

SPRING | SUMMER 2021

UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE



PANDEMIC PIVOT Multifaceted responses to 'why we are here differently'



A year ago at the start of the pandemic, we knew that the University of Maine's response as the state's research university needed to be rapid, dynamic and focused. In countless virtual meetings, we made decisions by bringing together those who could best inform us, implement the necessary steps, and put students first by being compassionate and caring above all else. We set aside our organizational charts and traditional communication pathways. We all had to be humble enough to listen to one another, and to science, as we weighed options, changed course as needed and continuously improved.

It is a perfect example of the leadership roles we all have and the opportunities to contribute for the greater good. When we are working to solve complex problems, the inclusion of diverse expertise, life experiences and points of view is vital to achieving solid solutions.

It is one of the many lessons from this challenging time that will inform our future.

Throughout this pandemic, we continue to be flexible, caring and compassionate, and to use the depth and breadth of our expertise, innovation and infrastructure to help meet needs in Maine and beyond. Our students and faculty have been remarkable in their resilience, willingness to adapt, and commitment to education under challenging circumstances. UMaine staff have stretched to take on new responsibilities for community well-being. Scientists have kept their research going while simultaneously becoming experts in coronavirus-related areas.

Our pandemic response has not been the only transformational experience in the past year. In this issue of *UMaine Today* magazine, you'll read about other initiatives foundational to our future, including the historic \$240 million grant for the University of Maine System by the Harold Alfond Foundation, which has UMaine at the center of the work.

We remain vigilant, mindful, and focused on our strategic vision and values.



Joan Ferrini-Mundy

*University of Maine System Vice Chancellor for Research and Innovation
President of the University of Maine and University of Maine at Machias*

In spring 2020, the pandemic forced biology lecturer Julia McGuire and other UMaine faculty members to reorient in-person classes and labs to remote learning models. For the remaining labs for 200 students in BIO 100, McGuire, lab coordinator Rachel Fowler and teaching assistant Edna Pedraza developed a five-week experiment that could be conducted wherever students were sheltering in place — from urban to rural settings, from South Korea to Maine. They gathered observations, developed and tested hypotheses, and analyzed, interpreted and presented their results virtually. The successful teaching and learning model in inquiry-based instruction is one of many examples of innovation in face-to-face, remote and distance learning this past year. Flexibility with greater focus on learning objectives rather than specific class plans is key to providing successful online learning experiences, says McGuire, who has expanded the undergraduate research experience project over three semesters for more than 1,000 students. Go to *UMaine Today* online to read more about McGuire's class and other stories about innovation in teaching (umainetoday.umaine.edu). Photos by Adam Kuykendall

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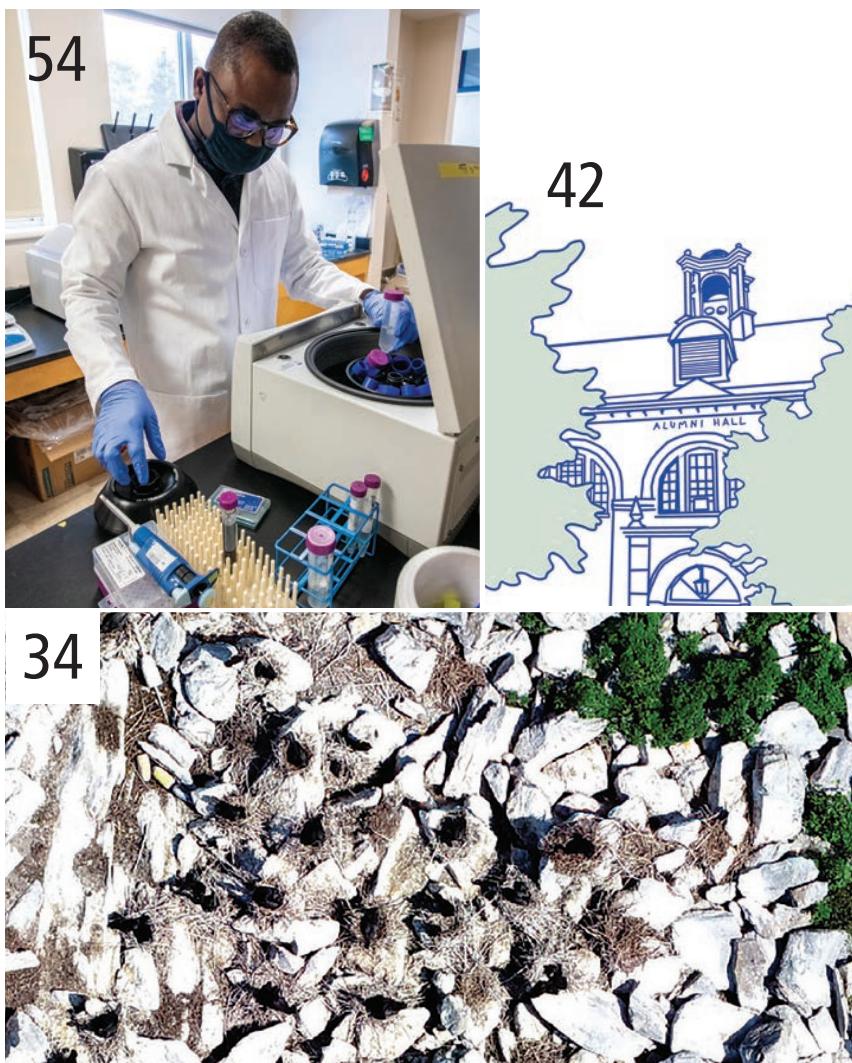
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UMaine Today Magazine

Managing editor
 Margaret Nagle

Digital/print content coordinator

Amanda Lozier

Designers

Jeanne Bauer
 Jenna Davenport
 Valerie Ireland

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Photo by Benjamin Burpee

Future Arctic scientists

THE UNIVERSITY OF MAINE will train future Arctic scientists to help address the socio-environmental challenges resulting from the world's most rapidly changing environment with a nearly \$3 million award from the National Science Foundation.

The new UMaine initiative, Systems Approaches to Understanding and Navigating the New Arctic, is funded by the NSF Research Traineeship (NRT) Program, which encourages the development and implementation of "bold, new, potentially transformative models" for science, technology, engineering and mathematics (STEM) graduate education training.

This is UMaine's third NRT award; the first two are the One Health and the Environment initiative and Enhancing Conservation Science and Practice. All align with the University of Maine System Research and Development Plan and emphasize workforce development.

The new Arctic initiative to train graduate students in the interdisciplinary field of Arctic systems science is led by Jasmine Saros, associate director of UMaine's Climate Change Institute and a professor of lake ecology. Its focus is on the interconnected nature of environmental and social changes in the Arctic and Northern Hemisphere.

"UMaine's Climate Change Institute has been an internationally recognized leader in polar science for more than four decades. This new training program builds off of our legacy to advance understanding of the interconnected impacts of Arctic change on people and ecosystems, both in the Arctic and in Maine," according to Saros, one of more than a dozen UMaine professors who have been conducting research in the Arctic in recent years.

Saros also co-leads the international working group, the Kangerlussuaq International Research Network (KaLRN), which focuses on recent climate-driven environmental changes in the West Greenland ice sheet, and terrestrial and aquatic ecosystems.

Over the next five years, the program is expected to train nearly 60 master's and Ph.D. students, including 20 funded trainees in ecology, Earth sciences, anthropology, economics and marine sciences. Their training will include an interdisciplinary curriculum, Arctic field experience, and research focused on changes in Maine, southwest Greenland and the Arctic–North Atlantic.

The new graduate training program to foster systems perspectives to address the Arctic's complex changes builds on UMaine's strengths and expertise in polar biophysical research, cross-cultural perspectives and integration of knowledge systems, Arctic law and policy, and socio-environmental systems research. ♦

Modeling New England species on the move

IN RESPONSE TO CHANGING CLIMATE, populations of plants and animals move to more hospitable locations. Predicting where species will end up, and how New England farmers and rural communities need to plan and adapt accordingly is the focus of a new interdisciplinary research initiative led by the University of Maine.

The National Science Foundation awarded \$4 million over four years to the EPSCoR Research Infrastructure project to develop novel approaches and software for modeling, visualizing and forecasting spatial and temporal data. The team — researchers from UMaine, University of Vermont, University of Maine at Augusta and Champlain College — will build some of the first mechanistic models of shifts in species ranges in response to climate change.

By harnessing diverse current and historical data with space and time dimensions, scientists will be able to better predict and help rural communities respond to the impact of climate change on biodiversity.

The goal is to better understand how plant and animal species — from forest plants and wildlife to diseases and their carriers, and agricultural crops — will respond to a changing climate in the next century. Data science and modeling will help inform farmers' adaptation strategies, according to the research team.

The four-year initiative has multifaceted economic implications for Maine and Vermont, which are both EPSCoR (Established Program to Stimulate Competitive Research) states. It will help create a trained workforce and strengthen research in the high-growth field of data science, provide insights to help conserve natural resources critical to livelihoods and cultural identity, and help farmers and other community stakeholders better prepare and manage their crops.

"Climate change is no longer an abstraction for farmers, foresters and others making their living off the land in Maine and Vermont. People are living the change. Scientists urgently need to move from warning about climate change to predicting the detailed nature of the changes we can expect and communicating this effectively to the people who need the information," according to principal investigator Brian McGill, UMaine professor of biological sciences, who has a joint appointment in the Sen. George J. Mitchell Center for Sustainability Solutions. ♦

The goal is to better understand how plant and animal species — from forest plants and wildlife to diseases and their carriers, and agricultural crops — will respond to a changing climate in the next century.





VolturnUS is UMaine's patented floating concrete hull technology that has been awarded 43 patents in the U.S. and abroad. The University of Maine will collaborate with New England Aqua Ventus, LLC (NEAV), a joint venture between Diamond Offshore Wind, a subsidiary of the Mitsubishi Corporation, and RWE Renewables, the second-largest company in offshore wind globally, to develop UMaine's floating offshore wind technology demonstration project off the coast of Maine.

Milestone development

THE UNIVERSITY OF MAINE will collaborate with New England Aqua Ventus, LLC (NEAV), a joint venture between Diamond Offshore Wind, a subsidiary of the Mitsubishi Corporation, and RWE Renewables, the second largest company in offshore wind globally, to develop UMaine's floating offshore wind technology demonstration project off the coast of Maine.

As the developer, NEAV will own and manage all aspects of permitting, construction and assembly, deployment and ongoing operations for the project. UMaine's Advanced Structures and Composites Center will continue with design and engineering, research and development, and post-construction monitoring.

The project will consist of a single semisubmersible concrete floating platform that will support a commercial 11 megawatt wind turbine and will be deployed in a state-designated area 2 miles south of Monhegan Island and 14 miles from the Maine coast. The purpose of the demonstration project is to further evaluate the floating technology, monitor environmental factors and develop best practices for offshore wind to coexist with traditional marine activities. It will supply clean, renewable electricity to the Maine grid.

Construction, following all permitting, is expected to be completed in 2023.

An immediate priority for the new development team is to engage with the fishing industry, other maritime users, coastal communities and interested parties on how to ensure

this new renewable energy source can optimally provide economic growth to Maine and work with maritime industries.

Since 2008, the University of Maine has researched floating offshore wind technology as a solution to Maine's overdependence on imported fossil fuels. After winning funding from the U.S. Department of Energy (DOE), the university worked with Maine-based construction firm Cianbro to build and deploy the first grid-connected offshore wind turbine in the U.S. in 2013, a one-eighth scale prototype of its VolturnUS floating hull technology. The success of the project led to additional DOE funding to further advance the VolturnUS technology, which has been issued 43 patents to date. The university and Cianbro sought to partner with a world-class offshore wind developer to further demonstrate this technology on a commercial scale. UMaine will continue to own its VolturnUS floating hull intellectual property and license it to NEAV for this project.

"Diamond Offshore Wind and RWE Renewables bring global expertise in offshore wind project development and construction, and we look forward to working with them to demonstrate UMaine's floating hull technology in Maine waters," says Habib Dagher, executive director of UMaine's Advanced Structures and Composites Center, where the VolturnUS hull technology was invented. "Our design is ideally suited for deepwater deployment anywhere and has the potential to play a significant role in global efforts to decrease dependence on fossil fuels."

“

The path from fundamental research to economic realization is complex, and success takes **incredible innovation, persistence and strategic partnerships**. Many faculty, staff and students have participated in the development of this technology, and will continue to **support the energy and marine economy** as this project transitions to the private sector. This collaboration exemplifies our role and commitment to creating and supporting the future of Maine.”

President Joan Ferrini-Mundy

Diamond Offshore Wind and RWE Renewables, with years of collective offshore energy experience and success, will invest \$100 million to build the project and help demonstrate the technology at full scale. Combined, the two new partners are responsible for nearly a quarter of the world’s offshore wind capacity.

Under the Mills administration and with a long history of bipartisan support, Maine has moved boldly ahead on renewable energy and offshore wind development, including enacting legislation authorizing approval by the Maine Public Utilities Commission of the power purchase contract for Aqua Ventus, and initiating a study of the port at Searsport as a potential site to support and develop offshore wind. The governor also accepted the invitation for Maine to join the Bureau of Ocean Energy Management Gulf of Maine Intergovernmental Renewable Energy Task Force, along with New Hampshire and Massachusetts, which is charged with facilitating coordination related to renewable energy activities in federal waters in the Gulf of Maine.

“This is a significant milestone for the University of Maine, the offshore wind research team and the state of Maine,” says UMaine President Joan Ferrini-Mundy. “As Maine’s research university, UMaine is continually advancing its broad land grant, sea and space grant mission. The path from fundamental research to economic realization is complex, and success takes incredible innovation, persistence and strategic partnerships. Many faculty, staff and students have participated in the development of this technology, and will continue to support the energy and marine economy as this project transitions to the private sector. This collaboration exemplifies our role and commitment to creating and supporting the future of Maine.”

NEAV will continue to involve Maine companies in permitting, construction and assembly, deployment, and ongoing operations and maintenance of the project. In addition, NEAV has committed to working with the University of

Maine on research, development and design to take the technology elsewhere in the U.S. and the world. The concrete hulls are designed to be built in communities adjacent to potential projects, generating local construction jobs and other benefits during the building and assembly phase.

The project is projected to produce over \$150 million in total economic output and create hundreds of Maine-based jobs during the construction period.

The developers also will work with the University of Maine System, the Maine Community College System and Maine Maritime Academy to attract K-12 students to science, engineering and business programs, prepare college students and help to create a skilled workforce in Maine with the technical skills necessary to support offshore wind development and operation.

“We are pleased to partner with the university to bring its ideas for floating offshore wind to fruition,” says Chris Wissemann of Diamond Offshore Wind. “This project south of Monhegan is a perfect opportunity to demonstrate a new technology that can be built in Maine, create jobs in Maine, and demonstrate how fishing and offshore wind can coexist. Together with RWE, our engineers conducted an extensive due-diligence review of UMaine’s VolturnUS floating wind technology, and believe it is a world leader in floating wind that reduces costs and creates local jobs. We are really focused on creating economic opportunities for Maine as this new carbon-free economy emerges.”

“We see great potential for floating wind farms worldwide, especially in countries like the U.S., with deeper coastal waters,” says Sven Utermöhlen, chief operating officer, Wind Offshore Global of RWE Renewables. “This innovative project combines the University of Maine’s knowledge with the state’s maritime heritage, allowing RWE Renewables to gain the experience that can help us provide future opportunities to grow local economies and produce clean, renewable power.” ♦



Poland Spring bio-based packaging

THE UNIVERSITY OF MAINE'S Forest Bioproducts Research Institute (FBRI) is collaborating with Poland Spring Brand 100% Natural Spring Water to evaluate and develop bio-based solutions that could serve as alternative packaging for Poland Spring products. As part of the collaboration, UMaine will explore new possible uses of materials derived from sustainably harvested Maine wood.

FBRI represents an interdisciplinary group of researchers and scientists dedicated to advancing understanding and development of forest-based bioproducts. The institute is directed by Hemant Pendse, professor and chair of the Department of Chemical and Biomedical Engineering. FBRI has brought the Maine forest industry and public and private technology innovators together to explore emerging bio-based solutions, from materials to chemicals to fuels, demonstrating the exciting possibilities available through advancement of the circular economy.

"UMaine is grateful for Poland Spring's support of our world-leading research, development and commercialization in this area," says UMaine President Joan Ferrini-Mundy. "Forestry is a cornerstone of Maine's economy, and the Forest Bioproducts Research Institute was created to provide and promote technology validation and partnerships that will meet societal needs for materials, chemicals and fuels in an economically and ecologically sustainable manner.

"This collaboration serves that important mission," says Ferrini-Mundy, "leveraging the expertise of our faculty and staff, and facilitating the engagement of our students in cutting-edge research with important implications for our state and the wider world."

The initiative aligns with the University of Maine System Research and Development Plan. ♦



Deborah Bouchard, director of the Aquaculture Research Institute and division lead for University of Maine Cooperative Extension Diagnostic Research Laboratory's Aquatic Animal Health Lab, is a member of a team that will test the safety and effectiveness of a new, cost-effective, easily deployable and highly potent ingredient to help create a stronger immune response in fish.

UMaine, Northeastern fund shared research

THE UNIVERSITY OF MAINE and Northeastern University and its Roux Institute have jointly awarded seed funding to five collaborative research teams to address topics important to people in Maine and beyond.

Broadly, the projects involve improving aquaculture vaccines, examining the link between pacifier use and sudden infant death syndrome, better understanding influenza A, creating an improved model of human-artificial intelligence interaction in self-driving vehicles, and developing an instrument that could have vast applications for human health monitoring.

The projects are the first funded in a new collaborative research initiative established between the two universities. Through a rigorous review process involving peer faculty reviewers and research leaders at each university, the five projects were selected from a pool of 21 applications.

Each team has been awarded \$50,000 to conduct the one-year projects and will work together to pursue larger external funding programs through federal and private sponsors.

"As manifested by the five selected joint research initiatives, faculty from both institutions should be commended for developing such high-impact projects of significant social and economic benefit to Maine and beyond," says Kody Varahramyan, UMaine vice president for research and dean of the Graduate School.

David Luzzi, senior vice provost for research and vice president of Northeastern's Innovation Campus at Burlington, Massachusetts, says, "In today's world of complex, interdisciplinary challenges, partnerships bring together researchers with complementary expertise that accelerate research progress. This program taps the diverse, deep expertise at our institutions. In addition to funding five impactful projects in the areas of human health and sustainability, the program has resulted in many more new collaborations that will drive progress against important societal challenges for Maine and globally."

UMaine and Northeastern began to seek ways to formalize partnerships in areas of shared expertise and significance — artificial intelligence (AI), Earth and climate sciences, health and life sciences, manufacturing and marine science — after the formation of The Roux Institute at Northeastern University was announced in January 2020. ♦



Harold Alfond Foundation invests \$240M to bring transformative change

IN OCTOBER, the Harold Alfond Foundation made a historic investment in Maine and its people with a \$240 million commitment to the University of Maine System to bring transformative change to the state's largest educational, research, innovation and talent development asset.

The investment in the University of Maine System is the largest ever to a public institution of higher education in New England and the largest gift in the history of the Harold Alfond Foundation. It was one of the foundation's new grant investments in Maine people and institutions to help grow the state's workforce and economy, and support quality health care, totaling more than \$500 million.

Collaboratively, UMS will build on strong foundations at its universities and take effectiveness to new levels by implementing creative, innovative ideas and programs to serve the students and people of Maine.

The Harold Alfond Foundation's \$240 million commitment over the next 12 years recognizes how the University of Maine System's first-in-the-nation unified accreditation, approved in June by the New England Commission on Higher Education, provides new opportunities for faculty development, student support and innovative collaborative degree programs to advance Maine's economy and workforce in partnership with the public and private sectors.

"The University of Maine System is rising to meet the challenges of our state in a very big way. Through the



initiatives we are supporting, it is perfectly poised to set new standards for how public higher education serves students and at the same time partners with employers in the pursuit of economic development and opportunity," said Greg Powell, chairman of the Harold Alfond Foundation.

"It needs resources to do that and so we are betting big on its success and urging others to join us," said Powell. "The System and its universities have a terrific leadership team and that leadership is setting an exciting strategic direction that commits our state's largest education and workforce development asset to student success, partnership and greater prosperity for the people of Maine."

The University of Maine System will leverage the transformative gift to secure an additional \$170 million in matching funds over the next 10 years from private, state and federal sources, resulting in \$410 million total investment in Maine's public university system.

