
2019
Research
Report
GLOBAL IMPACT
LOCAL RELEVANCE
1865 THE UNIVERSITY OF
MAINE

Maine's Research University at Work

Developing solutions to grand challenges of global impact and local relevance

We are delighted to present the 2019 Research Report for the University of Maine. This has been a remarkable year for research and scholarly achievements at Maine's flagship research university, where over 80% of all university-based research in Maine takes place. The University of Maine confers 96% of all PhDs awarded in the state. As one of the nation's select land, sea, and space grant institutions, the University of Maine for over one-and-a-half centuries has been at the forefront of educational advancements, research innovations, and community impact.

By building on this foundation, we have concentrated our efforts on growing the research enterprise and its impact on the university mission of:

… advancing learning and discovery through excellence and innovation in undergraduate and graduate academic programs while addressing the complex challenges and opportunities of the 21st century through research-based knowledge …

The research mission has been further defined by the University of Maine System Research and Development Plan, the development of which was led by the University of Maine. It was launched in 2019 with the primary goals of:

1. Make Maine the best state in the nation in which to live, work, and learn by 2030
2. Establish an innovation-driven Maine economy for the 21st century
3. Prepare the knowledge-and-innovation workforce in Maine

In recent years, while advancing as a modern 21st century research university, we have placed significant emphasis on the growth and development of the research enterprise. As shown by the examples provided in this report, we have been making significant progress in support of the above-mentioned goals.

In 2019, research expenditures reached $137.7 million — a 38% increase over a two-year period — and graduate enrollment grew by more than 16%. The university is ranked among the top 20% of universities nationwide for research expenditures (NSF HERD ranking), with a 25% increase in external research funding from 2018, including a 33% increase in funding from federal agencies.

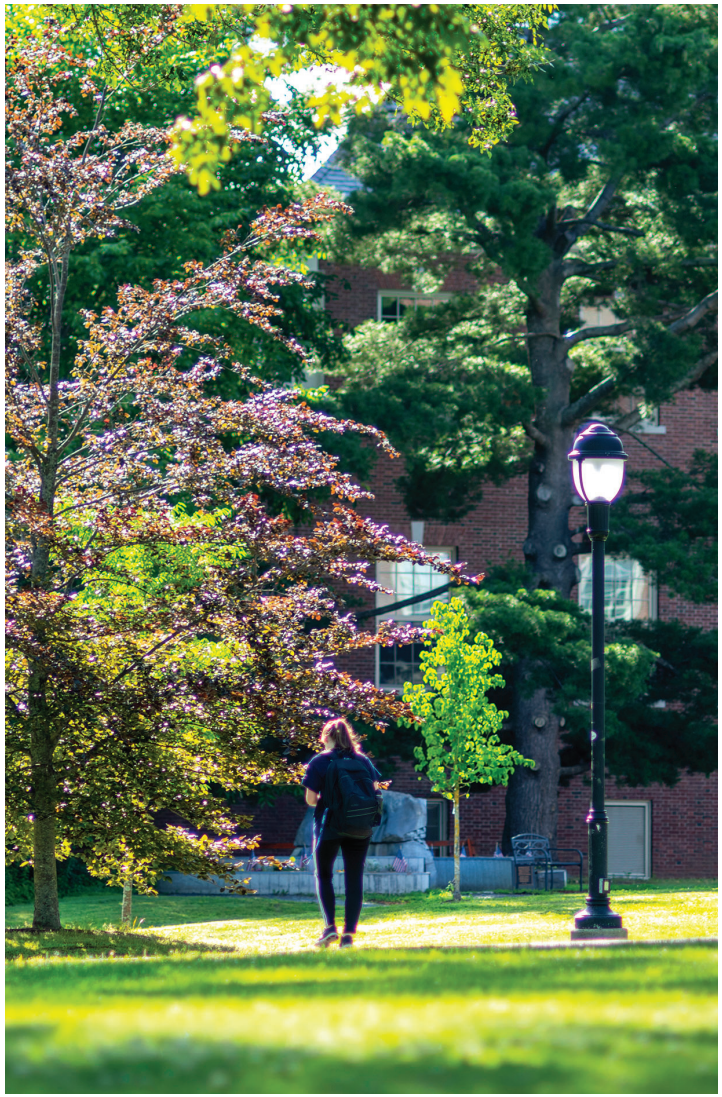
The university's nationally and internationally recognized research programs have global impact and local relevance in diverse areas, ranging from the energy, environment, advanced structures, marine and forestry sectors, to advances in human health, food and agriculture, community revitalization, and cultural preservation. Our institution is on the path to reach the highest Carnegie Classification for any top national university as a doctoral university with very high research activity.

