting of the Health Physics Society.

TYLER HARRINGTON, *Department of Environmental, Earth & Atmospheric Sciences,* "The Contribution of Transpiration, Ground Evaporation, and Canopy Evaporation to Local and Remote Precipitation Across North America," (2023), Journal of Geophysical Research: Atmospheres.

NOAH MASON, *Department of Chemistry,* received the Best Honors Thesis Award campuswide at UMass Lowell and is now a Ph.D. student at the University of Chicago.

ZHIHAO XIAO, *Department of Physics and Applied Physics,* post-doc of Archana Kamal, was invited to speak on "Parametric cQED: A New approach to Realizing Strong Light-matter Interactions" at the 2023 APS March Meeting in Las Vegas.