The foundation's investment focuses on four areas:

- \$20 million for student success and retention — funding for three programs to be piloted at the University of Maine and expanded across the System that include research learning opportunities for first- and second-year undergraduate students, a gateways to success initiative to expand learning assistance and curricular redesign to reduce failure rates and improve retention in gateway STEM courses, and a pathways-to-careers program to expand access to credit-bearing internships and other experiential learning opportunities.
- \$55 million for the University of Maine Graduate & Professional Center — supporting scholarships, integrated program development across business, law, public policy and graduate engineering; and a state-of-the-art building on the University of Southern Maine Portland campus to house the Maine Center programs and Maine Law, and to serve as a center for collaboration and engagement to help attract and strengthen the Maine economy.
- \$75 million for a multi-university Maine College of Engineering, Computing and Information Science to be cooperatively led by the University of Maine — providing additional undergraduate engineering programs at the University of Southern Maine, UMaine graduate engineering programs offered in Portland, expanded pathways into the statewide college from all UMS universities, new opportunities for shared programs, interdisciplinary structures and partnerships, and further renovations to UMaine's engineering education infrastructure.
- \$90 million for UMaine athletic facilities and the well-being of Maine people — providing support to maintain excellence in the state's only Division I athletics program, advance gender equity, and provide a preferred destination for high school sports championships, large academic fairs and competitions, and community events. All of the university's students and people from throughout Maine will be able to use the state-of-the-art athletic and convening venues. ♦

Scientists on the front lines



UMS Science Advisory Board provides an evidence-based focus to address campus communities' health, safety and well-being

By Margaret Nagle

Whenever there are reports of a new virus on the planet, University of Maine virologist Melissa Maginnis is listening. And the last weeks of 2019 were no exception. She was familiar with other coronavirus outbreaks — SARS and MERS — that have occurred in the past 20 years, largely limited to Asia. They seemed to be similar to the onset of the coronavirus characterized as novel — COVID-19. In January 2020, Maginnis started talking about this new virus in her graduate virology course at the University of Maine. It was a teachable moment. Until it became so much more.

Over the years, UMaine microbiologist Robert Wheeler

also has watched SARS and MERS, plus Zika and Ebola — epidemics that, ultimately, had been brought under control. But COVID-19 was different.

He clearly remembers when his concern became a call to action. He was in San Diego in late February to participate in a four-day National Institutes of Health study section on immunity with a number of other infectious disease researchers. On the second day, he looked around the meeting room and thought: "We should really be going back to our institutions and doing all that we can to study this coronavirus."

He was soon on a plane back to Maine. But before returning to his UMaine research lab, he had to spend two weeks in



Science has had a critical role throughout the pandemic — from health and safety guidance to the development of COVID-19 tests and vaccines. At the University of Maine, the asymptomatic testing on campus this academic year involved saliva-based tests, including Shield T3 PCR and Vault, and nasal swab antigen tests.

The UMS Science Advisory Board was formed to stay fully abreast of **fast-breaking scientific and medical developments** in areas relevant for universities and the **COVID-19 pandemic**, including vaccine development, diagnostic and serology testing, antiviral treatments, transmission mitigation and contact tracing.

self-quarantine, wondering if he had contracted COVID-19, weeks ahead of the World Health Organization (WHO) declaring a pandemic.

For UMaine biomedical engineer Caitlin Howell, her community connections were buzzing early last spring. She was hearing that hospitals in Maine were getting nervous about their ability to disinfect their personal protective equipment. They were looking for any information they could find on safe and effective sterilization methods.

Howell and her students quickly realized that there were a lot of knowledge gaps around what was likely to be effective and what might be dangerous. They set about helping Maine health care teams access and understand the latest information possible from the most rigorous scientific sources.

Neurobiologist Kristy Townsend was monitoring the rapidly evolving medical literature. When Bangor Public Health needed help distilling the latest findings to inform health and safety guidance, and had specific questions, Townsend and the students in her lab sprang into action, producing science and medicine update sheets from March to July.

Townsend also was talking about the need to mobilize UMaine's expertise and research infrastructure to build COVID-19 testing capacity, planting the seed for forming an advisory committee.

UMaine President Joan Ferrini-Mundy saw the big picture. The former chief operating officer of the National Science Foundation was a year and a half into her position as the president of the state's research university. With preparation in mathematics and education, and as a nationally recognized STEM education expert and thought leader who values science and evidence-based practice, she watched WHO declare a pandemic and knew what UMaine had to do — put its breadth and depth to work to help Maine in this time of crisis.

University of Maine System (UMS) Chancellor Dannel Malloy, former governor of Connecticut and no stranger to big-picture public health challenges, established a UMS Science Advisory Board (SAB), chaired by Ferrini-Mundy. She tapped UMaine faculty who were already on the front lines — Townsend, Maginnis, Howell and Wheeler. They were joined by Sara Huston, chronic

disease epidemiologist at the University of Southern Maine.

The UMS Science Advisory Board was formed to stay fully abreast of fast-breaking scientific and medical developments in areas relevant for universities and the COVID-19 pandemic, including vaccine development, diagnostic and serology testing, antiviral treatments, transmission mitigation and contact tracing. After UMaine pivoted in the spring semester to fully remote learning, SAB's evidence-based work was key to the UMS 2020 Safe Return Planning Committee, providing science-informed approaches to safely welcome students, faculty, staff and the public back to Maine public universities in the fall.

SAB members have provided scientific guidance on the latest COVID-19 health and safety best practices to a wide range of constituents — from university students through public health education campaigns to presentations to Maine legislators, and state and national health and science groups.

At the state's largest university, which also has offices and facilities statewide, scientific guidance informed the COVID-19 Response Team established in the Emergency Operations Center (EOC). UMaine staff who are members of the COVID-19 Response Team and UMaine's EOC, working in collaboration with the Maine Center for Disease Control and Prevention, have been the boots on the ground in the pandemic battle.

They are the unsung heroes working nonstop to ensure a safe return for UMaine students and employees, all doing COVID-19 response — from expanded facilities cleaning to care management and contact tracing and on-campus testing — in addition to their UMaine jobs, and meeting professional and personal challenges related to the pandemic.

All are in it together, demonstrating a primary example of Maine's public research, land-sea-space grant university mission in action during the pandemic.

"Research and Extension faculty, staff and students turned their attention to help solve very real problems for Maine — solutions that will scale," says Ferrini-Mundy. "This response is possible by having the infrastructure in place — facilities, people and networks. UMaine, like other land grant universities, has responded to state needs for over 150 years, perhaps no more so than during



UMS Science Advisory Board members provide guidance on the latest COVID-19 health and safety best practices to a wide range of constituents — from university students through public health education campaigns to presentations to Maine legislators, and state and national health and science groups. “Being able to communicate public health information across broad audiences, including translating science to a lay audience, is really important,” says SAB lead Melissa Maginnis. Ongoing SAB communication ranges from scheduled Zoom meetings like the one pictured here with University of Maine System leaders to updates on campus-based wastewater testing analysis (image upper right). There is even a student-focused public health campaign video starring Maginnis and UMaine’s mascot (image lower right).

this public health crisis. In doing so, this positions us for our next phases of work and impact, all of which will be informed by what we’re doing now as a public research institution.”

In spring 2020, the challenges of the unknown were daunting: stay-at-home orders, no robust testing available, uncertainty of just how the virus was transmitted, and measures needed in health care settings to help reduce the suffering.

The Science Advisory Board members were teaching and mentoring students in their labs, and conducting their own research. Most have young families at home. Like so many other members of the UMaine community, they heeded the call to do what they could in response to the pandemic.

“We were in a scurry the last week before spring break to figure out how many more classes we’d have in person, when and how we would go remote, how would that work,” Townsend says. “Looking back now (this is around March 13, 2020), it was incredible, in real time, to introduce the students to something that would then, over the last year, hugely evolve in terms of our scientific understanding and the available data that we had about this virus and the disease that it caused.”

Every hour, hundreds of emails were flying among SAB mem-

bers as they shared and discussed scientific papers and the latest COVID-19 updates. The team got organized with the Slack app. The search for the latest information is “going on all the time, every day, all day long,” Maginnis says.

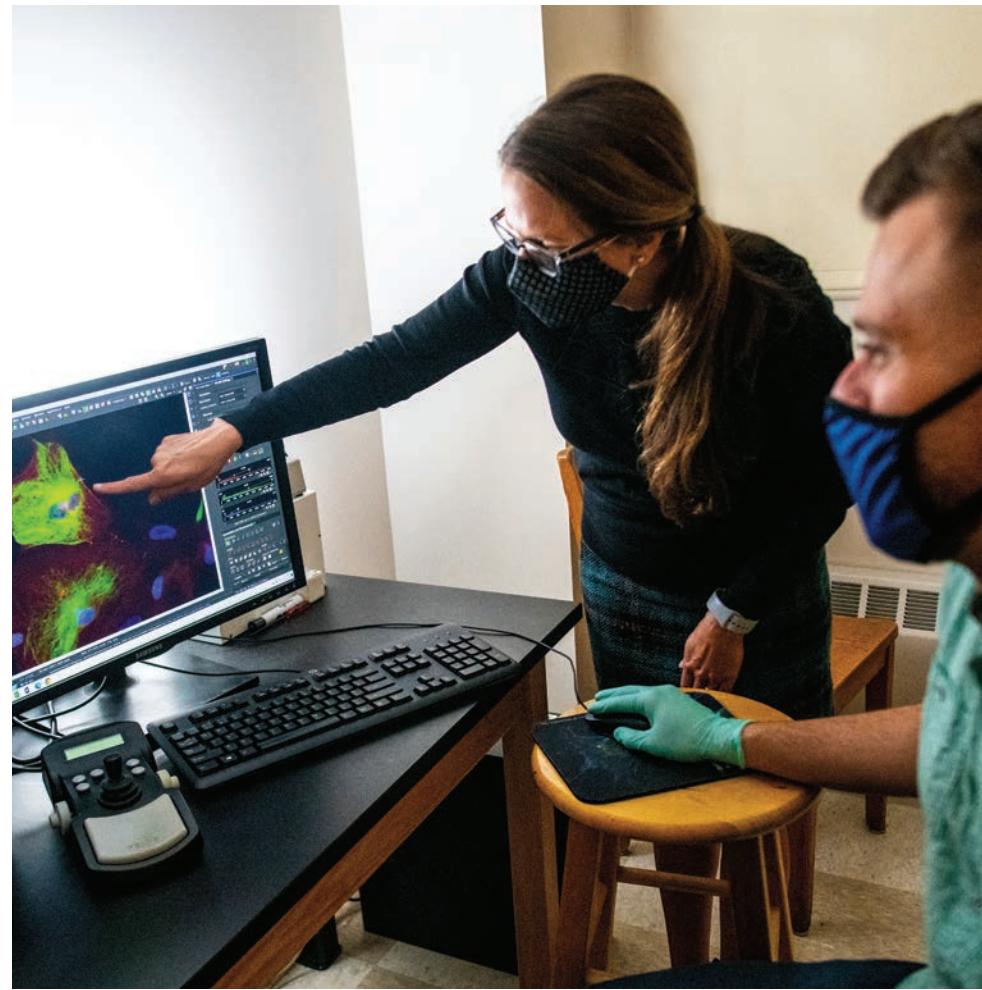
“Sometimes people are posting things at 1 in the morning. Sometimes it’s 5 in the morning. There’s usually always one of us active on Slack,” Maginnis says.

Trying to corral the latest COVID-19 information and make sense of it can really take over your life, Wheeler admits. “There are quite a few days where more than half of my waking hours are associated with either taking in and processing information or communicating that information out and discussing it.”

In April 2020, armed with the latest updates available from their disciplines, Centers for Disease Control and Prevention, WHO and other sources, SAB members began meeting via Zoom with university leadership and teams responsible for pandemic response for UMS campuses.

Questions about how to have a safe return to university campuses in the fall were complicated by the ever-evolving information about coronavirus. SAB shared the latest information about transmission and treatment, then testing and possible vaccines.

“One of the most pivotal moments was when we developed



In their laboratories on campus, Science Advisory Board members Caitlin Howell, Melissa Maginnis and Robert Wheeler research different but interrelated areas, all involving undergraduate and graduate students. Howell focuses on creating and testing new bio-inspired materials, developing nontoxic strategies to control the interactions of biomolecules, microorganisms and cells with surfaces. Currently, she is leading National Science Foundation-funded research to develop a membrane to capture airborne particles, including COVID-19 viruses, for analysis. Maginnis' research focuses on how viruses like JC polyomavirus infect cells to cause disease. Her broad background in virology was the foundation

our testing partnership with ConvenientMD and The Jackson Laboratory," Maginnis says. "There was a lot of work and research that went into developing these testing partnerships. When we determined that we could do robust testing and that we could do entry-level testing, that meant that our universities could choose to provide in-person instruction and have students reside on our campuses."

Testing partners for the fall semester also included Vault Health. To meet the rising demands of the pandemic in the 2021 spring semester, UMS partnered with Shield T3 to bring a mobile lab to the UMaine campus, which provides weekly saliva testing for the entire in-person population across the University of Maine System.

Initially, Maginnis focused on the latest information on treatments and vaccines, Townsend and Wheeler on testing, Howell on transmission, and Huston on public health epidemiology. Their roles and responsibilities evolved with the pandemic. As the months went on, other experts contributed their talents,

including statistician Bill Haltzman. In August, Townsend moved her lab to The Ohio State University, and continued to share information resources with SAB.

Asymptomatic testing and wastewater analysis are components of the campus and community COVID-19 monitoring strategy. "The wastewater testing group has been a wonderful collaborative project of folks in facilities, folks in procurement, undergraduate scientists who have been working in my lab to do the actual wastewater testing under my supervision and scientists who are working together with various disciplines from engineering to infectious disease," Wheeler says. "I've always known that the University of Maine is a collaborative place."

What is a typical day in the life of an SAB member who is also conducting research, teaching and having a home life? "My life shifted dramatically," Townsend says. "I set up a home office where I was sitting and working with my kids in the other room who weren't in school. I was hoping, unless I heard a loud noise, that they were entertaining themselves okay — they actually



for her current work in SARS-CoV-2. Wheeler's research focuses on understanding how the human immune system interacts with a human pathogen; in particular, the fungus *Candida albicans*. His study of microbes and their interaction with the human host, experience with mouse and zebrafish models of disease, and understanding of human clinical studies were important foundations for SAB.

did a great job. Many late nights, little sleep and a huge sense of responsibility."

From the start, President Ferrini-Mundy said she would like to see science be an important part of this, Howell says. "She recognized that that was a critical part of keeping our community safe. I'm very happy that our president had the foresight to recognize this so far ahead of the game and put it in place so that it can be doing what it's doing now."

"These are rock star researchers and I'm so grateful every day to be able to work with them," Howell says. "They're searching for solutions to problems. I think that it's that dedication and synergy, that collaboration, that has made it possible for us to get to where we are today as a Science Advisory Board."

The three UMaine researchers with laboratories on campus have expertise in different but interrelated areas.

Maginnis' research focuses on how viruses like JC polyomavirus infect cells to cause disease. Her broad background in virology

was the foundation for her current work in SARS-CoV-2.

"We view (coronavirus) as something that we need to understand and not fear," Maginnis says. "I think that that's true in science in general. If we can understand the basic biology of the virus, how the virus is transmitted, how it infects cells, and how it's activating the immune response, then we can develop therapeutics that can help to target those virus-host cell interactions to either activate or dampen the immune response."

Maginnis' interest in studying virology stems from her grandfather's experience with polio. The virus left him paralyzed for a year. He was 21.

"I stay in the field," she says, "because I want to contribute to understanding human disease so that we can help relieve human disease and suffering."

Maginnis teaches UMaine undergraduate and graduate virology courses, and leads a research lab with four Ph.D. students and eight undergraduates. Last spring in her graduate virology course, Maginnis and her students were watching the novel coronavirus



After UMaine pivoted in the spring semester to fully remote learning, SAB's evidence-based work was key to the UMS 2020 Safe Return Planning Committee, providing science-informed approaches to safely welcome students, faculty, staff and the public back to Maine public universities in the fall. That included COVID-19 testing before students moved

outbreak unfold. "By all definitions, it was a pandemic, but it had not been called a pandemic by the World Health Organization yet. We were saying, 'You've got to call it.' Two days later, we walked into class, and it was declared a pandemic."

The most asked question by her virology students: why don't people get it? Why don't people understand that if they just wear a face covering and follow the public health measures, that we would be in a much better position than we are now?

"That's another important learning experience through this pandemic — how people critically think through information and how we provide that information to the public so that it's accessible in a way for people to understand it," Maginnis says.

"Being able to communicate public health information across broad audiences, including translating science to a lay audience, is really important and something that we're training our students to do," says Maginnis.

Howell's research focuses on creating and testing new bio-inspired materials. Her Biointerface and Biomimetics Engineering Lab develops nontoxic strategies to control the interactions of biomolecules, microorganisms and cells with surfaces. The results



are new approaches to stopping infections in implantable medical devices that don't require antibiotics, or environmentally friendly methods to stop algae or other marine organisms from sticking to boat hulls, among other applications.

She is joined in this work by three Ph.D. students, three master's students and six undergraduates, and integrates the results into her courses on bio-inspired engineering and moving biomedical engineering technology from the lab to the market.

Last year, the National Science Foundation funded research led by Howell, in collaboration with Maginnis and University of Massachusetts Amherst chemical engineer Jessica Schiffman, to develop a membrane to capture airborne particles, including COVID-19 viruses, for analysis. The long-term goal is to have an air filtration system deployed for continuous monitoring in places that are particularly high risk for a widespread outbreak — hospitals, elder care facilities, travel hubs, schools.

"What lights the spark for me is being able to create things that can help people, not just doing science in a lab," Howell says. "I am curious, I want to know, but I also want to know that I am working on something that can help make people's lives easier."



into their residence halls; the Black Bears Care plan for all UMaine community members to protect themselves, others and the community; the health and safety guidance indoors and out, requiring face coverings, social distancing, frequent hand washing and campus-based COVID-19 testing.

Biomedical engineering is a fabulous way to do that.”

Howell encourages her students to be innovative and to ask questions. In the pandemic, she has told them “to be curious, to look deeper into information and try to understand what is going on from the global perspective.”

“If there’s anything that we’ve learned from this pandemic, it’s that our guesses can often be wrong because there are factors that we don’t understand,” Howell says.

For two decades, Wheeler has dedicated his research to understanding how the human immune system interacts with a human pathogen; in particular, the fungus *Candida albicans*. The microbe lives in our gastrointestinal tract and normally doesn’t cause any harm. But in immunocompromised people, it can cause a lethal, life-threatening disease. The drug-resistant fungus has proved particularly lethal in hospital settings.

Wheeler’s study of microbes and their interaction with the human host, experience with mouse and zebrafish models of disease, and understanding of human clinical studies were important foundations for SAB.

“There’s a combination of fascination and a real horror at how

successful it has been and how it’s uprooted my life, my family’s life, my colleagues’ lives and the whole world,” says Wheeler, an investigator in the pathogenesis of infectious disease by the Burroughs Wellcome Fund.

His interest in infectious diseases was sparked by UMaine alumnus Stanley Falkow, who went on to be a researcher at Stanford University, where Wheeler did his Ph.D. Today, Wheeler teaches courses in immunology and infectious disease at UMaine, and has 14 undergraduate and graduate students in his lab.

“My students have been amazing throughout the pandemic. They got into this field because they’re interested in helping to prevent and treat human health issues. There’s a real strong altruistic component to infectious disease research,” he says.

“A research university attracts people who want to help, contribute to science, and serve the university and strengthen partnerships in the community,” Maginnis says. “The important thing is making sure that that infrastructure is strong so that we can respond in times of crisis, and also in times when we’re generating new knowledge and moving the field of science forward.”



Starting in February, a Shield T3 mobile testing laboratory based at UMaine processed the COVID-19 tests for students and employees learning and working on University of Maine System campuses statewide.

“

Research and Extension faculty, staff and students turned their attention to help solve very real problems for Maine — solutions that will scale. This response is possible by having the **infrastructure in place** — facilities, people and networks. UMaine, like other land grant universities, has **responded to state needs for over 150 years**, perhaps no more so than during this public health crisis.”

President Joan Ferrini-Mundy

The researchers say there have been some silver linings to the pandemic, among them: the opportunity to collaborate across the UMaine community, statewide and beyond, and giving the public a better appreciation for the importance of science.

“Having that scientific expertise on campus, just the same as having expertise in history, in literature, in anthropology, and all of the different components of a research institution like the University of Maine, has such a tremendous forward-thinking component to it,” Wheeler says.

“When we look around at what other state universities have done with the pandemic, that role has been quite variable. What we have done is really exemplary,” he says.

Howell says she has been gratified to see the scientific com-

munity have the opportunity to show what it is capable of and what it can do for the larger public.

“We have been able to demonstrate that we are here to help, that we care,” says Howell, a member of the Department of Chemical and Biomedical Engineering that also had faculty, students and staff mobilized in numerous initiatives to aid Maine’s health care community. “We’re doing our best to get quality information that is as free from bias as possible because we recognize how important that is to our communities.”