To learn more about the impactful research and scholarly achievements realized at the University of Maine, we invite you to visit our research webpage, or contact us at research@maine.edu.

Sincerely,

Joan Ferrini-Mundy
President

Kody Varahramyan
Vice President for Research and Dean of the Graduate School

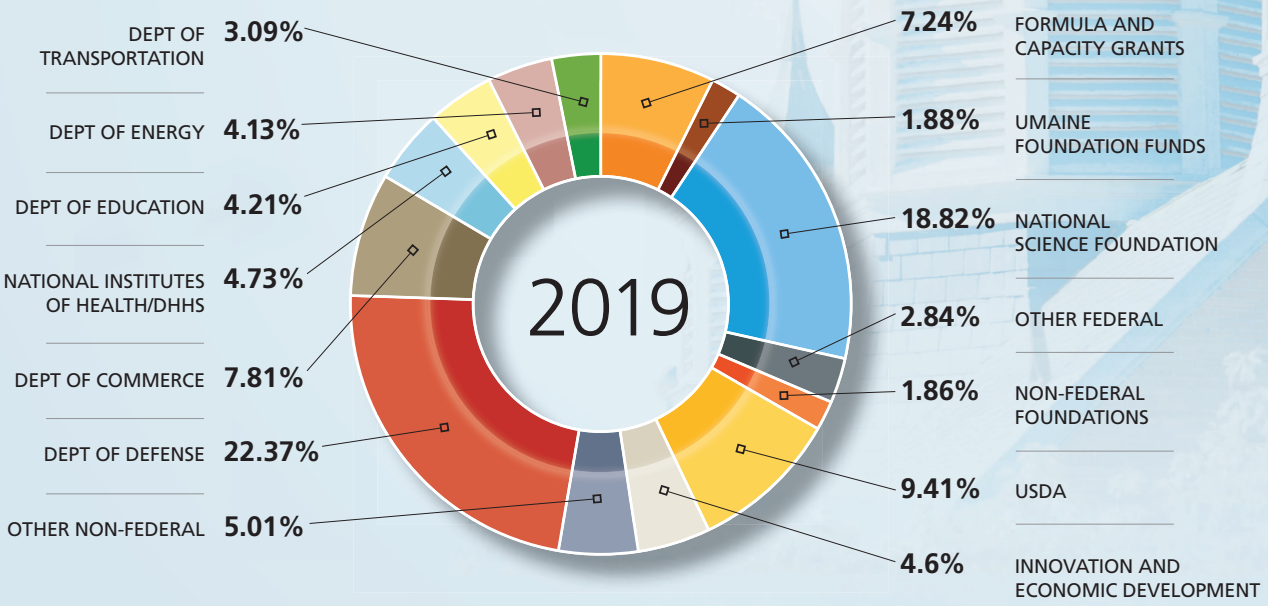


A 21st Century Research University

52% Increase

in awards greater than $1 million over previous year

Total Awards



83%

of all university research in Maine

150+

research institutes, centers, and labs

96%

of Ph.D.'s conferred in Maine

62

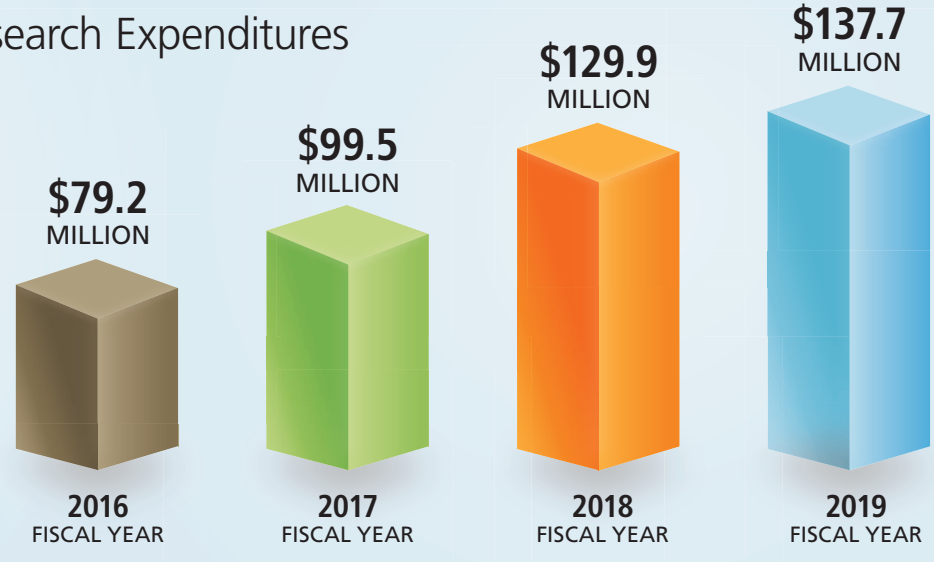
new faculty hired

Top 20%

of Universities for National Science Foundation (NSF) Funding

$137.7 Million

Total Research Expenditures



25% Increase

in External Research Funding from Previous Year

Serving Maine and Beyond

33% Increase

in Federal Funding from Previous Year

Top 20%

of Universities for Research Expenditures by NSF HERD ranking

High Achievers

UMaine climate scientists participate in National Geographic and Rolex's Perpetual Planet Extreme Expedition on Everest, to better understand 'Earth's critical life support systems'

Left: The National Geographic and Rolex Perpetual Planet expedition team, including Climate Change Institute glaciochemist Mariusz Potocki, had a spectacular view near Yellow Band, the rock on Lhotse Face between camps III and IV. PHOTO BY MARIUSZ POTOCKI
Above: From his tent, Climate Change Institute researcher Aaron Putnam had this view, which includes a portion of Mount Everest's Base Camp — the rock-covered surface of the Khumbu Glacier. PHOTO BY AARON PUTNAM

In May, Mariusz Potocki breathed the rarefied air near Everest's summit. So too, though, did hundreds of others.

Potocki was astounded by the view just below Mount Everest's Balcony at about 8,300 meters. Clusters of brightly outfitted climbers stood in a line, then moved, inch by inch, single file, toward the 8,850-meter-high (29,035-foot) peak.

"It was a little bit irrational," says Potocki, a University of Maine Climate Change Institute (CCI) glaciochemist who was working his way to the roof of Earth as part of the National Geographic and Rolex Perpetual Planet Extreme Expedition to Mount Everest.

A bit ironic, too. The goal of the two-month multinational, multidisciplinary endeavor was to document people's impacts on one of the planet's most severe environments.