“Scientists seek the truth,” Maginnis says. “They contribute new knowledge, enhance our understanding and share it for the greater good to improve the lives of people around them. It’s what we do.” ♦

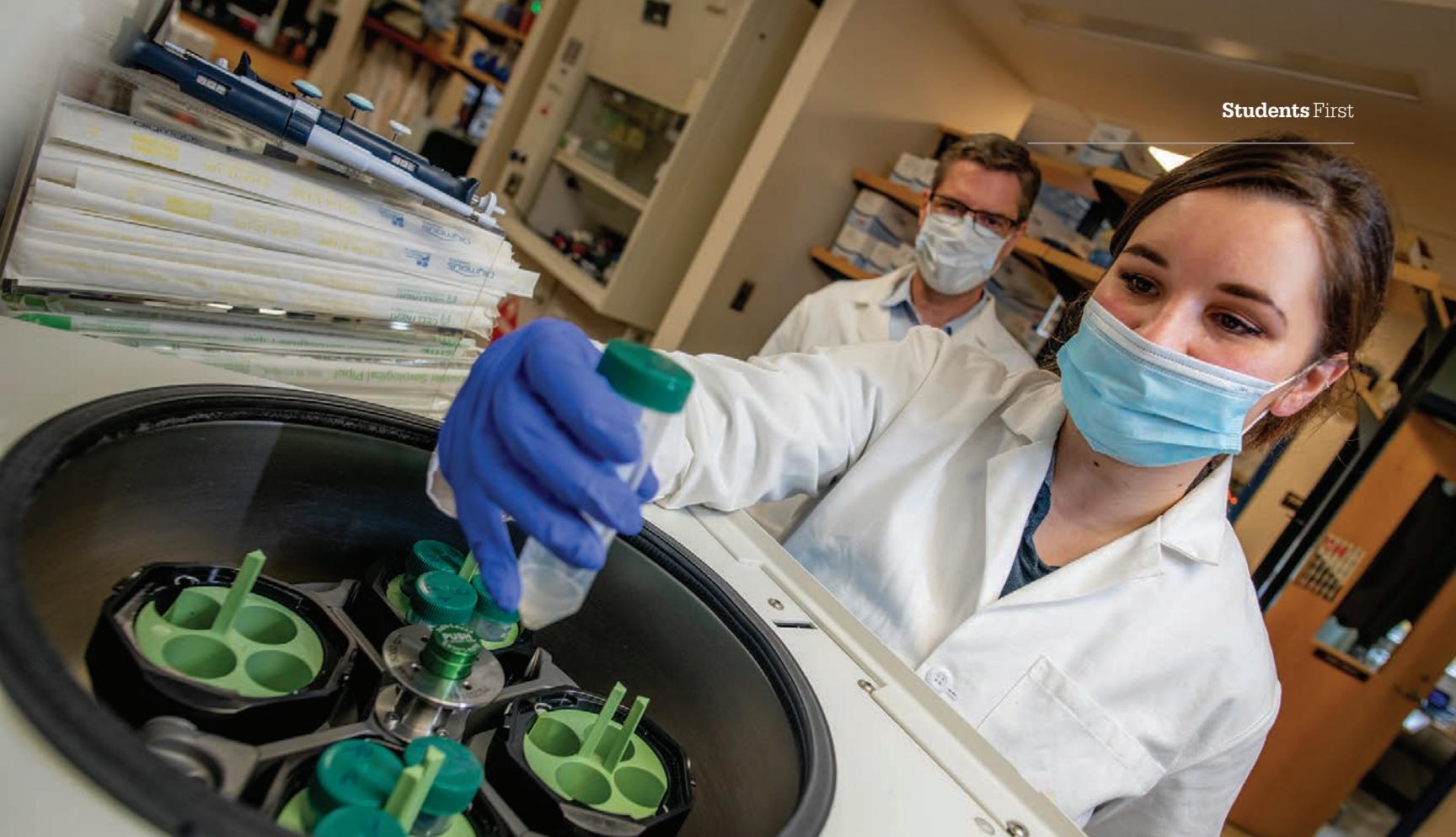


Photo by Adam Küykendall

Lab work

Claudia Desjardins applies disease research passion to pandemic

Claudia Desjardins of Bangor pursued a major in animal and veterinary sciences and a minor in mathematics to make a difference in the lives of animals and humans through disease research and prevention. As an undergraduate, she collaborated with UMaine researcher mentors for a study of Maine's wild turkey population and helped test ticks for pathogens, including Lyme disease.

Ultimately, she discovered her passion for laboratory diagnostic testing — skills that proved particularly important in the midst of the pandemic.

Last fall, she joined UMaine's COVID-19 wastewater monitoring team, a part of the UMS Science Advisory Board, focused on providing timely health and safety guidance for Maine's public universities. The wastewater monitoring team is led by Robert Wheeler, UMaine associate professor of microbiology.

Desjardins completed her undergraduate coursework in December and is now working full time in the Wheeler lab. She is involved in the processing and testing of wastewater samples collected twice weekly at UMaine, University of Maine at Fort Kent, University of Maine at Presque Isle and University of Southern Maine Gorham campus. The wastewater testing program also analyzes samples collected at the wastewater facilities in Orono and Farmington, and the University of New England Biddeford campus.

This testing is important in helping meet the health and safety needs of our community, Desjardins says, because people can shed the virus before they begin showing COVID-19 symptoms.

"By regularly screening our wastewater, we can determine if there is a significant prevalence on campus before we get the chance to test individuals," Desjardins says.

It has been exciting to generate and witness this data firsthand, she says, "and incredibly fulfilling when your work is making a positive impact on the rest of the community." ♦

Today, as throughout history, artists and humanities scholars reflect on the world and their work in a pandemic, and approach the questions about 'why we are here differently'

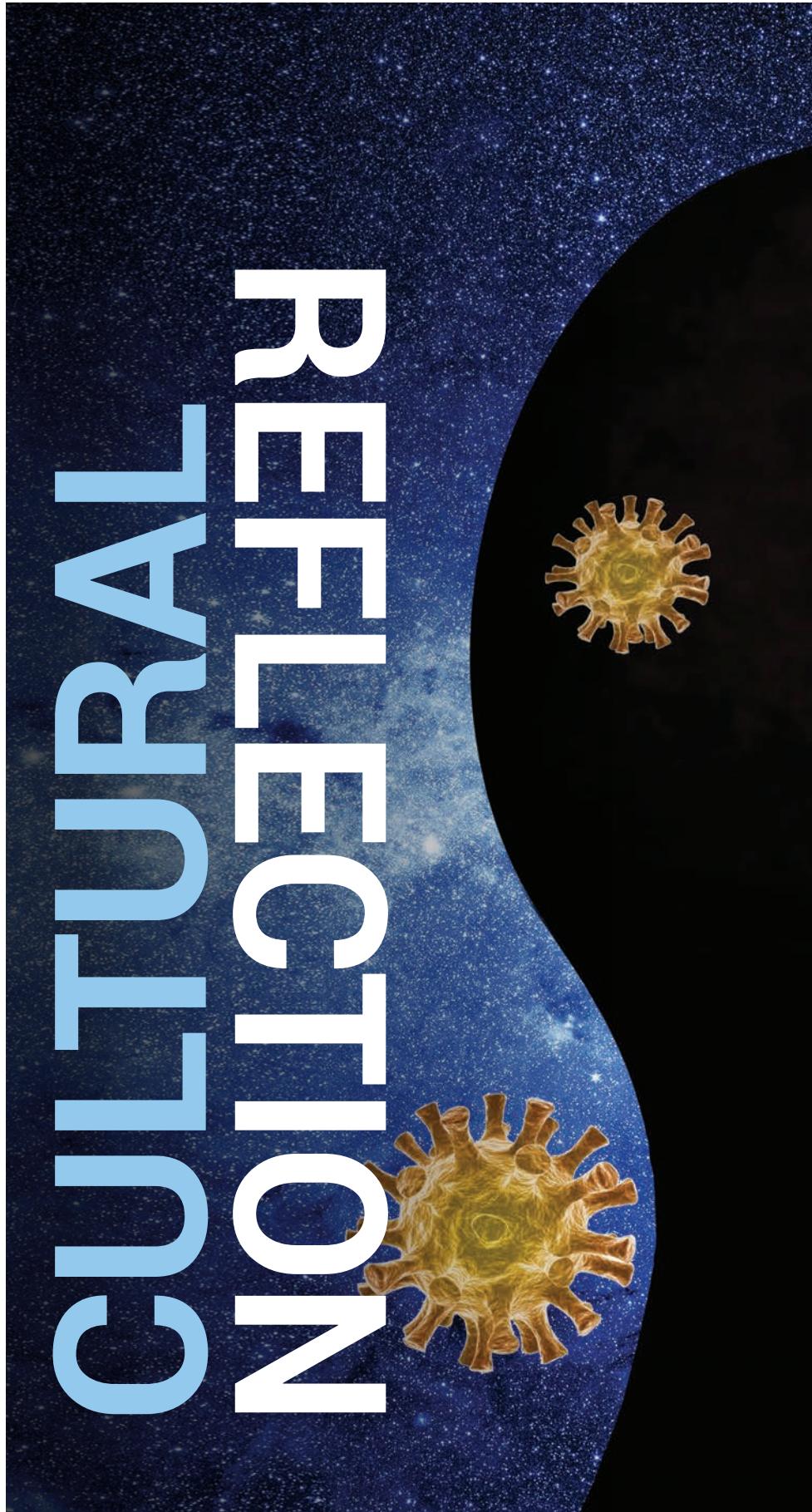
By Brian Jansen | Photographs by Adam Küykendall

When governments around the world began establishing coronavirus advisory panels in the midst of the first wave of COVID-19 cases in 2020, their memberships brimmed with the titles one might expect: virologists, epidemiologists, behavioral scientists and engineers. One notable exception, however, came in Germany, where the government augmented scientific advisory work by turning for advice to philosophers, historians and theologians. And as the situation developed over the spring and summer, many states and nations embedded in their recovery plans targeted relief funding for visual, literary and performance arts.

Amid the important scientific, medical and policy work that has been the focus of media attention, such an eye toward the arts and humanities is a reminder of their importance in times of crisis — for telling us who we are, where we have been and where we might go.

Our current pandemic has led so many of us to look back at previous major plagues — the Great Plague of Athens, the Antonine Plague in 165, Influenza in 1918–20 and HIV/AIDS in the 1980s, to name a few, says Michael Grillo, University of Maine associate professor of art history. But Grillo, a scholar of the late Medieval period, is particularly interested in the art that emerged in the wake of the Black Death of 1348.

The plague “forced societies to reexamine themselves, first reactively in immediate survival mode, but then in a more contemplative manner as people recognized the gravity of their times,” he says.





Sarah Harlan-Haughey, associate professor of English, agrees.

"In that period, when we look at the cultural artifacts that remain to us, we see that epidemics disrupt routine, damage communities and end lives," says Harlan-Haughey. "If there is a silver lining to be found, it is that those who survived reexamined their role in the world, looked hard at life and death, and approached the questions about why we are here differently."

Harlan-Haughey notes that 14th-century England saw a boom in cultural production after the plague struck and receded: visual art, music and poetry.

"People who were still alive seemed to want to live life to its fullest, and perhaps to leave something meaningful behind," she says. She points to Geoffrey Chaucer, in whose work we find virtually no explicit references to the plague. But "the sense of the tenuousness of human society, the frailty of the individual human life, pervades his writing and makes it the masterpiece of humanism it is."

Grillo, in turn, points to the architecture of Florence in the wake of the Black Plague, as conspicuously vacant spaces — "splendid palaces, fine houses and noble dwellings," in the words of the poet Boccaccio — became indexical markers, constant reminders of the dead who had once made up the fabric of the city, and ultimately paving the way for new models for art that emerged in the Renaissance.

For Grillo, the plague then and COVID-19 now are "cathartic moments, which rather than simply clearing away the old for an unprecedented new, instead force a moment of contemplative reflection."

In light of the disruptions presented by the COVID-19 pandemic, we turned to the community of musicians, visual artists and writers at UMaine, and asked them to reflect on what the last several months have meant for them, their practice and their work.



SUSAN SMITH

DIRECTOR OF THE INTERMEDIA
MFA PROGRAM



"Mourning Mask" 2020,
by Susan Smith,
screenprint on cotton

M

y artistic practice is focused on examining the struggles of displacement and making the invisible visible, using research to make stories heard. As we entered into lockdown in March 2020, I had just returned from a trip into the Sonoran Desert, using GPS data to create memorials for migrants whose lives were lost seeking asylum in the United States. As my attention turned to teaching hands-on artistic processes through Zoom and video tutorials, and creating online programming for fall for the Master of Fine Arts students, the numbers of lives lost from the pandemic mounted.

As artists, I feel it is our responsibility to situate our work right in the middle of what is happening around us, to lean into the discomfort that is there, and not to turn away.

The pandemic has hit hardest those least able to defend themselves against it. While I was able to transition to teach from home, millions of others were forced by necessity to go to work every day or were among the millions who lost their livelihoods and, for many, their lives. As the inequities that are part of everyday life across the country came into focus, the pandemic came ever closer into my own life, touching my family, and that sense of loss became the impetus for a series of work: "Mourning in America."

As we inched closer and then exceeded the number of lives lost in U.S. service during WWII, speaking the names and reading the families' accounts of their loved ones seemed the way to give the respect and attention these individuals deserved. Listening to the data and statistics in many ways

allows us to remain detached from folks such as Zach Leviton, 16, of Chicago, Illinois who died of COVID in April, and whose mother talks about his love of movies and video gaming. I read the memories of the family of Taraben Amin, from Rockaway, New Jersey who died of COVID on Oct. 29. "A super mom who never complained nor made excuses and always found something to laugh about," wrote her daughter.

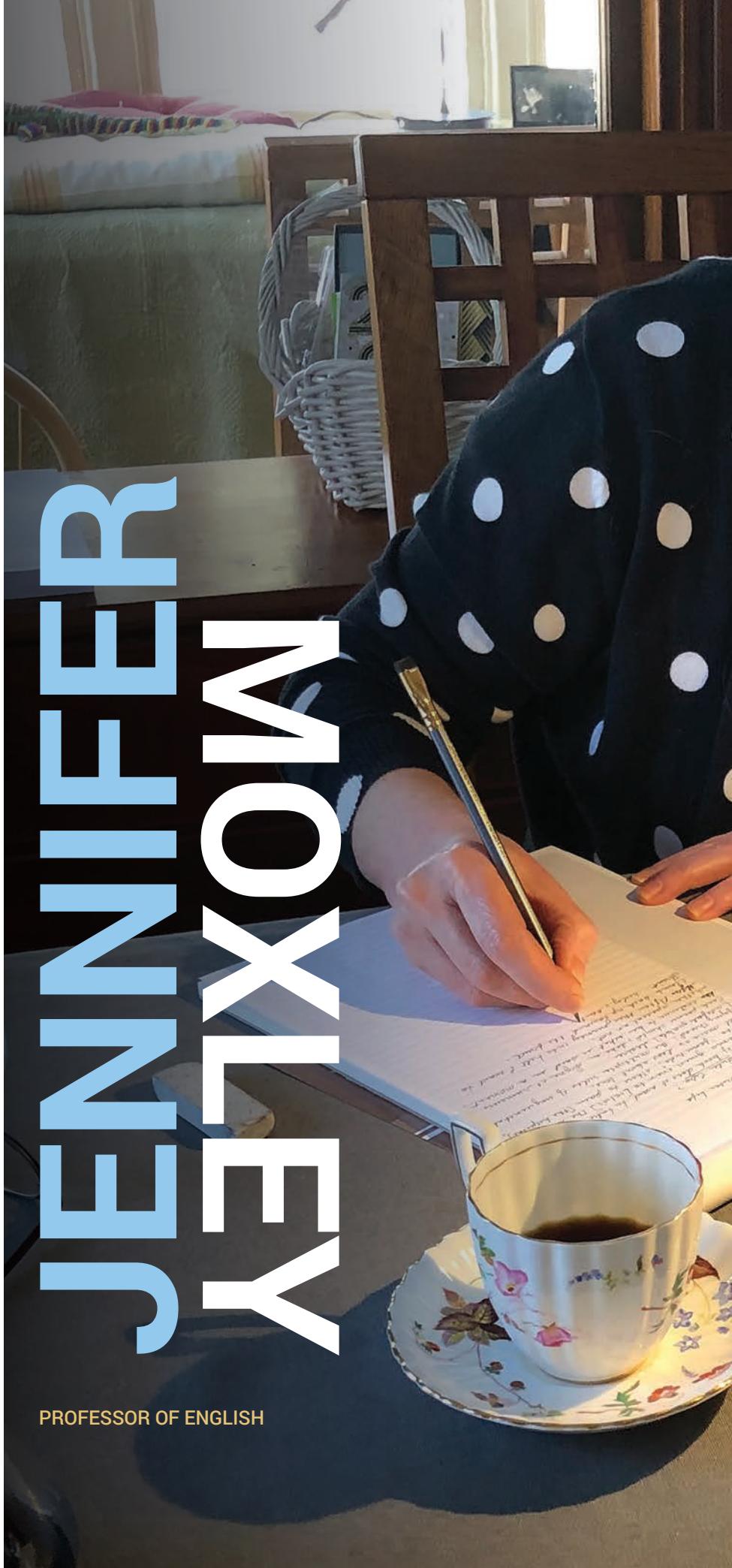
I have spent many, many hours reading hundreds of such narratives, and this act of witnessing is as much a part of the art practice as is the creation of yards of cloth imprinted with the roster of names and translated into fabric masks. I feel a responsibility as an artist and as an educator to humanize the statistics we hear. It is easy to become numb to the trauma if we do not find a way to humanize the toll that it's taking on our neighbors, our friends and our loved ones.



important sociopolitical events boss artists around. They say: this is what you must think about, this is what you must address. I stubbornly resist such voices, even when I can't shut them out. After 9/11, it seemed to me that some poets were penning their poems to the towers before the second one fell. I resisted. I needed time to process. I felt similarly during the first few months of the COVID lockdown. I didn't write. Of course, I was also finishing the semester, supporting students and working on coping strategies. And I was glued to the news, like everyone. "I don't feel like writing about politics or pandemics," I thought. So instead, I read *War and Peace*.

Tolstoy's genius at vivifying the complexities of the interior life against the large-scale canvas of the Napoleonic wars was an antidote to my creative lethargy. At the novel's end my muse hesitantly crept back. I wrote a poem titled "Inside the Shell," which obliquely let the present back in. Then my mother's mother showed up. I started to dream and think about this woman whom I had barely known in life, and who has been dead since 1989. My grandmother was an artist, a portrait painter who earned her living by her brush. She was born in 1900 and lived through the flu pandemic of 1918–22. Two other women born in 1900 also began to preoccupy me: French writer Nathalie Sarraute and American actress, opera singer and politician Helen Gahagan Douglas. I was reading Sarraute's memoir, *Enfance (Childhood)*, and researching the life of Douglas toward writing a libretto. I had pitched the idea of an opera about Douglas to composer and UMaine professor Beth Wiemann. In June, she reached out about the opportunity to apply for a grant to develop a new work. The Helen Gahagan Douglas project moved to the top of my list.

Thoughts about these three women began to intermingle and take shape in my creative unconscious. Then one day, in mid-July, I was seized by a poem. A poem about shopping at Hannaford during COVID-19, but not only. Against an account of the bizarre and exasperating experience of grocery shopping during the pandemic, the poem interweaves snapshots of my grandmother, Sarraute and Douglas. Their lives and the challenges they faced work to temper our contemporary moment. I titled the poem, which turned out quite long, "1900."



PROFESSOR OF ENGLISH

Excerpt from '1900'



.... There are still no Oscar Mayer "Selects" beef hotdogs. And no braunschweiger, "Not even for ready money," as my mom liked to say, quoting Oscar Wilde. "It's not even available to order," I learn from the lifer in the meat department. That's the standard response these days. There's plenty of Goya products, due to the boycott, but the canned soup has been decimated. "At least we know there's plenty of soup, just no cans," says Steve, as heard recently on the radio news. It's unappetizing, I think, to eat canned soup in the heat of summer, the slightly gummy gelatinous warmth of too-soft vegetables in salty broth. A few tiny cubes of chewy chicken.

What did mass-produced canned food taste like to the women of 1900? That's the year my mother's mother, Leola Isabel Warnock Freeman, was born. I am ashamed to admit that until I Googled and found a photo of her tombstone on "Find A Grave" dot com, I had no idea of the day or month of her birth. March 21. It says it right there on the flat slate grave marker, beneath her name and death date, August 21, 1989, seven months before her youngest child, my mother, would die at home of breast cancer. To the right of my grandmother's name hangs a decorative rosary in relief. As I zoom-in to get a closer look an ad pops up. A Kim Kardashian look-alike times three, wearing a mask with a clear window to allow her glossy nude lip to be admired in full pout mode. \$5.99.

Photo courtesy of Jennifer Moxley

SUSAN CAVANAGH

ADJUNCT ASSOCIATE
PROFESSOR OF ART





Latex "skins" made from casts of scarred trees, like the one in the photo, far left.

A

s we all try to navigate what is happening in this difficult and politically charged period of time, I have been fortunate to have a farm and woodlot to work on and with. For many years, a primary focus in my practice has been utilizing natural, biodegradable materials; keeping the environmental footprint of my artistic production as small as possible. Conceptually, my work focuses on our relationships with other species, the impact of agribusiness, food production and availability, and the marketing of "natural" products. In this work, I have collaborated with other species, including *drosophila*, gourds and mold. Most of this work involves constraining or manipulating these other species in environments of my creation.

What I notice in my approach to my work during the pandemic is an increased willingness to slow down, observe and listen to what other species are showing me without the need to exert any control on their growth patterns. COVID-19 and the co-existing political turmoil have posited questions of attention: are we really being observant or simply reacting? This has fomented a desire to be less analytical and more playful in my approach. I feel very much like I did as a child, wandering around in the woods, stopping for as long as I want to observe what I see, and finding ways to record those observations with the hope of eventually sharing the artifacts of my experience.

I have been building on my investigations of interspecies entanglements by creating "skins" made from natural latex casts of trees in my woodlot that were scarred by logging equipment over 40 years ago. These irregularities (where the trees have been forced to change their growth patterns) document the coercive forces that surround these organisms and the resilience in their adaptations to the changed environment. The impressions of the natural forms serve as visual metaphors for the damage we endure and inflict (both visible and hidden) and the beauty of resilience.

Scars, visible or not, make us who we are, and these amazingly nuanced casts reveal decades of ductility as the trees responded to trauma. In our culture, we often disdain the irregular — the scars and disfigurement that can accompany trauma, age and the passage of time. The bark of the trees, much like human skin, is more than a protective surface, but also a monument to experiences, heritage and history.

BETH BENNAN

PROFESSOR OF COMPOSITION,
CLARINET AND MUSIC THEORY





"Humidity: For Clarinet and Prerecorded Electronics" 2020,
by Beth Wiemann

My experience with the beginning of the pandemic was different from that of my UMaine colleagues. I was on sabbatical, already working on independent projects, sometimes in relative seclusion, for most of the 2020–21 academic year. I had received artist-residency support from several foundations, and so was using those opportunities to focus on composing, with some concertizing and short-term teaching in between those residencies.

After early March 2020, obviously all public musical things got postponed or canceled — my expected travel to performances and school visits included. I continued working on pieces that had, at least in theory, deadlines: one for Guerilla Opera and one for the Byrne:Kozar:Duo. Composing these pieces helped me stay focused in spite of all the constant news updates. Both had involving subject matter: for the opera, the real-life story of Rose Standish Nichols, Bostonian suffragette and peace activist; and for the duo, three early poems by Marianne Moore set as a cycle of songs. The song cycle had a test run during a virtual festival this past summer, with the real premiere still TBA. The opera is now into a second draft for an eventual 2021 premiere, and some of the revisions are being made with the thought of performances needing to be livestreamed rather than with an in-person audience.

Other online presentations this summer were more specifically COVID-inspired, like the Art of Virus Project. Invited composers wrote pieces based on a provided theme (or virus), and then invited two other colleagues to write pieces based on a mutation of that theme. My piece, "Masks," was described by the composer who invited me as "creepy" — accurate, given the visuals I included along with the electronic sound. To date, I've only completed two small works in direct response to the pandemic, one creepy and one attempt at a comic scene. I think the creepy one came out better.

Hear an audio excerpt online at umainetoday.umaine.edu

When I think of what it means to be a writer, an artist, in the midst of this pandemic, which, as of this writing, has killed over 200,000 Americans, a number that surpasses the American dead in the Vietnam War, the Korean War and the First World War combined, a number that, as of this writing, will, it seems, continue to grow, and perhaps overtake the number of American dead from World War II, that beginning of the so-called American century, the last century, that lauded and reified event (it's always war that is lauded and reified for its sacrifice; it is action and death, but not restraint, not consideration, not passivity, which is what our moment asks of us) — when I think of what it means to be an artist or a writer, I have thought of the catalogue, the diary, the record.

Before COVID-19 (or they say in the discourse, in the before times), I was working on a novel that uses the folktale “The Pied Piper of Hamlin” to think about grief, greed, capitalism, power, and how the culture seems, Cronos-like, intent on eating its own children. In addition, I have also kept a document open, an ongoing journal — this one about COVID-19, yes, but in particular about my father, who in March 2020, when the lockdown took hold, began a course of intense chemotherapy for aggressive prostate cancer, and who, this past month, on the advice of his doctors, decided to stop chemo and move to palliative care. I ask myself, the page: what does it mean to mourn from distance? To long to visit the ill, the dying — and, by selfishness and stupidity — be kept from the solace of intimacy?

Art doesn't change anything, or at least not much, it seems to me. But if art can't change our material circumstances, it can revivify. It can channel our courage and our rage. It can offer consolation and inspiration, necessary energies as we endeavor to do the difficult work of changing the world, trying to create a place where 200,000 dead can be mourned properly, a place where such death born from callousness, ignorance, greed can never happen again — the kind of work that will truly honor the dead. ♦

REGORY I OWA R D

ASSOCIATE PROFESSOR
OF ENGLISH



Excerpt from 'Worship'



Sometimes it's impossible to feel the thing you want to feel.

It's 1901, maybe, and, as it was told to me, Karl Bernau, who was my great-grandfather, stood outside the burning building that would kill him, a soiled blue bandana pulled up over his mouth, his nose. He had already begun the ledger in his head.

The building was greystone — a residence, not a factory, not a warehouse, not machines and stock, furs, textiles, which were his usual beat, the warehouse and stockhouses filled with objects, product, (another list here) that, as he came to understand it, were, for the owners something to be destroyed. The items unwanted, or at least no longer, the furs, textiles, it was not their season, his boss, Aronson, told him, and everything, my great-grandfather came to understand, has a season — how desire ebbs and flows, how there is demand, production and then liquidation, how when furs were no longer wanted the back stock of furs would suddenly catch fire. The crooked fire, Aronson told him, the fire that was wanted, in this city, he said, they will always bloom.

It was my great-grandfather's job, as part of the fire insurance patrol, to run into the building afire — the factory, the warehouses, or, in this case, the residence, the apartment block — run in, assess the damage, tarp anything that could be covered, and run out. Simple, Aronson said (he must have said, the light in the office dim), as that. Simple: to sprint into the buildings afire, the warehouses and storehouses, his head filled with figures; to count the stock, the furs, and then out, coughing, retching; to report back to Aronson who would take the report, calculate the loss, and deliver the news, the salvation, he called it, to his clients — this was the job. Because it was not mere calculation, Aronson had told my great-grandfather (he must have told him), no, no, no, not simply numbers, figures, a payment to be made — but something more delicate repair. A fire consumes, Aronson said. It is insatiable. A fire is loss, terrible loss. But what is terrible is not irreparable. (He licked his fingers, he laughed.) It was they who were the bulwark, Aronson told him, they who were against loss, against liquidation. (Everything can be replaced. This is what bosses know.) Don't you agree, Aronson had asked my great-grandfather, Mr. Bernau?



The AI developed by UMaine researchers will use object recognition and image segmentation to determine the number of birds, their species and behaviors in aerial photos captured on Maine's offshore islands and over inland rookeries during the spring and summer months. This image shows double-crested cormorants nesting on one of Maine's coastal islands. Photo by Meredith Lewis

PROGRAMMING for PROGRESS

UMaine researchers advance AI for understanding the world, solving problems

By Marcus Wolf

Sensors, satellites, scanners, other devices and the internet provide a deluge of data for researchers in multiple disciplines. Artificial intelligence is key to helping navigate it all. This evolving technology, in essence, helps connect the dots.

At the University of Maine, AI research is providing innovation, leadership and inroads needed to efficiently and effectively use the constant stream of data, and to help scholars solve long-lasting and emerging problems.

Penny Rheingans, director of the UMaine School of Computing and Information Sciences, says the growth of AI development has responded to an explosion of data, and coincides with the overall expansion of the data science field. Conducting research and serving as engaged citizens now require copious amounts of data and tools to harness it. Stakeholders in medicine, manufacturing, finance, environmental stewardship, public health, commerce, education and other areas also need to access extensive datasets.

“One of the core game changers for machine learning was that there was so much data that it was overwhelming and almost became a barrier to understanding,” says Rheingans, a professor of computer science. “It’s no longer really possible to understand what’s going on through manual approaches.”

UMaine computer scientists and engineers code software on their computers and build hardware at their benches to create AI that will perceive, reason, communicate and predict more like humans. With greater cognition, coupled with enhanced efficiency and accuracy, these technological neural networks will be able to collate copious amounts of historic and new data and use it in novel ways.

Rheingans says the abundance, interconnection and diversity of data has prompted researchers to not only develop new AI, but also find novel applications for existing software and hardware.

“It’s hard to think of an application in the world right now that doesn’t require a large amount of information,” Rheingans says. “There is also this greater potential to do what we could never do before.”

To help Maine capitalize on the social and economic benefits of this emerging field of technology, UMaine launched an initiative to make the state a hub for AI research, education and use. The endeavor, known as the University of Maine Artificial Intelligence Initiative (UMaine AI), seeks to achieve this goal by uniting experts in academia, government, industry and the community.

UMaine possesses the expertise and resources needed to develop new applications for AI that improve how researchers conduct studies and tackle problems affecting the quality of life for Mainers, Rheingans says.

The university also is poised to foster strong partnerships needed to advance AI development, and train students to excel and secure employment in this burgeoning field.

“We have the best potential to work on problems that are important to us here,” Rheingans says. “That’s why it’s important to have the expertise, to build that in-house expertise and to have partnerships.”

Research led by UMaine computer scientists and engineers is underway. Studies are creating AI technology and applications to combat disease, protect natural resources, defend against natural disasters and find new solutions for energizing communities.

Highlights of AI research at UMaine follow.



Defending cities against flooding

When a flood strikes a city, the damage can ripple through its many interconnected systems of infrastructure and services. Despite the interwoven nature of infrastructure, no tool can holistically predict or track the ramifications of a flood in a metropolitan area.

A team of scientists, including one from UMaine, plans to develop a program governed by AI that will identify what homes and neighborhoods would be inundated, what roads would be inaccessible, what systems would be inoperable and what areas would need evacuation during a flood.

Torsten Hahmann, an associate professor of spatial informatics, teamed up with researchers from across the country to create the Urban Flooding Open Knowledge Network (UF-OKN), funded by the National Science Foundation (NSF) with over \$6 million. The University of Cincinnati is leading development on the project. Hahmann has been structuring the UF-OKN knowledge graph with colleagues from the project team, particularly focusing on the semantics that will govern it.

UF-OKN will not only provide hydrological projections for a city facing a flood, but also identify which neighborhoods, businesses, roads, dams and public health, water, sewer and power systems would be threatened. The network will forecast probable courses of a flood event up to 48 hours before it reaches a city, with predictions updated every half hour. It also will provide real-time, high-resolution data that allows emergency managers and other stakeholders to track problems.

“At its core, the UF-OKN uses a knowledge graph that brings together ontologies and data,” says Hahmann, who directs the Spatial Knowledge and Artificial Intelligence Lab at UMaine. “It provides computers with the human knowledge necessary to correctly interpret and connect vast amounts of disconnected information.”

Collecting data to protect, preserve forests

New technology to enhance scientists’ understanding of the complex yet highly dynamic Northern New England forests

A team of scientists, including one from UMaine, plans to develop a program governed by AI that will identify what homes and neighborhoods would be inundated, what roads would be inaccessible, what systems would be inoperable and what areas would need evacuation in a flood.

began its first trial in a flowerpot. Ali Abedi, a professor of electrical and computer engineering at UMaine, tasked his new wireless sensor with gathering soil moisture data and sending it to a computer in his lab in April 2020, one of multiple tests for the prototype. The device, with rubber-coated wires connecting a red converter and two metal prongs, and its development will lay the groundwork for a multi-institutional effort to assess and forecast changes in 26 million acres of New England forestland.

Researchers from UMaine, the University of New Hampshire and the University of Vermont are collaborating to create a digital framework capable of gathering near real-time data about the forests spanning the northern portions of their respective states and New York — the Northern Forest Region.

The digital framework will consist of many small networks of wireless sensors spread across the region. Governed by AI, the sensors will collect data about soil moisture, soil temperature, ambient temperature, carbon dioxide, sunlight exposure and other characteristics; and communicate with each other to create a cohesive, regulated and self-monitoring network.

Abedi, who also serves as associate vice president for research and director of UMaine’s Center for Undergraduate Research, leads development of the new sensor technology that serves as the data collection part of the first phase of the multiyear interuniversity project, Leveraging Intelligent Informatics and Smart Data for Improved Understanding of Northern Forest Ecosystem Resilience (INSPIRES), which was awarded a \$6 million NSF grant in 2019. This collected data will be combined with remote sensing data within a new AI tool — the “Digital Forest” — that is developed with INSPIRES funding by another team of researchers, led by Kate Beard-Tisdale, UMaine professor of spatial informatics, and Hahmann.

“I think it’s exciting because it’s close to home here in Maine,” Abedi says. “We live in the forests. It’s important to understand what we have.”

Helping those with disabilities access the latest in automotive technology

Self-driving vehicles can offer the freedom of the open road, including for people with visual impairments and seniors. UMaine researchers are developing new tools to ensure the latest in automotive technology can accommodate all users.

The Virtual Environments and Multimodal Interaction (VEMI) Lab, led by UMaine computer scientists Richard Corey and Nicholas Giudice, is spearheading projects and supporting others in this area. The lab's Autonomous Vehicle Research Group (AVRG), which also includes researchers at Northeastern University and Colby College, is developing a smartphone app to aid in autonomous vehicles ride-sharing and ride-hailing. The app, known as the Autonomous Vehicle Assistant (AVA), will help users request, find and enter vehicles using a multisensory interface that provides guidance through audio and haptic feedback, and high-contrast visual cues. The U.S. Department of Transportation awarded \$300,000 to AVRG for the AVA project through its Inclusive Design Challenge.

UMaine assistant professor of computer science Salimeh Yasaei Sekeh has teamed with VEMI Lab scientists and other researchers from UMaine and Northeastern University to develop algorithms that will make traveling in self-driving cars safer. The algorithms will improve the ability for autonomous vehicles to detect and avoid deceptive objects, such as adversarial traffic signs, that could misguide them and place users in danger. Sekeh's team earned a UMaine AI Initiative seed grant for the project.

VEMI Lab also is working with AVRG member Shelley Lin, an assistant professor of electrical and computer engineering at Northeastern, and her colleagues to create algorithms that will improve how AI identifies, tracks and communicates with passengers. The project, funded by a seed grant from UMaine and Northeastern and its Roux Institute, will help self-driving car AI better assist people with visual impairments and seniors, and inform them of its actions.

Researchers from UMaine, the University of New Hampshire and the University of Vermont are collaborating to create a digital framework capable of gathering near real-time data about the forests spanning the northern portions of their respective states and New York.



A research group led by the VEMI Lab is developing an Autonomous Vehicle Assistant smartphone app to improve accessibility for people with disabilities and seniors.

Improving efficiency, accuracy of wildlife surveys

Biologists count and identify birds in thousands of aerial photos when conducting wildlife surveys, a laborious task that consumes many hours. To reduce time spent analyzing images and the margin for error, UMaine researchers endeavor to create artificial intelligence that will perform the task.

Faculty and graduate students from several UMaine departments will develop machine learning technology that can pinpoint colonial nesting birds in photos captured by cameras mounted in unmanned aerial vehicles (UAVs) or planes.

The AI developed by UMaine researchers will use object recognition and image segmentation to determine the number of birds, their species and behaviors in aerial photos captured on Maine's offshore islands and over inland rookeries during the spring and summer months. Their program, known as a Convolutional Neural Network (CNN), a deep learning AI algorithm typically used for visual analysis, will find and classify the birds in an image by analyzing the pixels that form them.

The project received \$43,000 from the UMaine AI Initiative seed grant funding program, and builds on previously funded grants and partnerships involving UMaine faculty and state and federal agency partners.

"Humans are prone to fatigue, error," says project lead Roy Turner, an associate professor of computer science and director of the Maine Software Agents/Artificial Intelligence Laboratory (MaineSAIL). "It takes forever to do this by hand. Graduate students can take several hours identifying birds in one image."

Assisting policymaking, public oversight

Public comments can help government officials evaluate potential policy decisions that affect national monuments and other federal land. The introduction of online comments, however, has brought staggering amounts of feedback that can be difficult to summarize, and bury concerns agencies should consider.

Caitlin McDonough MacKenzie, a postdoctoral research fellow with the UMaine Climate Change Institute, led a team of postdoctoral conservation researchers in testing the use of a machine-learning algorithm to quantify public sentiment toward decisions involving federal land.



The group tasked a deep recurrent neural network with analyzing more than 750,000 remarks submitted during the 2017 public comment period for the Department of the Interior's executive review of 27 national monuments. The review resulted in the federal government reducing the footprints of the Bears Ears and Grand Escalante national monuments in Utah.

The Interior Department dismissed comments that were critical of the review as "a well-orchestrated national campaign organized by multiple groups." Using machine learning, McDonough MacKenzie's team found that out of the comments submitted by individuals, not organizations or bots that would typically be used in campaigns, 97.4% expressed opposition toward the review.

Their network found that out of all comments submitted during the review, 20% derived from human individuals, 11% came as form letters, or "individual comment(s) drafted by nongovernmental organizations and customized for submission by humans," and 69% originated from bots.

"Through machine learning, we discovered that it's not form letter campaigns that are overshadowing individual public comments, but bots," says McDonough MacKenzie, who also is a visiting assistant professor at Colby College.

Developing novel materials for energy storage

Two UMaine researchers will use AI-aided design to develop new materials for improved batteries and supercapacitors.

The research initiative led by Liping Yu, assistant professor of physics, and Yingchao Yang, assistant professor of mechanical engineering, aims to predict, synthesize and characterize a new class of 2D materials for active electrodes in batteries and supercapacitors. These 2D materials will be comprised of four or more chemical elements in nearly equal concentrations; distinct from both traditional 2D materials, which consist only of two or three elements, and conventional alloys, which contain relatively small amounts of secondary elements added to a primary element.

The U.S. Department of Energy awarded the project \$750,000 through the Established Program to Stimulate Competitive Research (EPSCoR).

Yu's research focuses on the theoretical and computational prediction of new materials with properties suitable for sustainable clean energy and electronic applications, such as solar cells, supercapacitors and catalysts. Yang's research encompasses fabrication-property-application of novel materials, which includes synthesizing 1D and 2D nanomaterials through chemical vapor deposition, hydrothermal reaction, and other means; mechanics of nanomaterials in situ and ex situ investigated with micromechanical devices; and application of nanomaterials in energy harvest, energy storage and water treatment.

Existing energy storage devices experience limitations such as inadequate power, capacity, efficiency, life span and cost effec-

tiveness, Yu says. To overcome such limits, new electrode materials are critically needed.

Explaining the findings reached

AI helps scientists make discoveries, but not everyone can understand how it reaches its conclusions. UMaine computer scientist Chaofan Chen is developing deep neural networks that explain their findings in ways users can comprehend, and applying his work to biology, medicine and other fields.

Interpretable machine learning, or AI that creates explanations for the findings it reaches, defines the focus of Chen's research. The assistant professor of computer science says interpretable machine learning also allows AI to make comparisons among images and predictions from data and, at the same time, elaborate on its reasoning.

Scientists can use interpretable machine learning for a variety of applications, from identifying birds in images for wildlife surveys to analyzing mammograms.

Before joining UMaine, Chen and research colleagues at Duke University developed machine learning architecture known as a prototypical part network (ProtoPNet) to pinpoint and categorize birds in photos, then explain its findings. The ProtoPNet would explain why the bird it identified was a bird and why it embodies a particular type of bird.

Chen has begun another AI study with colleagues and students from Duke exploring how they can apply ProtoPNet to review mammograms for signs of breast cancer. He also is investigating the possibility of integrating interpretable machine learning with environmental DNA (eDNA) applications in the hope of uncovering the connections between eDNA and environmental signals.

"I want to enhance the transparency for deep learning, and I want a deep neural network to explain why something is the way it thinks it is," Chen says. ♦



A team of conservation researchers tested the use of a machine learning algorithm to quantify public sentiment toward decisions involving federal land.

Community builder

Claudia Cummings is focused on social justice

At the University of Maine, Claudia Cummings had an engaged undergraduate student experience. As a result, she found her voice that now inspires others. Cummings is the recipient of the 2020 Sharon Barker Student Activism Award for her work to enrich communities through social justice advocacy.

Cummings, a member of the Penobscot Nation from Indian Island in Old Town, found her academic passion in the School of Social Work, where she says professors are compassionate and inviting, and peers truly care about their education and each other.

In particular, professor Robin Russel discussed social work through the lens of politics and policy, and encouraged Cummings to apply to Maine New Leadership. The Margaret Chase Smith Policy Center program is designed to prepare young women to seek and hold elected office and leadership roles.

Last October, Cummings ran for a seat on the Indian Island Tribal Council, where she is now the youngest member ever elected and is serving a four-year term.

On campus, Cummings' involvement included serving as vice president of Yarn Over Orono, a student organization that builds community through fiber arts education. She also represented the Penobscot Nation and UMaine's Native student population on the Penobscot Language Signage Committee, the group that motivated installation of bilingual campus signage in Penobscot and English.

Cummings earned her bachelor's degree in social work last May and is now in the master's program. She plans to work in Maine to address social justice issues, including substance use disorder and domestic violence. ♦

Photo by Adam Küykendall





The science of politics

Mark Brewer was one of UMaine's most sought-after experts in 2020

For nearly two decades, Mark Brewer has been a touchstone for journalists covering politics in Maine and the United States.

The University of Maine professor is valued and respected not only for his extensive expertise on state and national political matters, but also for his ability to deliver timely, accessible, knowledgeable perspective and insight on a wide range of topics — from how ranked-choice voting works to the latest facets of a high-stakes Congressional race.

Just the facts. Objective and nonpartisan.

Brewer and his colleagues in the Department of Political Science are nationally and internationally recognized for their fields of specialization. Their teaching, research and outreach are the social sciences in action, educating students and contributing to scholarship, and helping inform citizens of all ages about the latest nuances and long-standing traditions of political systems and civic life.



Photo by Adam Kuykendall

Brewer's research and scholarly publications focus on political parties, elections, and religion and politics in the U.S. His numerous books include the seminal textbook *Politics and Elections in America: The Electoral Process*, coauthored with L. Sandy Maisel, and *Polarization and the Politics of Personal Responsibility*, written with Jeffrey Stonecash. Brewer also is editor of the *New England Journal of Political Science*.

Being a go-to expert for media means helping inform countless readers, viewers and listeners, as well as reporters, and contributing to the common good. Since joining the UMaine faculty in 2004, he has given well over 1,200 interviews with local, state, national and international media outlets.

In the 2020 election cycle, Brewer was one of UMaine's most sought-after experts, with nearly 150 media interviews since May.

People, Vox, U.S. News & World Report, GQ.

Boston Globe, New York Times, Washington Post, USA Today.

AP, CBC, CNN, NPR, CNBC.