Thankfully, Potocki, one of six CCI scientists who took part in the single most comprehensive scientific expedition to Everest, already had accomplished his mission. He had collected the highest ice core on the planet.

"Dreams do come true," Potocki says of conducting science on the 60-million-year-old mountain.

The researcher, cave explorer, mountaineer, underwater diver and photographer drilled the 10-meter ice core at 8,020 meters on South Col.

He did it with an off-the-shelf ice-coring instrument modified by UMaine's Advanced Manufacturing Center.

Potocki had hoped to drill another ice core May 23 just off the summit. But that was the day dozens of people attempting to reach the peak bottlenecked in Everest's "death zone." Climber Nirmal Purja snapped a widely circulated photo of the human traffic jam near the top of the world.

Potocki says if the ice core — which could be 2,000 or more years old — yields good preliminary results, he wants to return to Nepal, brave the conditions, have another shot at the summit and drill additional ice cores.

CCI director and expedition leader and lead scientist Paul Mayewski led the fantastic team. He communicated via satellite phone with Potocki and other climbers as they maneuvered through the treacherous Khumbu Icefall — a steep, shifting, jagged, narrow stretch of glacier — and ascended to Camp I (19,861 feet), Camp II (21,015 feet), Camp III (23,573 feet), Camp IV/High Camp (26,314 feet), South Col and beyond.

Mayewski directed the biological, geological, glaciological, meteorological, mapping and multimedia enterprise from Base Camp, at an altitude of 17,514 feet.

"We believe the best way to do science on Everest isn't just to do one kind of science, but do many kinds of science," he told National Geographic.

The world-renowned climate scientist and explorer is grateful for his role in this pioneering project that National Geographic calls a "new model of exploration that expands understanding of the Earth's critical life support systems and delivers data to catalyze solutions for a Perpetual Planet."

The purpose of this expedition was to examine high mountain glaciers, which are water towers for people downstream. Two other critical systems that fuel Earth's engines — rainforests and the ocean — are on the docket for future National Geographic exploration.

Water flowing from Himalayan glaciers is a resource for energy, food and consumption for about 20% of the world's population. One billion people living in the watershed will be stressed due to the shrinking of the glaciers, Mayewski says. Initially from flooding and landslides, and later due to drought.

"Water is the new oil," he says. "You need clean water to live."

While little is known about climate change impacts on iconic Everest and water towers in the region, Mayewski says this comprehensive project — which he calls "a new window into the planet" — will change that.

During the Fueling Earth's Engines discussion with other Perpetual Planet Extreme Expedition team members in Washington, D.C., Mayewski described the 10-meter-long ice core that Potocki collected at 8,020 meters on South Col as a "buried weather station." The buried treasure will allow people to go back in time — tens, hundreds and perhaps thousands of years.

"It will unlock a lot of secrets," says Mayewski, who lost 20 pounds during the two-month endeavor due to the flu and high elevation.

UMaine's laser technology that yields 10,000 samples per meter in ice cores will reveal first-ever details about the atmosphere above 8,000 meters.

Scientists will glean facts about human-made pollutants, past temperatures, precipitation and snowfall amounts. They'll also learn where air masses over and around Everest hail from — which will be key to understanding the region's monsoon cycle.

The data will allow scientists to better understand the past climate and make more accurate predictions about future climate.

In addition to analysis of the ice core, Mayewski, Potocki and UMaine colleagues will analyze numerous other specimens they painstakingly gathered.

UMaine Ph.D. candidate Peter Strand and Laura Mattas, then an undergraduate and now a Quaternary and climate studies master's student, were part of the group that wound its way up the valley to Base Camp from Lukla.

They gathered rock samples along the way. The team also used drone-mapping technology to create 3D images of landforms — moraines and the modern-day terminus of the glacier — to establish a baseline for monitoring year-to-year changes in the glacier's retreat and volume of ice.

The scientists used a technique called cosmogenic surface-exposure dating to determine when the Khumbu Glacier retreated up the valley. They started lower in the valley, sampling older ridges of rubble left along the former glacier margins, or moraines, from the last ice age. They worked their way up the valley toward the youngest landforms exposed in recent years.

The researchers followed the route pioneered by Sherpa Tenzing Norgay and Sir Edmund Percival Hillary, who are credited with being the first to summit Everest in May 1953.

Near the foot of the Khumbu Icefall at Base Camp, Earth and climate sciences assistant professor Aaron Putnam and Strand also did cosmogenic dating on recently exposed rocks to determine if they have any "memory of past times when it was warmer and the ice was smaller."

The results, says Putnam, will allow them to assess whether the current meltdown of Himalayan glaciers is unprecedented since Homo sapiens first roamed Earth.

Mayewski is eager to share those forthcoming scientific discoveries with people in Nepal so they can make informed decisions and strengthen their climate change resilience.

"Nepal opened up to us basically their heart, the most important thing they can offer us," he said during the Fueling Earth's Engines event at the National Geographic Explorers Festival.

"Our requirement, or our privilege, now is to try to put the science together and be able to talk about its impact on hydroelectric power, agriculture activities, quality of life, tourism and all of the things important to these people."

Time is of the essence, says Mayewski. ■

This story originally appeared in UMaine Today magazine

Here's a synopsis of what the explorers, including six scientists from the Climate Change Institute, accomplished during the two-month mission:

RECORDED:
- The highest ice core at 8,020 meters, and obtained additional ice cores from lower elevations

COMPLETED:
- A survey of biodiversity and wildlife in multiple high-elevation environments, including possible elevation records for at least two insect species — a centipede at 5,510 meters (18,077 feet) and a caddisfly at 5,610 meters (18.405 feet)
- The highest-elevation helicopter-based lidar scan at about 7,000 meters
- The most detailed lidar and photogrammetric imaging of Mount Everest Base Camp

COLLECTED:
- Glacial lake sediment cores
- Rocks for glacial and geologic analysis
- Snow samples from each precipitation event over the study period
- Water samples from seven glacial lakes

CONDUCTED:
- The highest-resolution scans of the Khumbu Glacier

INSTALLED:
- Five automated weather stations on Everest, two of which are the world's highest operating stations — at South Col at 7,945 meters, and on the Balcony at 8,430 meters. Data is available at www.natgeo.com/everest.

Historic 3D Printing

The Advanced Structures and Composites Center celebrates historic event: Unveiling the world's largest 3D printer and 3D-printed boat

"This is a big deal," said Sen. Angus King at the Oct. 10 unveiling of the world's largest 3D printer at the University of Maine Advanced Structures and Composites Center (UMaine Composites Center).