Interviews with media in Canada, France, Chile.

And more.

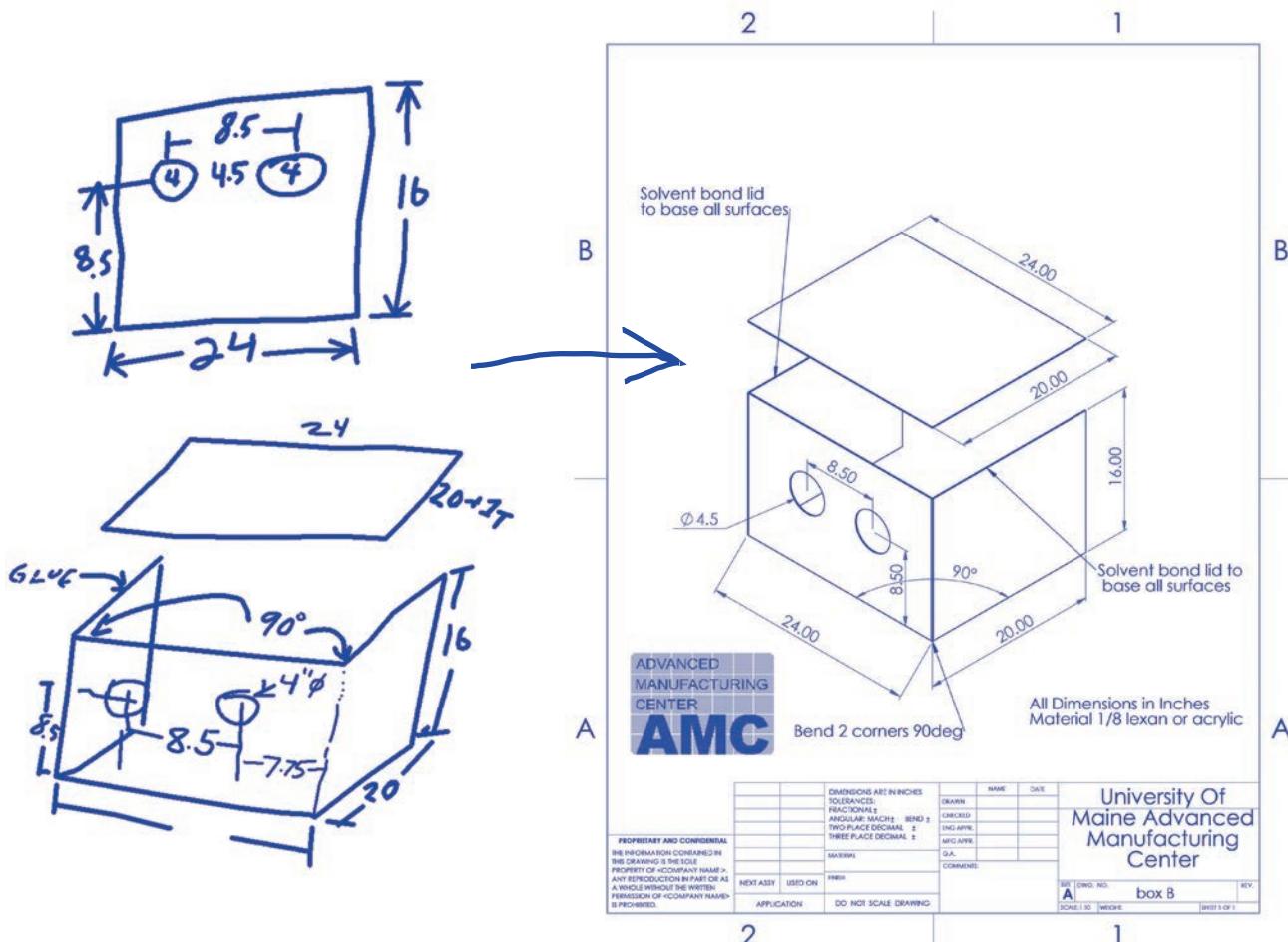
Most-asked question of Brewer in 2020? It was the two sides of Maine's 2nd Congressional District race. In the first half of 2020, the questions focused on the logistics of what it would take for Sara Gideon to beat Susan Collins. In the second half of the year, the media focus was on whether there was any way Susan Collins could retain her seat.

"Successful representative democracy requires a critical mass of educated, informed and involved citizens. I see my interaction with the media as my small contributions to achieving this goal," says Brewer, who received the 2019 Outstanding Faculty Award for service and outreach in the UMaine College of Liberal Arts and Sciences. ♦

Greatest need, greater good

By Ashley Forbes

Expertise, infrastructure and partnerships key to the **effective response of the state's research university** in the pandemic



Ntension typically plays to a crowd. The Hermon-based company specializes in large-scale tension-fabric structures for trade shows and exhibits, elaborate temporary construction designed to draw attention and draw people in. **Not in 2020.**

As the pandemic forced the cancellation of the big events that make up Ntension's regular market, the company, with help from the University of Maine, began exploring products with a much smaller footprint: personal protective equipment (PPE) for health care workers.

Leveraging its existing fabric manufacturing capacity, Ntension moved ahead deliberately, first working with UMaine's Advanced Manufacturing Center (AMC) last spring to test the filtration properties of materials that could be used to make face masks.

From there, the company began production of face masks and shields, working closely with Northern Light Health to meet the medical group's specifications for a general-use mask that could be worn by those whose duties don't require an N95. Ntension is in the early stages of developing a medical product line, and has continued to work with AMC on product development and process improvements as it begins to build capacity and pursue U.S. Food and Drug Administration (FDA) approval for their masks.

As AMC director, John Belding regularly visits Maine manufacturing company sites to assess operational effectiveness, plan prototype projects and help link UMaine research with industrial needs.

AMC's work with Ntension is one example of statewide economic development efforts during the pandemic. Indeed, partnerships between the engineering support and service center and manufacturers throughout Maine have been more important than ever in addressing COVID-19-related challenges.

Since late summer, Belding's focus has been on asking detailed questions about operations and gathering data for a sweeping project aimed at helping Maine's manufacturing sector weather the ongoing economic effects of the pandemic.

The COVID Countermeasures Project is a collaborative effort that marries AMC's product and process development and research with services provided by the Maine Manufacturing Extension Partnership (Maine MEP) and the Manufacturers Association of Maine (MAME), two regional trade organizations. Supported by \$286,000 in CARES Act funding and a \$100,000 grant from the Maine Technology Institute, they surveyed more than 250 companies about impacts related to the pandemic and are conducting 50 in-depth assessments for companies that requested additional support. From these assessments, the group is developing a series of customized remediation projects to solve individual challenges.

It's a big lift for a critical sector that accounts for more than 54,000 Maine jobs and a \$5.9 billion share of the state's gross domestic product. Projects run the gamut from marketing assistance to engineering work, and draw on the expertise of a statewide network of consultants, including AMC.

"Basically, we can do anything," Belding says of the collaborative. "It's a great partnership that builds on company retention work MAME was already starting to do. Responding to COVID has reinforced the purpose. By pooling our resources and our expertise, we've been able to develop a well-defined plan for how to approach this."

Some firms the group works with are trying to make existing processes more efficient. Others, such as Ntension,

have ventured into entirely new markets as a result of COVID.

Months into a public health crisis that has upended life in Maine and across the world, the COVID Countermeasures Project is an active example of UMaine's ongoing response efforts. While the pace has shifted from the frenzied early days of the pandemic, the university's role and mission to support evolving state needs remain unchanged.

In the beginning

In the first week of March, professor of chemical and biomedical engineering Mike Mason received an urgent email from one of his regular contacts at Northern Light Eastern Maine Medical Center in Bangor.

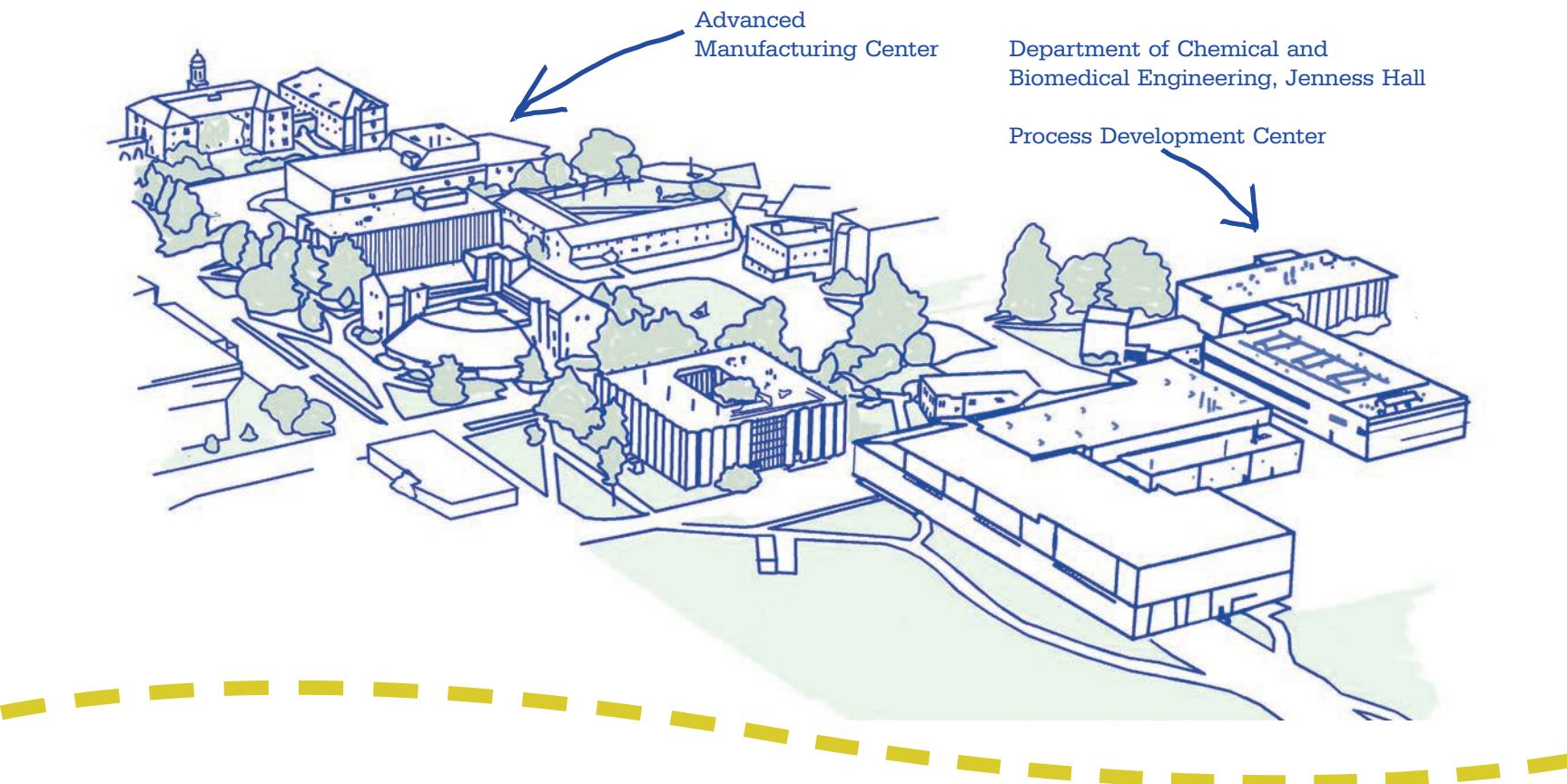
"The message essentially said 'We're exploring strategies to continue to supply critical PPE, and we'd like some help troubleshooting on different sterilization strategies we might use,'" Mason says.

Mason talked regularly with the sender, Northern Light Health director of clinical engineering Ken Mitchell, but their discussions typically revolved around student projects related to UMaine's biomedical engineering co-op program. As COVID-19 spread rapidly worldwide and began appearing in New York and Boston, the conversation was very different.

On March 3, 2020, the World Health Organization (WHO) warned of severe and mounting disruption to the global supply of PPE. Northern Light EMMC, like many other hospitals, began investigating all options to keep its staff safe.

"My first thought was that this was a problem that we might be able to help with, but I was also not fully aware yet how seriously COVID was impacting the health care supply chain," Mason says. "That is to say, the normal inventory of supplies was not going to cut it because the daily burn rate for these things is huge."

Mitchell's email set in motion UMaine's research response to COVID-19, spawning the development of a broad-based COVID-19 innovation team that brought together multiple



university research centers, and representatives from Maine health care, manufacturing and government to solve emerging challenges related to the pandemic. The UMaine-led group tackled PPE needs from hand sanitizer to ventilator parts, working swiftly to address problems the state was facing and initiating collaborations that would reach far beyond the campus.

Bringing people together

Mason and Mitchell began talking through potential sterilization strategies for N95 masks. By the second week of March, other faculty members in the department — including assistant professor of chemical and biomedical engineering Caitlin Howell and professor of practice Robert Bowie — were approached by their own contacts at area hospitals, many of them raising similar issues.

“We were hearing about masks, face shields, ventilators and ventilator parts — vent pieces and splitters — and we didn’t have good clarity on what the need was going to be yet,” says Mason. “It was everything from ‘We’re not going to need much’ to ‘We’re going to need a thousand of these a day and how fast can you make them?’

“It started to become obvious that we were all dealing with different aspects of the same problems, but not really making a lot of progress,” says Mason. “We needed to organize.”

To coordinate that process, Mason called on Jake Ward, UMaine vice president of innovation and economic development, and noted coalition builder.

“Mike told me what he was hearing from the hospitals and we just started bringing people in on the different issues,” says Ward. “In the beginning, it all seemed to center around what we might be able to 3D print. But we realized that first we needed to understand the hospitals’ needs to make

sure we were producing items that were needed and could actually be used in a medical setting.”

The first formal meeting of what would become the COVID-19 innovation team occurred March 19. Ward invited experts from across the university and the state, and encouraged them to invite others.

“I think we had 47 people on the first call,” Ward says. “The working relationships I and others already had with all those individuals made it easy to pull that group together, and using Zoom, allowed us to assemble people from all over the state in a short time. We had people who never came back again, and went off and worked on different issues independently, but the group that stuck was one that wanted to be interdisciplinary and work together.”

That unit eventually gelled to include faculty, staff and students, representatives from the Maine Department of Economic and Community Development, Maine MEP, MaineHealth, St. Joseph Hospital, and Northern Light Health. Other collaborating partners included MAME and Maine Procurement Technical Assistance Center.

Those early days were a blur of activity. And daily calls. Ward opened the discussion the same way — by asking the participating members of the medical community what they were hearing, what they were seeing and what they needed.

“We were talking a lot about masks, but part of that conversation was ‘Are there other things that you guys are running out of?’” says Mason. “And that’s when we first heard about sanitizer.”

It was the end of the third week of March. Shortages that had been looming began to take on new urgency as the pandemic took hold nationwide and hospitals’ regular supply chains were increasingly strained by high demand.

“I believe it was on that Friday the 20th that we got connected with Central Maine Medical Center,” Mason says. “And they said, ‘We’re not only looking at a problem, we’re out on Sunday.’”

A **broad-based COVID-19 innovation team** brought together multiple university research centers and representatives from Maine health care, manufacturing and government.



President's Office, Alumni Hall

Getting started

The pressing need for hand sanitizer kicked UMaine's response into high gear. The Department of Chemical and Biomedical Engineering team took the lead on the project, reaching out to hospitals statewide to coordinate with their in-house pharmacists about the required formulation for hand sanitizer.

Mason enlisted the help of two of his graduate students, Aileen Co and Radowan Hossen, to broadcast a list of needed supplies to the campus research community, and the response was swift.

"People gave us glycerin and hydrogen peroxide from their labs," says Mason. "We didn't know at first how much we were going to need and the idea was that if we could just get 25 gallons of the stuff made, it would help us prove the process and meet that need for Central Maine."

Mason spent Friday and Saturday nights poring over documentation on formulas provided by the hospitals, FDA and WHO. March 22, he and professor William DeSisto met at the Process Development Center (PDC) in Jenness Hall, ready to go to work.

"We did a little chemistry," Mason says. "What we found is that it's really easy to make. It's a liquid hand sanitizer, not gel, so it's not very complex in terms of mixing."

The 25-gallon pilot batch of FDA-compliant, hospital-grade, 80% ethanol hand sanitizer was distributed to Central Maine Medical Center in Lewiston and Northern Light EMMC in Bangor that same day, meeting urgent needs.

"By the end of the weekend, we thought 'Hey, this is really something we can do, but we don't have enough ethanol. How can we get that one critical component, and how do we go about tapping into the available supply chain to get the other things that we need?'"

Scaling up to meet demand

At this point, Ward's rapid innovation collaborative concept began to crystallize. The group kept the "fail fast, fail cheap" principle of innovation front of mind as it looked for solutions to supply chain issues.

"If hand sanitizer is a product we need to produce, how are we going to get legal on board, can we set up an account to buy materials, how do we do that?" Ward says. "The work we do in the Department of Industrial Cooperation made it easy for us to facilitate that interaction and help get things done within the university."

The team operated as part of a March 22 agreement with the Maine Emergency Management Agency (MEMA), allowing the University of Maine System to provide goods and services to state health care facilities and agencies.

While the first batch of sanitizer marked a milestone, the work was just beginning. With supplies increasingly tight, the team realized that an intricate understanding of hospital demand was critical to the success of hand sanitizer and any other potential projects. Rapidly changing FDA guidance was another reality for both the team trying to find solutions and the health care facilities trying to respond.

"The hospitals can't decide to use something just because they have it," says Mason. "We knew that things the FDA would never approve weren't true solutions, but we also knew we had this industrial production capacity if we could identify the right items."

"We also had to translate the way the hospitals were used to ordering supplies into a daily burn rate that we could use to gauge production," says Mason. "With hand sanitizer, we knew we couldn't deliver a thousand gallons tomorrow, but we could deliver 50 gallons a day for 20 days. Really understanding the actual supply chain requirement became so important that we had to start putting people on just that."

Once word got out that UMaine could make hospital-grade hand sanitizer, demand from medical facilities intensified. Mason and his collaborators began fielding hundreds of emails per day on the subject and Mason tapped his graduate students to coordinate with hospitals about their needs. Managing logistics essentially became a full-time job for Co, a biomaterials engineering Ph.D. student, who was among those in the UMaine community putting in 14-hour days.

Working in 50-gallon batches, **PDC shipped more than 3,000 gallons of hand sanitizer to more than 100 locations in Maine.** Recipients included major hospitals, long-term care facilities, Maine tribal health facilities and first responders.

The project scaled up and soon the university's hand sanitizer production was being run out of PDC, UMaine's commercial-scale pilot plant that supports the pulp, paper and bioproducts sector with research, development, demonstration and commercialization services. With its existing capacity for commercial-scale products and chemical engineering processes, the facility was able to pivot swiftly to scale up production in early April. The PDC staff's logistics expertise also proved to be an asset in coordinating the supply of ethanol and other materials, a persistent challenge in the operation's early days.

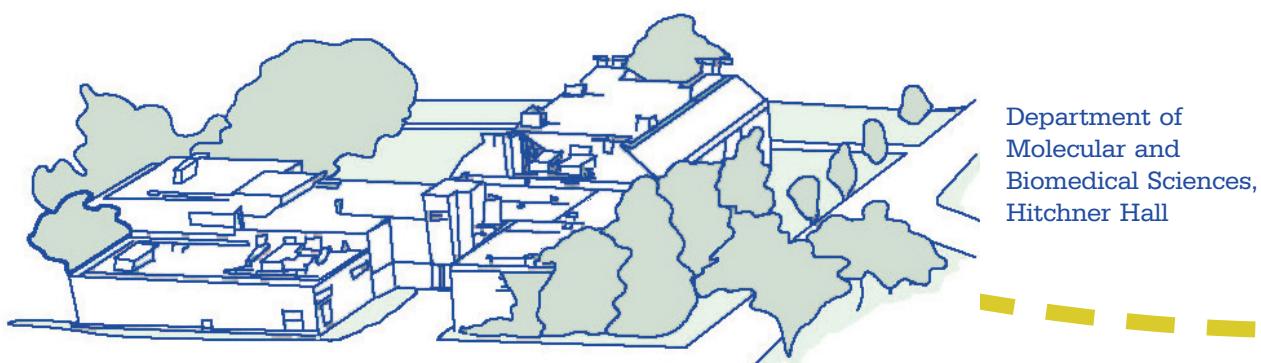
"It was a mad scramble to get materials," says PDC director Colleen Walker. "In the beginning, we estimated we might need to make 190 gallons per day, and we were thinking 'Where the heck are we going to get the alcohol?'"