Big, indeed. In fact, UMaine now boasts three Guinness World Records for the world's largest prototype polymer 3D printer, largest solid 3D-printed object, and largest 3D-printed boat.

While the 60-foot-long printer and the resulting structures it produces are huge, physically — the innovative research and collaborative interdisciplinary work behind them are enormous.

The U.S. Department of Energy's Oak Ridge National Laboratory (ORNL) is a key partner in the fundamental, biobased additive manufacturing research enterprise at the UMaine Composites Center. This collaboration will focus on developing innovative and sustainable materials conducive for large-scale 3D printing.

Researchers are already brainstorming how to utilize cellulose nanofiber (CNF) — the nanocellulose product derived from wood by breaking it down to its nano scale — to develop economical, strong, and recyclable bio-based feedstocks for large-scale 3D printing.

The CNFs can have mechanical properties similar to metals. Combining them with polylactic acid (PLA) thermoplastic resins produced from corn creates 100 percent bio-based and 100 percent recyclable materials for 3D printing applications.

The UMaine Composites Center recently printed a 1,200 pound mold for the roof of a limousine boat using a polylactic acid (PLA) thermoplastic resin strengthened with microcellulose and nanocellulose fibers.

3Dirigo weighs 5,000 pounds and was printed in 72 hours. Distinguished guests, including Sen. Susan Collins, Sen. Angus King, and Rep. Jared Golden demonstrated the boat's seaworthiness in the UMaine Composite Center's wind-wave pool after its ceremonial christening.

The unveiling ceremony featured the printer itself and items it has successfully produced, such as a communications shelter for the U.S. Army (printed in 48 hours) and a 25-foot-long Navy patrol boat (printed in 72 hours) designed by industry partner Navatek, a leader in ship design.

The world's largest 3D-printed boat is named 3Dirigo — "Dirigo" is the state of Maine's motto and Latin for "I Lead." Very fitting for the technology that will lead the world in a new era of green design and manufacturing.

"We are delighted about this latest accomplishment by our Advanced Structures and Composites Center, which is another example of how Maine's research university is at work with respect to its global impact and local relevance," says UMaine Vice President for Research and Dean of the Graduate School, Kody Varahramyan.

James Anderson, senior R&D program manager and 3Dirigo project lead, developed the innovative, patent-pending process to print the boat. The boat, printed in 72 hours, was monitored 24/7 by Anderson and Rich Fredericks, a recent grad from the UMaine School of Forest Resources.

"This groundbreaking effort builds on more than 20 years of bio-filled thermoplastic materials research by professor Douglas Gardner, structural composites work by professor Roberto Lopez-Anido, and cellulose production by professor Hemant Pendse and his colleagues in Chemical and Biological Engineering," says Habib Dagher, project principal investigator. ■

Paving the Way

The University of Maine is a leader in cutting-edge, innovative research that will improve transportation throughout New England, reduce costs and positively impact the durability of infrastructure.

RECENT DEVELOPMENTS

A $500,000 National Science Foundation research grant to the University of Maine to study self-driving vehicles aims to make the transportation of the future more accessible, usable and trustworthy.

Nicholas Giudice and Richard Corey, who run and direct the VEMI Lab at UMaine, are co-leaders of the project, which is designed to improve user trust of fully autonomous vehicles through a new study they call human-vehicle collaboration (HVC).

The goal is to explore new ways of sharing how decisions are made and information is communicated between the human passenger and the artificial intelligence "driver." This will address the key human factors of perceived loss of control over driving activities and fear of not "knowing" what the vehicle is doing during autonomous operation.

"Current vehicle designs have often overlooked passengers and their diverse needs, especially the very people who will benefit most from their release," says Giudice. This project seeks to extend the potential of autonomous vehicles to all users.

DAGHER RECOGNIZED

The Maine Better Transportation Association (MBTA) – the largest transportation organization in the state – recognized Habib Dagher, founding executive director of the University of Maine Advanced Structures and Composites Center, as the 2019 Transportation Champion.

The University of Maine is the U.S. Department of Transportation's regional hub for the Transportation Infrastructure Durability Center (TIDC), also under the direction of Dagher. It works on a national scale to reduce costs and improve technology within the industry. Five universities collaborate on research at the TIDC. Maine's partners are University of Connecticut, University of Massachusetts Lowell, University of Vermont, University of Rhode Island and Western New England University.

In October, the world's largest 3D printer made the world's largest 3D-printed boat in 72 hours at the Composites Center. Dagher holds more than 57 patents and was honored as the 2015 White House Transportation Champion of Change. ■

The Next Generation of Conservation Leaders

The National Science Foundation Research Traineeship (NRT) Program has awarded the University of Maine with a five-year, $2.9 million grant.

A unique traineeship program designed to produce interdisciplinary environmental conservation leaders now offers Master's and Ph.D. degree opportunities to address the challenges presented by global and local changes in environmental, social, economic and climatic conditions.

The National Science Foundation Research Traineeship (NRT) Program has awarded the University of Maine "NRT: Enhancing Conservation Science and Practice" program with a five-year, $2.9 million grant to train graduate students in research-based curricula to pursue a range of STEM careers in all workforce sectors associated with conservation efforts.

The first cohort of seven graduate students started in fall 2019, with two more starting in spring 2020. Students participate in a variety of courses and have the opportunity to collaborate with a diverse group of peers, mentors, faculty and conservation partners as they pursue their research and coursework.

Neil Clayton, from Ashland, Oregon, whose focus in the program is habitat conservation feels that, "If you want to be empowered to make a difference and understand the complexity of conservation from a holistic perspective, this program is for you."

Asha DiMatteo-LePape, from Guilford, Vermont, says the program provides the tools and support to gain practical skills for real-world conservation collaboration and implementation as she focuses on the study of moose conservation and management.

Lydia Horne, from Holden, Maine, was drawn to the program because of its focus on transdisciplinary teamwork that integrates social and biophysical sciences. She studies how Maine's coastal tourism industry experiences and thinks about climate change impacts — and how these impact how they plan and react.

Valeria Briones, from San Rafael, California, wants to gain experience conducting her own research and become prepared for a career leading research projects in the future. Her program focus is in remote sensing and spatial analysis — studying phenological trends and how they impact Maine's $6.2 billion recreation and tourism industry.

Left to right: Gabriela Wolf-Gonzalez, Valeria Briones, Neil Clayton, Kathleen Bordewieck, Gabrielle Sherman, Asha DiMatteo-LePape, Lydia Horne

The program is led by Sandra De Urioste-Stone, associate professor of nature-based tourism, and involves faculty with expertise in several fields, including communication, conservation biology, community psychology, ecosystem modeling, economics, forestry, tourism, governance, and public policy.

"This is such an exciting program that allows for collaboration among faculty, students and conservation partners to work across disciplines, to solve emergent conservation problems in Maine," says De Urioste-Stone. "Our program focuses on providing students both technical and practical skills that will enhance graduate students' ability to work in multiple settings, and not just academia. We are thrilled to have welcomed our first cohort this fall, and to all the joint learning that is occurring in and outside the classroom as we work with our partners." ■

The University of Maine has also been awarded a second NRT award for the One Health and the Environment initiative. The National Science Foundation Research Traineeship (NRT) — "Convergence of Social and Biophysical Sciences to Optimize Training in One Health" program begins in September 2020.

Collecting Genetic Fingerprints

Solving coastal ecosystem challenges.