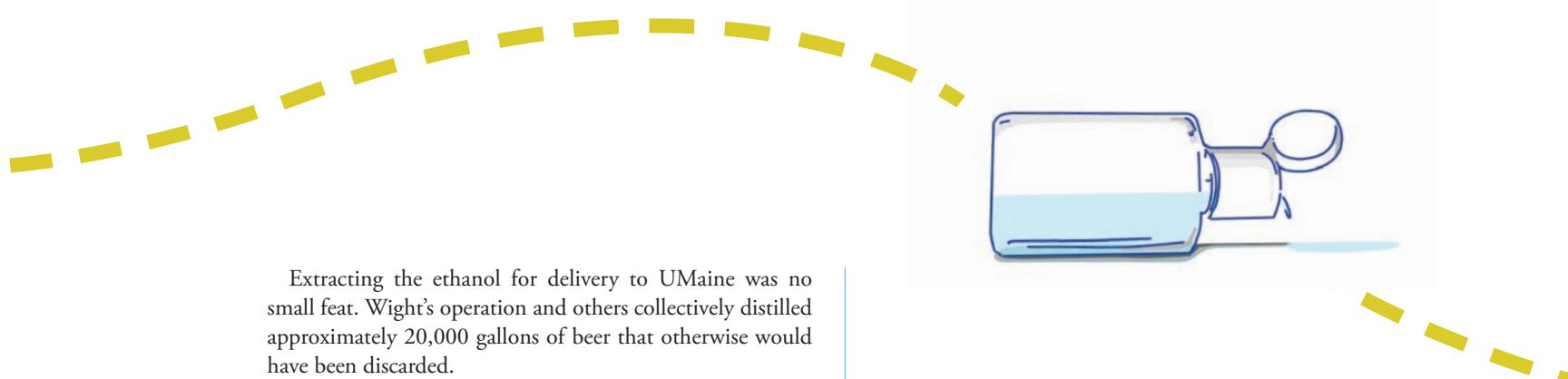
The answer came from Maine's craft distilleries and brewers, largely idle after the state's restaurants and bars closed March 18.

Mason and Walker began working with the Maine Distillers

Guild to source ethanol, including some made from local brewers' unsold beer, to support hand sanitizer production. New England Distilling, Hardshore Distilling, Stroudwater Distillery, Sebago Lake Distillery, Split Rock Distilling, Blue Barren Distillery and Mossy Ledge Spirits were among the university's partners in this effort, and brewers including Allagash, Maine Beer, Rising Tide, Foundation, Oxbow, Shipyard and Baxter provided feedstock for the distilleries. A sizable donation of high-proof alcohol from Boston Brands of Maine also supported early UMaine efforts.

"UMaine was the guiding hand to give us direction for this effort," says Ned Wight, president of the guild and one of the owners of the Portland-based New England Distilling. "First, working with the university allowed us to contribute alcohol and do it legally. Second, they had the manufacturing and supply connections to procure the other chemicals that were needed and handle compounding, packaging and distributing the sanitizer to hospitals, which allowed us to focus on what we know how to do — the alcohol side."





Extracting the ethanol for delivery to UMaine was no small feat. Wight's operation and others collectively distilled approximately 20,000 gallons of beer that otherwise would have been discarded.

The sheer volume of alcohol involved required PDC to get some special permissions.

"We had to get approval from the town of Orono to have so much alcohol on site, and the fire department to work with the alcohol inside the building," says Walker.

The biggest shift, Walker says, was adjusting the pace of PDC's operations and coordinating the many individual steps in the process, from procuring the alcohol to working with UMaine Facilities Management to ensure delivery of the final product. Health care facilities were able to place orders through the WebEOC, a communications system used in state emergency operations. Co responded to each request, tracking packaging requirements and other details that PDC staff used to build a production schedule. Once an order was complete, Facilities Management arranged delivery.

Working in 50-gallon batches, PDC shipped more than 3,000 gallons of hand sanitizer to more than 100 locations in Maine. Recipients included major hospitals, long-term care facilities, Maine tribal health facilities and first responders.

Parallel projects

While hand sanitizer production and coordination emerged as the signature piece of UMaine's response to meet state needs in the pandemic, it was not the only initiative members of the innovation team tackled. Projects emerged rapidly and with much still unknown about how severely the virus would impact Maine, there was a lot on the table.

The Advanced Manufacturing Center, home to an engineering support and resource center specializing in precision manufacturing, played a key role in several of these projects, including design, prototyping and materials testing services for a variety of companies looking to respond to shortages and emerging needs.

AMC's work started with an early effort to develop masks that could be manufactured in state for use in a medical setting to answer PPE shortages. While that project ultimately

did not move forward, a number of Maine companies began making cloth face coverings for consumer use.

The AMC team, led by Belding, tested in excess of 100 different types of material intended for use in face coverings, everything from basic cotton T-shirts to technical fabrics. Their methods measured how effective the material is at blocking particles of different sizes.

While no certified protective face masks for hospital use are currently being manufactured in Maine, AMC helped a number of companies, including L.L. Bean and Strainrite, gauge the filtration properties of different types of material they explored for use in face coverings. AMC has continued work with Ntension as the Hermon firm cultivates PPE product lines and pursues medical certification.

In a similar vein, the center tested N95 masks before and after different sterilization treatments to ensure the filtering performance was not degraded, supporting hospitals' exploration of techniques to allow for limited reuse of PPE.

AMC also assisted Maine plastics manufacturers with new products. Given nationwide shortages of N95s, many hospitals turned to alternative forms of PPE, including clear plastic face shields intended as an extra layer of protection. The shields made an ideal product for local manufacture, and AMC facilitated their rapid development by evaluating prototype designs.

By late April, Maine companies had produced hundreds of thousands of shields, more than enough to meet in-state needs and supply other markets.

A request from MaineHealth led to AMC prototyping two designs for "aerosol boxes" that can be used to protect medical workers during transportation and intubation procedures in patients suspected to have COVID-19. The designs are based on a concept first conceived by Dr. Hsien-Yung Lai, a physician in Taiwan whose aerosol box design to treat COVID-19 patients has been shared widely during the pandemic.

AMC's designs, developed in coordination with professor Bowie and with help from the Maine MEP, were tested in area hospitals and refined based on feedback from the front



lines. The first is a three-sided shield, with handholes, that covers the patient's head and shoulders, and allows medical personnel to intubate safely to contain aerosol spray from a patient's respiratory tract. The second fully encloses a patient's head and, with the help of a portable tube and filter, creates a negative-pressure environment so that viral particles leaving a patient's respiratory tract can be captured to minimize contamination.

Both variations of the boxes were manufactured in Maine for Maine hospitals.

AMC also worked on ventilator parts and pieces, including a splitter that would allow two patients to share the same ventilator in the event of a shortage.

In late April, PDC also responded to an urgent request from Maine Center for Disease Control and Prevention (Maine CDC) for chemical solutions used to fit medical workers with N95 masks. There was a national shortage of fit-testing kits and test solutions.

Fit testing to ensure the seal between the facepiece on a respirator mask and the wearer's face is required by the U.S. Occupational Safety and Health Administration. The test must be conducted when a worker is first fitted for a respirator, such as an N95. COVID-19 has created an expanded need for respiratory protections in health care and other settings, resulting in a surge in fit testing.

In May and June, UMaine delivered 4,500 bottles of fit-testing solutions for Maine CDC to distribute to the Maine National Guard and partner agencies that conduct the tests.

While the N95 is typically a single-use mask, hospitals began evaluating protocols to sterilize and reuse this and other forms of PPE in the face of shortages. Howell and professor David Neivandt have provided key counsel to Maine's health

care community on decontamination and sterilization of PPE.

At UMaine's Virtual Environments and Multimodal Interaction (VEMI) Lab, staff and students led by director Richard Corey explored a range of technology projects, including the development of 3D-printed infrared thermometers that were in short supply and considered a potentially vital screening tool for businesses and schools. Using parts readily available for purchase online, the lab was able to design a nonmedical-grade thermometer that could be printed economically at home. The lab also released a guide to support hobbyists who might produce them for community use. In addition, VEMI served as a key resource for Maine officials exploring prospective COVID tracking apps and other potential software solutions.

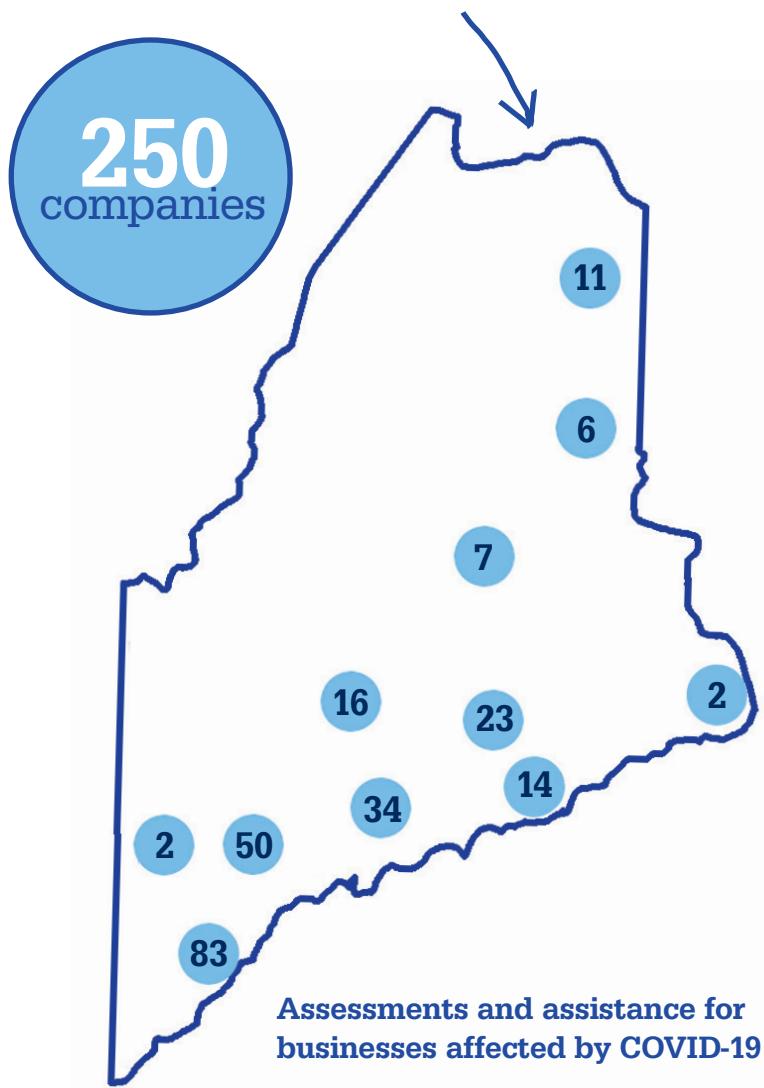
"All these projects went off on their own tracks, but bringing everybody together (in daily virtual meetings) to hear the same things meant we could run things to ground really quickly with an understanding of the urgency from the front lines," Ward says.

Reflecting

As the state's flagship research university, UMaine had both the capability and the responsibility to respond in a crisis. The university-led innovation efforts established a new framework to address not only Maine's worst-case COVID-19 scenarios, but a range of other challenges.

"We pulled this group together based on existing working relationships, but what it turned into was a function of

COVID Countermeasures Project



Maine Manufacturing Extension Partnership

Manufacturers Association of Maine

University of Maine Advanced Manufacturing Center

the people who participated,” says Ward. “The diversity of the group made the difference because everybody had a chance to bring their lens to the issues, from health care to manufacturing to government to the different research groups on campus. If you’re really trying to solve problems, you need that kind of blend. You need to be able to think about quick answers, quick solutions that can help you rule things out. We just had a group of really pragmatic subject matter experts who were willing to listen to other subject matter experts, and it worked.”

For Mason and others who were part of the group, what emerged from the crisis was a common language that already is helping to support collaborations between the university, health care and other key sectors in Maine.

“In the beginning, translating the hospitals’ normal rate of purchasing supplies into what we could think of as a daily production rate was a significant hurdle,” says Mason. “We had all this capacity that we couldn’t engage until we found clarity, but once we truly understood the need, we could start providing solutions. From the very beginning, when we were staring the possibility of the worst-case scenario in the face, the professionals in the health care sector and the involved UMaine faculty did not panic, but got to work to meet a need that was a moving target the whole way. I think that building that trust and expanding those networks through this process will open the door to new conversations.”

This is already happening. Regional health care partners and UMaine have established a working group to apply rapid innovation principles to other public health challenges, such as addiction and rural access to care.

The collaborations forged and reinforced in the early days of the crisis have now shifted to meet longer-term needs for Maine businesses, such as the work AMC is doing to support manufacturers.

“We now have better, stronger relationships with the people we were already working with,” says Belding. “This COVID Countermeasures Project is one example of that. I think it helped broaden awareness of the university’s capabilities, too, and people understand that if other stuff comes up, we’ll be here to help.”

Ward, whose everyday role centers around emphasizing UMaine’s willingness and ability to problem solve to support state priorities, has found the process invigorating.

“I didn’t go into this thinking ‘What’s the machine that’s going to work and how are we going to make it?’” says Ward. “We were innovating the process, never mind the solutions.”

“How can we apply the things we know now to what is happening around us? This effort showed the value of deploying our existing knowledge fairly quickly to help solve problems,” Ward says. ♦

Digital Extension

UMaine's statewide outreach unprecedented, transformed

During the pandemic, University of Maine Cooperative Extension has a digital presence like never before, allowing it to fulfill its statewide mission with its thousands of constituents of all ages. Last spring in response to COVID-19, UMaine Extension quickly moved its workshops, classes and events online. As a result, its impact on K-12 learning, business and economic development, innovation and food system security has been unprecedented.

New online resources included COVID-19 support for Maine farmers, livestock producers, U-pick operations, cut flower and seedlings industries and consumers.

Weekly Zoom meetings allowed producers to share what was happening on their farms.

New "Learn at Home" resources provided educational opportunities for parents, teachers and youth.

Horticulture and food preservation videos, webinars, interactive forms and virtual office hours provided answers to an increased number of questions from home gardeners.

With the closing of state and county fairs, the first-ever Maine State Virtual Fair recognized 4-Hers for their efforts on projects they completed and skills they gained in the past year.

The popular Ask the Expert online form received 346 questions from Maine home gardeners between March 1 and Dec. 31, 2020, nearly twice the number during the same period in 2019.

Nearly twice as many new publications were published last year specifically in response to the COVID-19 pandemic. The 42 included "Finding New Markets for Maine Farmers." ♦

extension.umaine.edu

58 interconnected websites consisting of **10,000+ pages**
received **2.8 million pageviews** from visitors in 2020,
up nearly 30% from 2019

Interactive Maine Farm and Seafood Products Directory

190,000+ views since its launch on
March 20, 2020

200 virtual classes, workshops and events

WITH 8,350+ REGISTERED CLIENTS





Call to action

University experts contribute to Maine Climate Council plan

When Maine Gov. Janet Mills convened the Maine Climate Council in September 2019, she announced an executive order to make Maine's economy carbon neutral by 2045. The council's four-year plan for climate action, released Dec. 1, is titled "Maine Won't Wait" for a very good reason, says Ivan Fernandez, University of Maine Distinguished Maine Professor in the School of Forest Resources, the Climate Change Institute, and the School of Food and Agriculture.

The state, and the world, can't wait.

"The indicators of climate change are accelerating and so, too, must our response," he says.

Fernandez referenced 2020's increasingly common intense winds, the Gulf of Maine's record-warm temperatures, megafires that have scorched 8 million U.S. acres, punishing drought, 30-plus tropical storms and hurricanes, and mounting devastation due to sea level rise.

The Maine Climate Action Plan lays a pathway for what needs to be done, he says.

Fernandez and other experts from UMaine, the University of Maine at Machias, the University of Maine School of Law, the University of Southern Maine and the University of Maine at Farmington helped inform and craft the plan with government officials, scientists, business and industry leaders, and citizens.

The path includes investing in renewable energy, harnessing natural climate solutions to store carbon, and building resilience in farms, forests and fisheries to survive and thrive in the 21st century.

"We have seen time and again that science-informed policy is cost-effective for American society," says Fernandez, who also co-chairs the council's Scientific and Technical Subcommittee and serves on the Natural and Working Lands Working Group.

It's important that we "invest in the future rather than in the past. This is guidance to do that," says Fernandez, who also serves on the governor's newly established Maine Forest Carbon Task Force with UMaine School of Forest Resources professor Adam Daigneault.

Sean Birkel, the Maine state climatologist and a research assistant professor with UMaine's Climate Change Institute and School of Earth and Climate Sciences, served with Fernandez on the Scientific and Technical Subcommittee. He says that by implementing climate mitigation, adaptation and resiliency strategies now, we can help minimize future climate impacts, while also protecting Maine's economy and natural environment.

Birkel, who developed the Climate Reanalyzer, says there's clear evidence of climate change in Maine during the past century, especially the past 20 years. "The changing climate affects all of Maine's economic sectors, from tourism, to agriculture and forestry, to trade."

Maine Sea Grant director Gayle Zydlewski says the council's work is critical for the sustainability and resilience of the state's coastal communities and ecosystems. Climate-related changes are already threatening valuable wild and farmed fisheries, along with the marine heritage and cultural identity of coastal communities.

"Based on our work with coastal communities, the seafood industry, and statewide coastal energy and infrastructure planning initiatives, we understand that the cost of not advancing these efforts will far outstrip the cost of making what changes we can make today to help communities and industry mitigate and adapt to the challenges of climate change," she says.

A thoughtful approach to change is key, says Jonathan Rubin, director of UMaine's Margaret Chase Smith Policy Center who serves on the Transportation Working Group and Scientific and Technical Subcommittee.

It's important to balance smart regulations that both reduce damage and position Maine's businesses to be in sync with other businesses across the country and world, says Rubin, a nationally recognized expert on climate change economics, including transportation energy.

If the council's recommendations are implemented, Fernandez envisions a state with more electric vehicles, offshore wind technologies, energy-efficient and climate-friendly buildings, a clean-energy economy, regenerative agricultural practices, communities with prioritized investments for climate resilience, improved tracking of vector-borne diseases, better delivery of medical treatment, and substantial gains with regard to equity.

Experts from the University of Maine System serving on council subcommittees/working groups include:

Brian Beal, University of Maine at Machias; Ivan Fernandez (co-chair), Sean Birkel, Adam Daigneault, Joe Kelley, Rick Kersbergen, Glen Koehler, Bradfield Lyon, Jonathan Rubin, Robert Steneck, Rick Wahle and Aaron Weiskittel, UMaine, Scientific and Technical Subcommittee

Abigayle Hargreaves, Jeff Thaler (and University of Maine School of Law), and Jake Ward, UMaine, Energy Working Group

Jonathan Rubin, UMaine, Transportation Working Group

Heather Leslie (co-chair), Kathleen Bell, Dave Townsend, Hattie Train and Jessica Reilly-Moman, UMaine; and Curtis Bohlen, University of Southern Maine, Coastal and Marine Working Group

Hannah Carter and Ivan Fernandez, UMaine, Natural and Working Lands Working Group

Andrew Barton, University of Maine at Farmington; Tora Johnson, University of Maine at Machias; and Esperanza Stancioff, UMaine, Community Resilience Planning, Public Health, and Emergency Management Working Group

Dan Dixon and Steve Shaler, UMaine, Buildings, Infrastructure, and Housing Working Group ♦

Mitchell Center helps assess equity of climate strategies

Sustainability experts from the University of Maine advise the Maine Climate Council on how efforts to combat climate change could support historically underrepresented populations in the state.

The Senator George J. Mitchell Center for Sustainability Solutions was tapped to assist the council with its efforts to improve equity outcomes of the state Climate Action Plan.

The center provided expertise to the Governor's Office of Policy Innovation and the Future to help determine how the Climate Council's strategies for reducing carbon emissions and adapting to climate change can benefit underserved residents and communities.

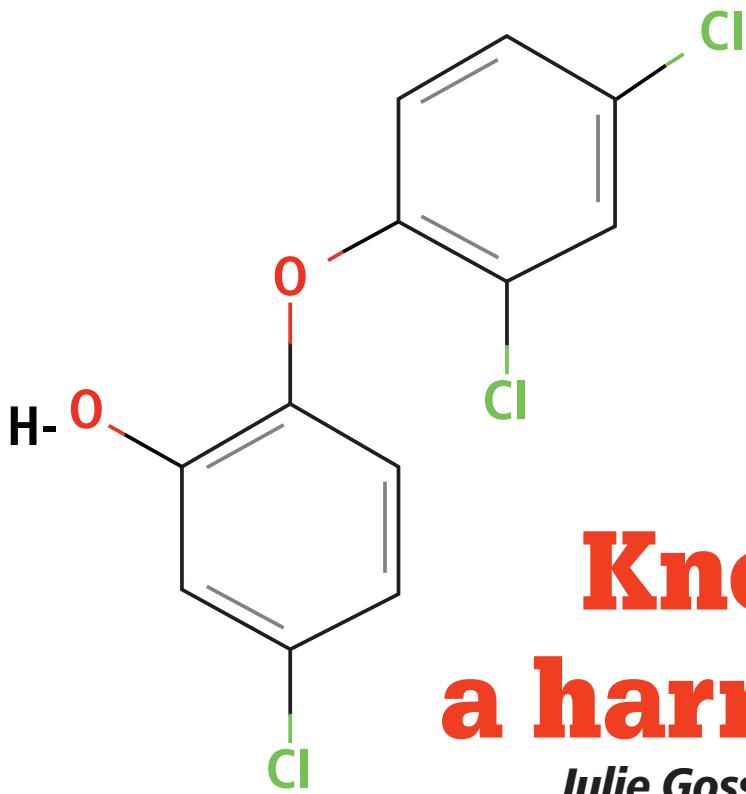
The Mitchell Center's work also contributed to the establishment of the Climate Council's Equity Subcommittee, which is helping to inform the implementation of Maine's four-year Climate Action Plan.

Climate change affects the various populations in Maine in different and unequal ways, says Linda Silka, a Mitchell Center senior fellow. To help all Mainers, officials can focus on reducing the disproportionate effects of climate change on lower income and rural populations, older adults, tribal communities, persons of color and other underrepresented groups.

"Our responsibility is to look at equity issues in a clear, systematic and well-informed way," Silka says. "It's a wonderful way to say, 'We're not the kind of state that's good for some people. We want it to be good for everyone.'"