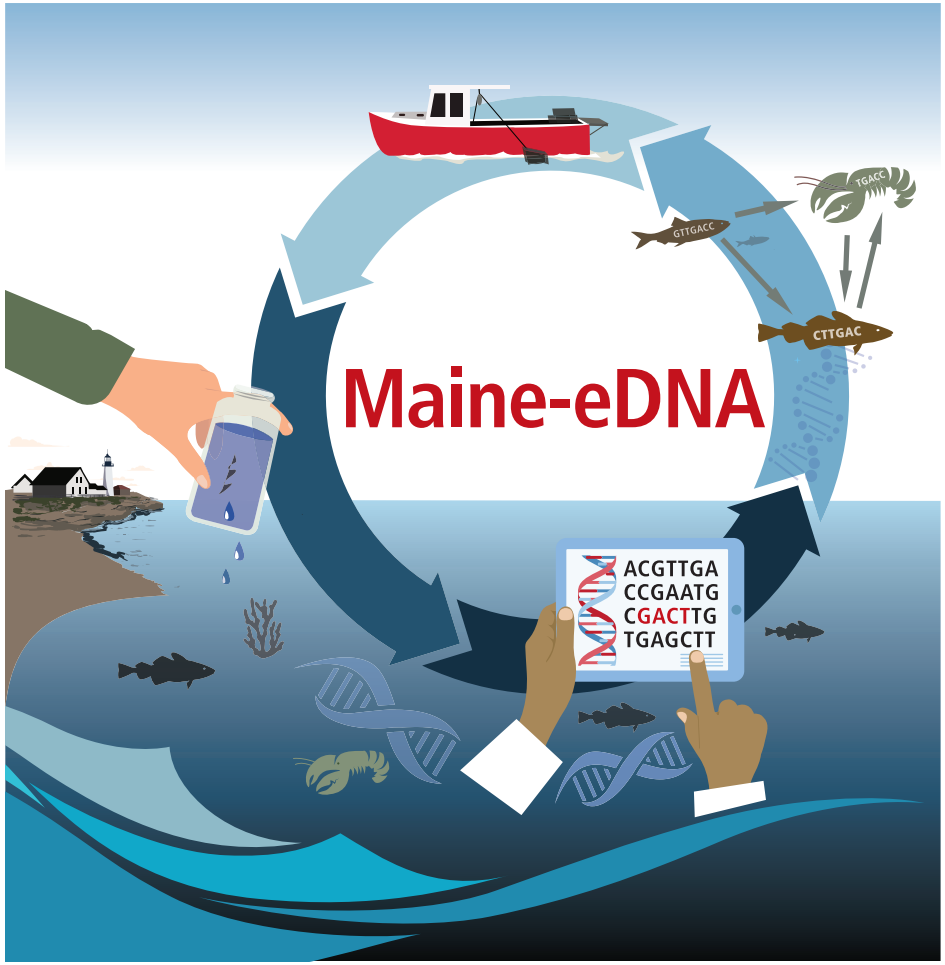
All organisms leave traces; whether they be pawprints, fingerprints, or DNA. We are able to track pawprints through the woods to find animals or collect left-behind fingerprints at crime scenes, but what about DNA? Or, more specifically, DNA from small organisms that live in the deep and expansive ocean?

In August 2019, the University of Maine, Bigelow Laboratory for Ocean Sciences, and other collaborators were awarded a $20 million grant from the National Science Foundation (NSF) EPSCoR program to develop efficient ways to collect the DNA of those small organisms. The Maine EPSCoR Track-1 Grant: Molecule to Ecosystem: Environmental DNA as a Nexus for Coastal Ecosystem Sustainability for Maine (or Maine-eDNA), will collect, identify, and link the genetic fingerprints of marine ecosystems back to specific species.

The five-year initiative will aid in monitoring coastal systems and improve outcomes, such as healthy fisheries and aquaculture, and reduce costs from harmful invasive species of toxic algal blooms for the state of Maine. With the funding provided from the Maine-eDNA grant, students, scientists, agencies, industries and citizens will collect water samples from around the state to create an expansive understanding of how species — the building blocks of communities — interact to make ecosystems function.

Environmental DNA (eDNA) is the genetic material left behind by organisms in their environments as a byproduct of their natural life and death processes. For some microbes, eDNA can come from the whole living organism. For larger organisms, eDNA typically comes from shed skin cells, gametes or waste products. Samples of eDNA typically look like a bottle of water — providing the state of Maine with a safer, more accessible and sustainable alternative to previous collection methods, such as nets, trawls, or divers.

Dr. Kody Varahramyan, the University of Maine vice president for research, dean of the Graduate School, and Principal Investigator of Maine-eDNA stated: "The Maine Environmental DNA initiative represents a multi-institutional partnership that will position Maine as a national leader in the understanding and sustainable use of coastal ecosystems, and in addressing the statewide workforce needs in critically important areas, including biotechnology, ecology, environmental and data sciences."



After months of development, the five-year Strategic Plan for Maine-eDNA was accepted by the NSF in October of 2019. The Strategic Plan established resources, including graduate and undergraduate support, and set in motion the field sampling and data collection needed to complete the objectives of Maine-eDNA.