Silka; Mitchell Center director David Hart; Sara Kelemen, a graduate student of plant, soil, and environmental science; and other partners evaluated climate action proposals from the council's working groups for their ability to achieve equity and foster diversity and inclusion. Recommendations will include ways to improve how any particular strategy can support the various underserved populations in Maine.

As state officials solicit citizen feedback on climate action strategies, the Mitchell Center also advised on how to connect with underrepresented communities across the state, including groups that may be unaware of the Climate Council's work, residents without internet access, and others. ♦



Knocking out a harmful toxicant

***Julie Gosse caps a decade of research
into troublesome triclosan***

By Marcus Wolf | Photographs by Adam Küykendall

University of Maine toxicologist Julie Gosse spent a decade unearthing the medical harm posed by the germ-fighting agent triclosan (TCS). Manufacturers had included the synthetic chemical in soap, toothpaste, facial cleansers, sanitizer and other common products since the 1970s, when no research delved into its health and toxicological effects.

By the time Gosse and her students began investigating it, 75% of Americans were exposed to it, according to the National Health and Nutrition Examination Survey.

Various studies in the past 10 years have revealed that TCS weakens disease resistance and interferes with various bodily functions. Research led and overseen by Gosse, an associate professor of biochemistry, found TCS inhibits immune cells, particularly T and mast cells, and damages mitochondria. Investigations from other toxicologists and experts also found that TCS can harm human fertility, development, cognitive and thyroid function.

Growing scientific evidence from Gosse and other scientists inspired public outcry against TCS and government intervention. The U.S. Food and Drug Administration (FDA) banned

TCS from bar soaps, liquid soaps and body washes in 2016, hospital soaps in 2017 and hand sanitizer in 2019.

The chemical has since been removed from almost all products.

When Gosse wrapped up her TCS research with a final paper, she sent two graduate students to the grocery store to search for any goods with it. They found none.

"I think the public became aware of triclosan's toxicity, so the decision was really made by consumers," says Gosse.

The now controversial antimicrobial agent was not on the UMaine toxicologist's radar until she watched a presentation by Environmental Protection Agency scientist Susan Richardson, hosted at UMaine. Richardson noted that the antimicrobial agent resembled a dioxin. Despite experts producing virtually no toxicological literature for the chemical, it had become widespread, which Gosse and Richardson found troubling.

"Here we have a chemical to which the vast majority of Americans are exposed, and we have no idea what it does to their health," Gosse says.

Rachel Kennedy, then a graduate student in Gosse's lab, searched for medical literature about TCS. She found only a



In the Gosse lab, molecular and biomedical sciences graduate student Bright Obeng continues to conduct research on chemicals that have significant impact in the cellular pathway of immune cells.

couple studies pertaining to the chemical's ability to disrupt cells in the endocrine system. Gosse and her students were studying endocrine disruptors at the time, so Kennedy delved deeper into TCS.

The work conducted by Kennedy, her colleagues and Gosse resulted in the UMaine researchers' first study into the antimicrobial agent, which concluded that TCS suppresses mast cell function. Kennedy, who was first author on the paper and received her Ph.D. in 2013, is now CMO transformation and communication lead for EMD Serono Inc. in Rockland, Massachusetts.

"Ever since," says Gosse, "we've been trying to figure out the exact biochemistry that causes that cellular disruption."

The study launched a series of investigations into TCS from Gosse's lab. They found out how the antimicrobial agent suppresses mast and T cells, particularly mast cell signaling, and that it damages mitochondria in immune and nonimmune human and other organism cells.

Mitochondria provide energy that cells need to perform various tasks, including combating disease.

Funding sources for the research included the National Institutes of Health, the U.S. Department of Agriculture, Maine Agricultural and Forest Experiment Station, and Pharmaceutical Research and Manufacturers of America Foundation.

Lisa Weatherly, then a Ph.D. student of biomedical sciences from the Graduate School of Biomedical Sciences and Engineering, led a study from Gosse's lab that revealed how TCS as a toxicant harms mitochondria. Weatherly also was the first to use super resolution microscopy in the field

of toxicology, in particular, the fluorescence photoactivation localization microscopy (FPALM) technique developed by UMaine professor of physics Sam Hess.

Using FPALM, they watched TCS deform live mitochondria in real time.

Gosse says without Weatherly's hard work, several papers may not have been produced. The former UMaine student now serves as a researcher at the Centers for Disease Control and Prevention National Institute for Occupational Safety and Health in Morgantown, West Virginia.

"We wanted to continue studying this as long as people continued to be exposed," Gosse says. "If you know what a chemical does, the causes and effects, you might be able to predict what the next chemical with a similar structure will do."

TCS is intended to slow or stop bacteria and mildew growth. Incorporating it into numerous products for the majority of Americans to consume resulted in TCS becoming less effective, Gosse says. Bacteria had grown resistant to the chemical, making its implementation useless in many goods while still posing health risks.

Rather than banning TCS outright, the FDA tasked companies with proving that its inclusion provided benefits. When companies declined to demonstrate the benefits of TCS in their goods, the FDA forced them to remove the chemical.

Colgate-Palmolive was able to keep TCS in its Colgate Total toothpaste after demonstrating that the product can combat gingivitis better than products without the antimicrobial agent. Public pressure eventually prompted the company to remove TCS from its product.

Gosse says the benefits of Colgate Total for consumers with gingivitis outweighed the risks, but likely not so for other users. The toothpaste, she says, should have been marketed only to people with the disease.

"The last triclosan product really standing was Colgate Total toothpaste," she says.

After years of investigation, Gosse and her colleagues determined why TCS inhibited immune cell function. They knew the antimicrobial agent stifled the inflow of calcium into the cell cytoplasm, a necessary function for immunity, but lacked the findings to define how it occurred.

A team of scientists, led by then UMaine master's student Suraj Sangroula and then UMaine undergraduate student Alan Baez Vasquez, found, to Gosse's surprise, that TCS is acidic. The chemical releases enough acid to deform the calcium channels leading into the cytoplasm in immune cells. That prevents them from transporting calcium and, therefore, from responding to various threats such as pathogens, allergens or inflammation.

The study also revealed new details about the biological pathway calcium follows throughout the cell. Toxicological studies can reveal information about basic biology, creating knowledge beyond the mechanism of a single toxicant. Gosse says by understanding how a chemical affects users, scientists can begin to predict how others with similar structures may act to prevent future harm.

Sangroula, Baez Vasquez, Gosse and their UMaine colleagues were joined by former student Juyoung Shim, now an assistant professor of biology at the University of Maine at Augusta. *Toxicology and Applied Pharmacology* published a paper describing their findings in the October 2020 issue.

It was the eighth published research paper on TSC from the Gosse lab.

"They really did the precision experiments to prove (their hypothesis)," Gosse says of Sangroula and Baez Vasquez. "Their experimental data replicated the exact conclusion drawn from their theoretical calculations."



Biochemistry major Bailey West, a student researcher in the Gosse lab, plans to pursue a Ph.D. in biomedical science. She is the recipient of the Society of Toxicology Undergraduate Student Research Award.

Through the years, the multiple TCS studies from Gosse's lab involved 12 UMaine graduate students, 19 undergraduate students, two students from the University of Maine at Farmington and University of Maine at Presque Isle, six UMaine professors and four senior research collaborators from other institutions.

Their findings provided knowledge that informed everyday people, assisted in government decision making and trained a new generation of scientists and other professionals, all of which Gosse says are crucial services from a research institution.

Many of Gosse's former and current students use skills they learned in the lab to excel in later academic studies and careers in pharmacology, biotechnology, medicine, teaching and other fields. Senior Bailey West, for example, is the recipient of the Society of Toxicology Undergraduate Student Research Award.

After leading the final TCS study from Gosse's lab, Sangroula graduated and now serves on the front lines of vaccine production for COVID-19. She works as a pharmaceutical validation engineer for Verista.

Baez Vasquez enrolled in Harvard University's molecules, cells and organisms program as a Ph.D. student after graduating from UMaine.

Students who succeed in Gosse's lab prove to be naturally hard workers with the patience and dedication needed to complete challenging experiments that lead to answers to hard-hitting questions. Gosse says she considers her students research partners, some who unveil findings she may have overlooked while performing other duties.

"We are now moving on to study new chemicals of interest, to which people are widely exposed, but for which there is little or no published toxicological or epidemiological data," says Gosse, who is working with graduate student research partners Bright Obeng and Sasha Weller, and several undergraduates including West.

"The overarching goal of toxicology research is to protect human and environmental health." ♦

The future today

Vision for Tomorrow campaign success has enhanced the fabric of UMaine

The University of Maine Vision for Tomorrow comprehensive campaign exceeded its \$200 million goal by more than \$8 million, providing funding in four major priority areas — Fostering Student Success, Ensuring Access for All of Maine, Catalyzing Maine's Economy and Accelerating Discovery to Impact.

UMaine President Joan Ferrini-Mundy and University of Maine Foundation President Jeffery Mills announced the successful completion of the record-setting fundraising effort in September.

Almost 60% of the \$208,586,510 raised is for student and faculty support. That support included more than 500 new scholarship funds.

An anonymous \$1 million matching gift created over \$4.8 million in total new investment for scholarships and other endowment support for Maine students to attend UMaine.

Other highlights include gifts supporting UMaine's six colleges and athletics, and major funding for the new Ferland Engineering Education and Design Center, which is expected to be open in fall 2022.

Among other transformational gifts that now shape UMaine's future: Emera Astronomy Center (now Versant Power Astronomy Center), Clement and Linda McGillicuddy Humanities Center, Stephen E. King Chair in Literature, Linda G. and Donald N. Zillman Art Museum – University of Maine, and Lafayette and Rawcliffe 4-H Science and Engineering Center.

Additional support for students included the Alton '38 and Adelaide Hamm Campus Activity Fund, and, in 2020, the Student Crisis Fund, created by the University of Maine Foundation to help students with emergency funding during the COVID-19 pandemic.

Thank you to all the donors who made this possible. ♦



Photo by Brenda Hall

South American glaciers

The history of South America's retreating glaciers at the end of the last ice age is the focus of a three-year National Science Foundation study led by the University of Maine.

Brenda Hall, UMaine professor of glacial geology in the School of Earth and Climate Sciences and the Climate Change Institute, will lead the team of scientists and student researchers. Their work, funded by a more than \$510,000 NSF grant, will help clarify the timing of the last ice age termination in the Southern Hemisphere and the forces behind it by studying the glaciers in the Cordillera Darwin. The ice field is located in the southern tip of South America.

Delving deeper into the last ice age termination, the largest natural warming event in recent geological history, could provide more context for understanding rising global temperatures today and improve future climate predictions.

Research team members include UMaine professor George Denton and assistant professor Aaron Putnam, both with the School of Earth and Climate Sciences and the Climate Change Institute; associate professor Joellen Russell, an Earth-system modeler from the University of Arizona, and professor Patricio Moreno, a paleoecologist from the University of Chile. UMaine students and a student from the Medill School of Journalism at Northwestern University also will join the field team. ♦

BEE APPEAL

A natural way to support Maine's wild blueberry industry is to cultivate plants popular with bees, such as butterfly weed, starflower, summer sweet, sweet clover and swamp rose, according to a University of Maine study.

Recent declines in wild native bee populations have garnered global attention, particularly in Maine where blueberry growers depend on bees to pollinate their crops. While bumblebees (*Bombus spp.*) are recognized as the most effective pollinators of wild blueberries, Maine growers are increasingly relying on *Apis mellifera*, a non-native bee, to pollinate their fields. Establishing bee reservoirs to provide forage when the blueberries are not in bloom is one strategy that could benefit Maine's native bumblebees while sustaining an economically important agricultural industry.

To ensure that bee reservoirs are effective, UMaine assistant research professor Alison Dibble led a four-year study to assess the appeal of plantings to native and other bees. The study, conducted in collaboration with UMaine researchers Frank Drummond and Lois Stack, measured the relative attractiveness of nearly 90 species of annuals, perennials and shrubs. The research results are published in a UMaine Cooperative Extension bulletin, "Selecting Plants to Support Bees in Maine: Summary of the Bee Module Project." ♦



\$4.8M FOR FBRI FACILITIES

The University of Maine Forest Bioproducts Research Institute (FBRI) will upgrade its Technology Research Center (TRC) in Old Town and Process Development Center (PDC) in Jenness Hall to bolster ongoing efforts to create new bioproducts, increase production and find uses for woody biomass materials typically considered waste.

Defense Logistics Agency awarded \$4.8 million for FBRI research in crafting renewable fuel, heating oil, chemicals, plastics and other goods from woody biomass at a large scale. Institute director Hemant Pendse says his team will invest about \$2 million in processing technology infrastructure improvements for the off-campus TRC facility, as well as the on-campus PDC facility, with the balance supporting ongoing research.

Equipment added to TRC, located on the pulp mill site in Old Town, will help researchers process biochar, charcoal derived from the pyrolysis of wood, as well as preprocess biomass. Upgrades at PDC will boost nanocellulose production.

"It's a significant upgrade in our pilot-scale infrastructure," says Pendse, also a chemical engineering professor. "This significant investment will allow us to rapidly advance development in several major areas of ongoing research."

New equipment at PDC will allow the production of nano-fibrillated cellulose starting with wood chips or sawdust particles. The new tools also will help FBRI create a variety of chemicals, liquid fuels and nanocellulose materials from woody biomass such as sawdust, and assess the prospects for beneficial uses of biochar, which is typically viewed as a waste byproduct. ♦





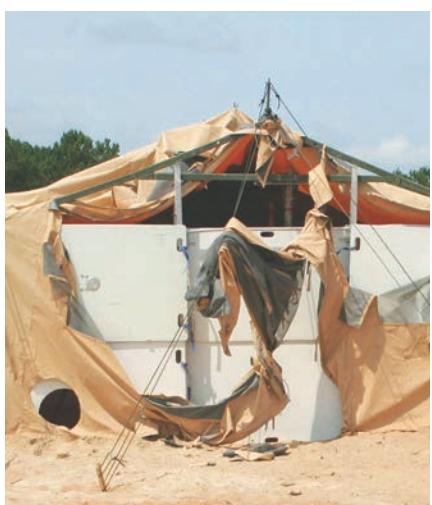
Illustration by Veena Jain

Freshwater equity

Anne Lausier and Shaleen Jain say a reevaluation and refocusing of the ways that water resources are managed are urgently needed. Equity should be a foundational tenet of management, they say, especially today when there are unprecedented pressures on Earth's freshwater resources and ecosystems. Toward that goal, Lausier and Jain put forth a Water Resources Stewardship framework, published in the journal *Water Security*, that includes six interlinking elements to comprehensively evaluate water management. Their invited article based on their research titled "Water resources stewardship: Changes, extremes, and equity," was posted in Global Water Forum, a United Nations global portal for water-related issues and knowledge.

Lausier conducted the research when she was a civil engineering doctoral student and a U.S. National Science Foundation Graduate Research Fellow at the University of Maine. She is now a physical scientist at the Office of Ground Water and Drinking Water with the U.S. Environmental Protection Agency.

She and Jain, a UMaine professor of civil and environmental engineering, say they view water resources stewardship as a societal imperative that demands carefully devised solutions toward "our shared human responsibility for the environment under changing conditions." ♦



TROOP PROTECTION

The University of Maine Advanced Structures and Composites Center has been awarded more than \$3.2 million from the U.S. Army Natick Soldiers Systems Center to support development of technologies to protect troops in the field. The research builds on decades of R&D that led to the development of products like modular ballistic protection systems to protect military personnel in tents and inflatable arches for rapidly deployable shelters. The modular ballistic panel system is lightweight and rapidly deployable. Researchers are exploring the use of 3D printing to create shelters, and the development of new materials to increase protection and reduce detection, weight, production times and overall costs. ♦

ALTERING EVEREST

New findings from the most comprehensive scientific expedition to Mount Everest in history, published in November in the scientific journal *One Earth*, identify critical information about the Earth's highest-mountain glaciers and the impacts they're experiencing due to climate change.

As part of the 2019 National Geographic and Rolex Perpetual Planet Everest Expedition, climate scientists, including those with the Climate Change Institute at the University of Maine, studied environmental changes, including in Everest's "death zone," to understand future impacts for life on Earth as global temperatures rise.

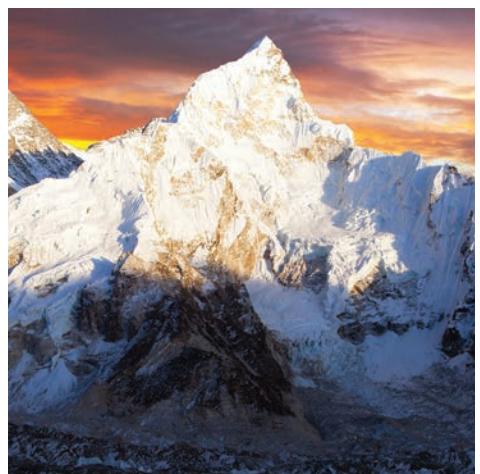
The new research fills a critical knowledge gap about the health and status of high-mountain environments, which are incredibly difficult to study due to the inhospitable environmental conditions.

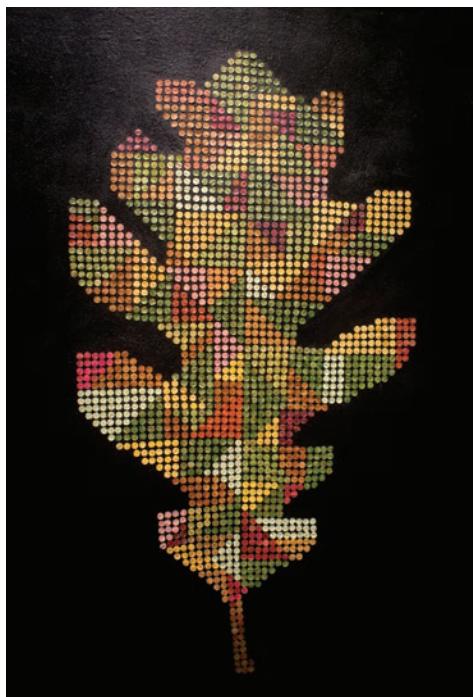
Key findings include:

The highest-ever recorded sample of microplastics was found on the "Balcony" of Mount Everest at 8,440 meters, one of the last resting spots before reaching the summit. This microplastic is likely coming from the clothing and equipment worn by climbers, highlighting the impacts of humans on even the highest reaches of our planet.

Researchers surveyed nearly 80 glaciers around Mount Everest and found evidence of consistent glacial mass loss over the last 60 years and that glaciers are thinning, even at extreme altitudes above 6,000 meters. Using declassified spy satellites and a new highest-resolution data set, this is the most complete assessment of the status of the world's highest glacier as a baseline for future research on its changes.

The research captures the first documented surge of a glacier (when it moves 10 to 100 times faster than it normally does) in the Mount Everest region, a phenomenon that can put people and communities at risk. ♦





"Biomimicry" by Adriana Cavalcanti

SEEING THE LIGHT

The way leaves reflect light can illuminate the evolutionary history of seed plants, according to an international team of scientists led by a University of Maine researcher.

Plant reflectance spectra, or the light profile leaves reflect across different wavelengths, capture the change and diversification of seed plants as a result of evolution, according to Dudu Meireles, UMaine assistant professor of plant evolution and systematics.

Meireles and colleagues from the United States, Canada, Switzerland and England explored how spectra have evolved and diversified over the last 350 million years of plant evolution. They found that by measuring the light spectrum reflected by a leaf, they can identify the plant, learn about its chemistry and evolution, and pinpoint its place in the tree of life.

Spectra also can be used to "provide breakthrough assessments of leaf evolution and plant phylogenetic diversity at global scales," the group wrote in its report for the study. Meireles says he hopes to eventually perform these measurements remotely using unmanned aerial vehicles, airplanes or satellites.

The research team conducted the study using a dataset of more than 16,000 leaf-level reflectance spectra.

The team's findings were published as the cover article in the international journal *New Phytologist*.

The cover also features artwork titled "Biomimicry," created with leaves and reclaimed wood by Adriana Cavalcanti of Orono, a UMaine intermedia MFA student.♦

#Selfies4Science

Next time you put on a face mask before heading into the grocery store, Mollie Ruben would like you to snap a selfie and send it to her. Your #Selfie4Science will support COVID-19-related research.

The University of Maine assistant professor of psychology is interested in learning about people's social perceptions and biases related to face masks in the pandemic. She's building a database of people with and without face masks for a study that will have important implications for business, health care, education and interpersonal relationships.

"COVID-19 has certainly changed many aspects of our everyday lives, but as a nonverbal communication researcher, the most stark change has been in our everyday social interactions," says Ruben. "Not only are we interacting with people in different or fewer ways, but when we do interact with others in public spaces, it's often and will continue to be behind a face mask."

Nonverbal research suggests the eye and mouth regions are particularly important for communication purposes and impression formation, she says.

Ruben is a certified Facial Action Coding System (FACS) coder and an expert at analyzing facial expressions to assess emotions. At UMaine, she directs the Emotion, Pain, and Interpersonal Communication Lab, where she examines the expression and perception of nonverbal cues, and the role of nonverbal behavior in communication processes.♦

“

We are interested in capturing **what biases may exist** for particular stigmatized groups when wearing or not wearing a mask in the hopes of using this information **to help reduce these potential biases from forming.**"

Graduate student Shelby Helwig



HEALING POTENTIAL

When the human body sustains injury, cells spring into action. New blood vessels emerge through a process called angiogenesis, and cells migrate in a coordinated campaign of healing. The ability to control these mechanisms has the potential to advance therapies ranging from cancer to wound treatment.

Polyphenols, a type of bioactive compound that naturally occurs in certain plants, have emerged as candidates for enhancing or slowing these processes. Lowbush blueberries like those grown in Down East Maine are among the richest known sources of polyphenols.

At the University of Maine, scientists are working to identify exactly which of these wild blueberry polyphenols at what concentrations influence cell migration, angiogenesis and inflammation, and how they can be applied in clinical settings.

A recent study led by Dorothy Klimis-Zacas, UMaine professor of clinical nutrition, found that different extracts and concentrations of two polyphenol fractions in wild blueberries, anthocyanins and phenolic acids, can influence blood vessel tube formation, gene expression and the synthesis of proteins — all of which are important factors in the tissue healing process.♦



WHYCLIMATECHANGEMATTERS.COM

Experts from the University of Maine, Harvard and Long Island universities, and the University of Maine School of Law have created a website with 10 talking points titled "Why Climate Change Matters to Your Security, Health & Wealth." The site offers a one-stop shop for undecided voters and the general public to understand how climate change affects the most sensitive aspects of their everyday lives, and how efforts to reduce and reverse its effects represent the defining opportunity of our time. Paul Mayewski, Distinguished Maine Professor and director of the Climate Change Institute (CCI) at UMaine; Alexander More, associate professor of environmental health at LIU and research associate at Harvard and CCI; and Charles H. Norchi, the Benjamin Thompson Professor of Law at the University of Maine School of Law and director of the Center for Oceans and Coastal Law, framed the talking points and the research supporting them. ♦



RURAL YOUTH ASPIRATIONS

For middle and high school students in some forest-dependent rural communities in Maine and Oregon, a lack of money for education is the top barrier to pursuing the career they want, according to a survey of more than 2,000 youth by researchers at the University of Maine and Oregon State University.

The teens surveyed in Piscataquis and northern Somerset counties in Maine, and in Coos County in Oregon were in agreement that training in hands-on skills, advice on education or college, and advice on jobs and applications would be most valuable in helping them realize their aspirations.

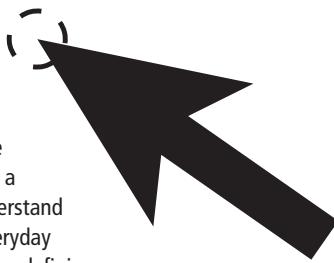
The Rural Youth Futures project survey results, published in a series of fact sheets and available on Digital Commons, provide schools and communities with insights into what the next generation of residents and workers value and need as their rural hometowns face economic, demographic and workforce changes, according to professors Mindy Crandall and Jessica Leahy.

"Middle and high school students in both Maine and Oregon were able to clearly communicate what they would like to see as a future for their hometowns, and what they'd like to see for themselves — whether more school, a career, or where they live as adults," says Leahy, UMaine professor of human dimensions of natural resources.

In 2017, Crandall and Leahy, then both faculty members in the UMaine School of Forest Resources, launched the three-year study, "Youth aspirations and labor market transitions in rural communities," funded by a more than \$458,000 USDA award. Crandall is now an assistant professor in the College of Forestry at Oregon State University.

The project looked at economic restructuring, community characteristics and young people's perceptions of local labor markets in traditionally forest-dependent rural communities in Maine and Oregon. The survey included questions designed to learn how teens felt about their local community, their school and their economy. It also explored rural youths' perceptions and aspirations, with a goal of better understanding youth decisions about their human capital investments, and the potential impact their choices may have on rural community persistence in the future. ♦

When asked where they want to live and expect to live when they are 30 years old, the largest percentage of Maine students — **31% and 35%, respectively** — said it would be in the same town, or nearby.



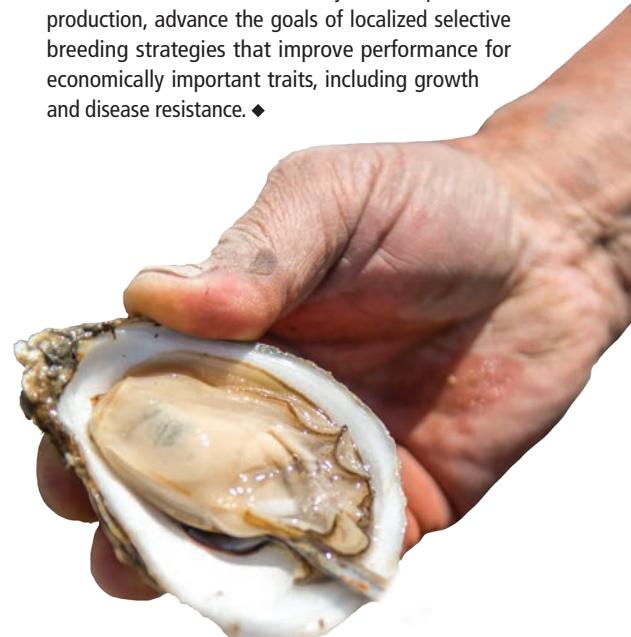
New Aquaculture Experiment Station

To address the issues facing the aquaculture industry in Maine and the nation, an Aquaculture Experiment Station has been established by the University of Maine Aquaculture Research Institute (ARI), in partnership with the U.S. Department of Agriculture Agricultural Research Service (ARS) and Auburn University. This cooperative agreement is a commitment to an ongoing conversation between researchers and the aquaculture industry to increase sustainable production and industry resilience.

The cooperative research and development agreement, eligible for renewal every five years, is funded by \$950,000 from USDA ARS for the first year, and \$750,000 annually thereafter. The Aquaculture Experiment Station will harness the expertise of ARI-affiliated faculty in Orono and at UMaine's Darling Marine Center in Walpole, and ARS researchers based on the Orono campus and at the National Marine Cold Water Marine Aquaculture Center in Franklin. The agreement also includes ARS shellfish researchers at the University of Rhode Island.

ARI faculty leads Deborah Bouchard, Damian Brady and Paul Rawson work at a national level in aquatic animal health, shellfish genetics and intelligent farm siting. As researchers in the Aquaculture Experiment Station, the three UMaine experts will expand their work to address USDA ARS priorities.

The experiment station will allow researchers to provide rapid response to the shellfish industry in a farm and hatchery setting. New research initiatives, focused on genetic improvement of North American Atlantic salmon and the Eastern oyster for aquaculture production, advance the goals of localized selective breeding strategies that improve performance for economically important traits, including growth and disease resistance. ♦



GENE DISCOVERY

Jared Talbot is part of a 32-member international research team that identified a gene that, when altered, can cause bent fingers and toes, clubfoot, scoliosis and short stature.

The team discovered that partial loss of the protein coding gene MYLPF (myosin light chain, phosphorylatable, fast skeletal muscle) results in a disorder called distal arthrogryposis (DA) that's present at birth.

Talbot, an assistant professor in the University of Maine School of Biology and Ecology, is the study's second author. He contributed equally with Jessica Chong, the first author and an assistant professor of human genetics at the University of Washington.

The discovery has several exciting implications.

"Before a disease can be effectively treated, its cause needs to be understood," says Talbot. "Right now, DA is treated through surgery, which often has to be repeated several times over a lifetime. By understanding the disease better, we may be able to discover longer-lasting and less-invasive ways to treat it."

The breakthrough adds to scientists' knowledge about how prenatal muscle formation affects health throughout a lifetime, he says.

American Journal of Human Genetics published the team's findings. ♦

OUTDOOR RESOURCES FOR TEACHERS

Students in the University of Maine outdoor leadership program have created a website that K-12 teachers can use to plan outdoor lessons and activities. The site features videos, quizzes, slideshows and other resources produced by UMaine students on topics ranging from mountain biking and wilderness survival to outdoor ethics issues, such as planning trips that leave no trace.

The resources were developed in the Advanced Methods of Instructing Outdoor Activities course during the fall 2019 and 2020 semesters. Instructor Lauren Jacobs, UMaine lecturer of outdoor leadership, says the idea is for students in the outdoor leadership program to add to and build on the resources. ♦



Photo by Joseph Kelley

Shifting shorelines

Every year since 1982, Joseph Kelley captured photos of the fastest deteriorating portion of Maine's coast, located in Camp Ellis, for use in his work as a state marine geologist, and research and teaching at the University of Maine.

The public now has the opportunity to view decades of geologic transformation captured in the images taken of the Saco-area shoreline, as well as thousands of others depicting dramatic changes in Maine's coastal vistas.

The professor emeritus partnered with the Maine Geological Survey to archive 8,000 of his landscape images, most of which depict the coast, in an online database on the state agency's website. Users will have access to photos capturing vistas at particular moments in history and time series collections featuring the shifting geology of certain places over time. The U.S. Geological Survey provided more than \$30,000 in funding for the archiving project.

The coast of Maine always changes, and every photograph of it captures an iteration no one will witness again, says Kelley, who retired from UMaine Sept. 1.

"On the coast, every photo is a 'before,'" he says.

Research Kelley conducted in the last 38 years, including studies of the response of developed and pristine shorelines to sea level change, provided ample opportunities to take photographs. His collection features photos taken from the ground and some from the air highlighting the geology of locations such as Silsby Plain in Aurora, Jasper Beach in Machiasport and Sand Beach in Acadia National Park. ♦



Photo by David Fuller

FIDDLEHEAD FINDINGS

Fiddleheads, a traditional springtime delicacy in New England and Eastern Canada, can decline significantly over time if harvesters pluck too many from the same plants in a season, according to a new four-year study conducted by a University of Maine Cooperative Extension expert.

Fern crowns with all the fiddleheads removed in a single harvest suffered significant decline in growth in the subsequent years, and in some cases were killed outright, according to David Fuller, UMaine Extension agricultural and nontimber forest products professional.

A more sustainable harvest removed 50% of the fiddleheads in a one-time picking, but also resulted in reduced frond production in subsequent years.

"These findings suggest that fewer than half of the fiddleheads from a given plant could be harvested and be sustainable with no follow-up harvest that year," Fuller says. "Plants whose fiddleheads have already been harvested by other harvesters that spring should be left alone." ♦

Portal to Franco American history

A University of Maine initiative to create a first-ever bilingual portal to Franco American history records from archives in the United States and Canada received a nearly \$60,000 grant from the National Endowment for the Humanities.

UMaine Franco American Programs, which is spearheading the Franco American Portal, also was awarded \$10,000 from the Maine Bicentennial Commission for a similar project titled "Where Were You." That effort involves developing an online public history, genealogy and map of Franco American populations in Maine.

Researchers of history and culture of the French Canadian and Acadian diaspora of New England sometimes struggle to find primary sources when pertinent records are not cataloged with relevant identifiers, or are otherwise difficult to access, says Susan Pinette, director of UMaine Franco American Programs and professor of modern languages. The online, bilingual Franco American Portal will make these Franco American records more visible, searchable and accessible to researchers, educators, students, genealogists and the public.

The University of Southern Maine Franco-American Collection; University of Maine at Fort Kent Acadian Archives; Assumption College's French Institute, Worcester, Massachusetts; and Saint Anselm College Msgr. Wilfrid H. Paradis Archives and Special Collections, Manchester, New Hampshire, joined UMaine's Franco American Programs in developing the online gateway. Jacob Albert, project manager for UMaine's Franco

American Programs, guides portal development, and Pinette oversees it.

The website will provide access to books, letters and other correspondence, scrapbooks, family and business records, photographs and other media depicting Franco American history, culture and people, all curated by the portal project team. In addition to connecting users with records from their own universities' collections, the team behind developing the portal is seeking to partner with other institutions across the U.S. and Canada. ♦



From "Memoirs of Alice Michaud Cyr, 1868-1960"

UMAINE NATIONAL TERRORISM EXPERT TAPPED

A University of Maine researcher who is a national expert on terrorism research is part of the new National Counterterrorism Innovation, Technology and Education (NCITE) Center of Excellence at the University of Nebraska at Omaha.

The center is funded by a 10-year, \$36 million grant from the U.S. Department of Homeland Security Science and Technology Office of University Programs.

The University of Nebraska at Omaha leads a national consortium of industry partners and 17 universities selected by the Department of Homeland Security.

Karyn Sporer, a UMaine assistant professor of sociology, is one of 63 researchers in the consortium. She serves as a principal investigator for counterterrorism and terrorism prevention research. Sporer received a Ph.D. in criminology and criminal justice from the University of Nebraska at Omaha, and continues to collaborate with a research team there. The team of scholars and faculty from diverse disciplines, including business, industrial/organizational psychology, and information science and technology, is examining the organizational structure of and use of innovation (e.g., malevolent creativity, including innovative weapons, recruitment tactics, etc.) by violent terrorist organizations.

Sporer's research project as part of the new center will focus on the role of families of violent Islamic extremists in reporting suspicious behavior. According to Sporer, family members of violent extremists play an important part in preventing terrorism, whether it be with deradicalization and disengagement, or by alerting authorities when concerned for the safety of their loved one(s) and/or others. ♦

FITNESS TRACKERS IN THE LOBSTER SUPPLY CHAIN

Miniature fitness trackers for lobsters and devices to monitor the quality of their shipping conditions are being prototyped as part of an initiative to reduce stress points and improve survival in the lobster supply chain for the Maine lobster industry.

The University of Maine Lobster Institute leads the initiative in collaboration with lobster industry partners and scientific collaborators at Saint Joseph's College and Wells National Estuarine Research Reserve. This effort to improve practices to reduce mortality throughout the lobster supply chain was one of 30 projects nationwide to receive funding earlier this year from the National Oceanographic and Atmospheric Administration Saltonstall-Kennedy Program. Of the eight funded projects in the Atlantic region, it is the only one focused on the American lobster.

"Maine's lobster industry asked the institute to help quantify and mitigate stress points in the lobster supply chain that reduce survival and profitability," says Lobster Institute director Rick Wahle, who is based at UMaine's Darling Marine Center. "The industry calls it 'shrink' — the mortality lobsters experience as they change hands from capture to kitchen. It's been a long-standing, contentious issue that is heating up, both literally and figuratively, in a changing climate and competitive world market."

As part of the two-year project funded at more than \$299,000, miniature sensory devices — crustacean heart and activity trackers (C-HAT, pronounced sea-hat) — are being prototyped.

Comparable to a human fitness tracker, the noninvasive device strapped on a lobster is designed to monitor heart rate and movement

as the crustacean passes from trap to on-board live tank to live storage crate to truck to wholesaler or processor.

A separate sensor-equipped device called the MockLobster also will travel along with crated lobsters to log environmental conditions experienced, including temperature, light and dissolved oxygen. ♦





Photo by Dulcinea Groff

SEABIRD RESPONSE

The Falkland Islands are a South Atlantic refuge for some of the world's most important seabird species, including five species of penguins, Great Shearwaters and White-chinned Petrels. In recent years, their breeding grounds in the coastal tussac (*Poa flabellata*) grasslands have come under increasing pressure from sheep grazing and erosion. And unlike other regions of the globe, there has been no long-term monitoring of the responses of these burrowing and ground nesting seabirds to climate change.

A 14,000-year paleoecological reconstruction of the sub-Antarctic islands led by University of Maine researchers has found that seabird establishment occurred during a period of regional cooling 5,000 years ago. Their populations, in turn, shifted the Falkland Islands ecosystems through the deposit of high concentrations of guano that helped nourish tussac, produce peat and increase incidence of fire.

This terrestrial-marine link is critical to the islands' grasslands conservation efforts going forward, says Dulcinea Groff, who led the research as a UMaine Ph.D. student in ecology and environmental sciences, and part of a National Science Foundation-funded Interdisciplinary Graduate Education Research Traineeship in Adaptation to Abrupt Climate Change. The connection of nutrients originating in the marine ecosystem that are transferred to the terrestrial ecosystem enrich the islands' nutrient-poor soil, thereby making the Falkland Islands sensitive to changes in climate and land use.

The terrestrial-marine linkage was the focus of Groff's dissertation in 2018. Groff conducted the research in the Falkland Islands during expeditions in 2014 and 2016 led by Jacquelyn Gill, a UMaine associate professor of paleoecology and plant ecology. Groff is now a postdoctoral research scientist at the University of Wyoming. ♦

Microfluidic channels

Development of a new, low-cost microfluidic water purification system by researchers at the University of Maine and Harvard University's Wyss Institute for Biologically Inspired Engineering has been funded by the National Science Foundation.

The initiative, led by Caitlin Howell, UMaine assistant professor of biomedical engineering, focuses on a method of quickly prototyping a portable pulsed-electric-field sterilization system for membrane filters with a direct route to mass manufacture on industrial-scale equipment. NSF awarded the project \$154,566 in EPSCoR Research Infrastructure Improvement funding.

Membrane filtration to purify drinking water can be expensive as the filters can become blocked with debris and need to be replaced. One solution, invented by researchers Richard Novak and Elizabeth Calamari, as well as professor Donald Ingber of the Wyss Institute, is AquaPulse, an off-grid, portable water purification apparatus that uses a pulsed electric field to kill bacteria, parasites and viruses. The system uses a series of microfluidic channels to expose the water to the electric field, removing the need for filters.

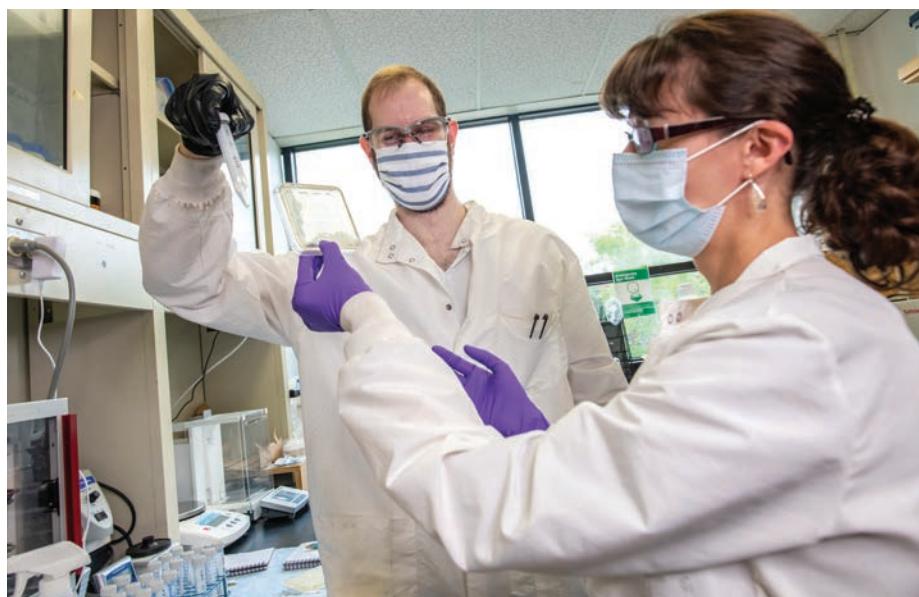
However, making these devices widely available at a low cost requires a method to mass-manufacture the microfluidic channel system. Working with Novak, Adama Sesay and Ingber, Howell will apply a new method based on 3D printing direct to industrial roll-to-roll casting, which she recently developed in collaboration with Sappi North America for fast prototyping of scalable microfluidic systems using papermaking equipment. *PLOS ONE* published a journal article about the technology on Dec. 28.

Howell and the Wyss researchers will focus on a broad range of microfluidic fabrication, assembly and analysis techniques needed to apply the process to water purification.

In addition, Howell and University of Massachusetts Amherst chemical engineer Jessica Schiffman received a more than \$225,000 NSF EAGER — early-concept grants for exploratory research — award for development of a bioengineered membrane for the detection and analysis of airborne coronavirus droplets. Collaborating on the project is UMaine virologist Melissa Maginnis. ♦

“Microfluidics exemplifies the **nanoscale texturing capability** of Sappi's Ultracast paper manufacturing process.”

Nicholas Yardy, director of release technology,
Sappi North America





“

We are proud to invest in Maine Law at this time, so our outstanding new dean, faculty and students may fully participate in the University of Maine Graduate & Professional Center's collaborative programming, along with the University of Maine Graduate School of Business and USM's Muskie School of Public Service. We hope others will join us in completing the first Harold Alfond Foundation match to the University of Maine Graduate & Professional Center now, to attain the next \$40 million grant to make a new, interdisciplinary building a reality.”

Peter McKenney

B.S. Mechanical Engineering '71, MBA '72, UMaine
J.D. '77, University of Maine School of Law

Susan Foisy McKenney

B.S. Food Science and Human Nutrition '73, UMaine
M.S. Adult Education '76, B.S. Nursing '95, USM

Investing in Maine's Future

Proud Alums and Black Bear Pair

Peter McKenney and Susan Foisy McKenney continue to commit themselves to the mission of the University of Maine System. Recently, after meeting with Dean Leigh Saufley '76, they made a new pledge to the University of Maine School of Law Foundation.

Their pledge helps the important fundraising progress toward the Harold Alfond Foundation's \$15 million matching challenge to build collaborative programs among the University of Maine System's partner institutions through the **University of Maine Graduate & Professional Center** — a first of its kind in northern New England.

For more information on supporting this effort:

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SCENE ON CAMPUS

On Feb. 12, the last beam of the structural steel frame of the Ferland Engineering Education and Design Center was lifted into place during a virtual Topping Off Ceremony. Watch it online: umainefoundation.org/beam. The \$78 million facility, named in honor of Skowhegan natives E. James "Jim" Ferland '64 and Eileen P. Ferland, will be dedicated in August 2022.