Now, Maine-eDNA is getting its feet wet in their first year, with leaders, researchers, faculty members, and industry partners feeling optimistic. The next four years will see the state progress in genetics-oriented research and outreach, and sustainable practices will be developed to benefit all residents of Maine. ■

Supporting Marine Economy

$1.6M from NOAA Sea Grant National Aquaculture Initiative

Maine Sea Grant, UMaine researchers, and partner organizations received $1.6 million to lead four projects to advance sustainable aquaculture in Maine.
The projects will:

- Establish a Maine Aquaculture Hub to build capacity for innovation, diversification and workforce development
- Examine public perceptions of recirculating (land-based) aquaculture systems (RASs)
- Develop innovative technologies for commercial shellfish growers
- Examine the viability of quahog and oyster cultivation in Maine

"With these new resources, the Maine Sea Grant program will be able to conduct additional research and analysis that supports the sustainability of this emerging sector of the Maine economy—from work on food safety and quality to developing new markets and providing critical information to policy makers." – U.S. Sens. Susan Collins and Angus King.

$2M American Lobster Initiative

Maine Sea Grant and UMaine researchers Rick Wahle and Damian Brady are project leaders in the $2 million NOAA National Sea Grant initiative to increase the American lobster industry's resilience to the biological, economic, and social impacts of ecosystem change in the Gulf of Maine and Georges Bank.

The initiative supports seven two-year research awards and a four-year regional lobster extension program. Wahle received a research award to examine lobster larval feeding ecology, and Brady will explore the potential effects of warming on the early life history of the American lobster. Maine Sea Grant will lead the four-year lobster extension program in partnership with state Sea Grant programs in NH, MA, RI, CT, and NY, and a regional steering committee of lobster industry representatives and resource managers.

The extension effort is designed to complement and enhance the research investments by facilitating collaboration with industry and resource managers to identify additional research and technical assistance needs, and support cross-sector communication and outreach. ■

Sea Grant
Maine
at the University of Maine

Interns Dive into Aquaculture

A collaborative program between the Aquaculture Research Institute (ARI) at the University of Maine and aquaculture industry partners supported 13 undergraduate interns in a wide range of hands-on research and work experiences in summer 2019.

Aquaculture research covers broad topic areas, such as fish health, product development, impacts of ocean acidification, species husbandry and science communication strategies. Students looking for careers in aquaculture farming or with regulatory entities, such as NOAA or the Department of Marine Resources, benefit from experiential internships like the ARI Summer Aquaculture Internship Program.

"Aquaculture isn't all just farming fish," says Emily Tarr, a marine science major from Holden. She designed outreach materials and educational content for the Aquaculture Research Center in Orono. Tarr credits this internship for the professional connections she made and the opportunity to learn about other aspects of aquaculture from her peers.

The interns were mentored by nonprofit and industry leaders to gain hands-on experience in workplaces across Maine.

Student projects ranged from studying seaweeds' capacity as a buffer from ocean acidification, the use of eel waste as crop fertilizer, sea lice effects on Atlantic salmon, and harmful algal blooms in Downeast Maine. ■

Aquaculture research covers broad topic areas, such as fish health, product development, impacts of ocean acidification, species husbandry and science communication strategies.

Left to right: Callie Stout, Hallie Arno, Kenny Lamm, Emma Christman, Tessa Houston, Grace Robie, Declan Brinn, Jessica Moore, Sophie Garbuz, and Selah Smith. *Not pictured: Emily Tarr, Kate Hustus, and Alex Cirata.

Art Fusion and Interpretation

Giles Timms, assistant professor of art, is a digital artist who combines various media and genres into new, hybrid forms to explore the interrelationship between art, technology and science. In the classroom, he encourages students to embrace experimental failure when creating digital art and 2D animation.

"When we explore new concepts and methods — and go beyond what we already know — we learn and grow," he says.

Timms describes his research process as iterative and experimental. He explores the fusion of media and technology, looking for combinations that work in an innovative way. *Touch my Human* was inspired by the "terrific and terrifying absurdity of modern life." ■

Touch my Human, Giles Timms, 2019 digital print, laser cut plywood, digital photograph, 2D animation and augmented reality collaborator: Ian Donnelly, NMD 2019

Laurie E. Hicks, professor of art and curator of Lord Hall Gallery, views art as a means to investigate, understand and engage with the diverse experiences and possibilities that make up everyday lives. As a teacher, Hicks encourages students to reach beyond the creative process and enhance awareness of how art functions as a means of communication and how that influences our thinking, and as a result, our actions.

"My hope is that they will learn to critically engage with, unravel, and make sense of the visual and material culture that surrounds them — and perhaps more importantly, that they create as artists," says Hicks.

Between 2010 and 2015, Hicks explored the role of a documentary photographer in the ChinaVine research project. Her efforts resulted in archiving more than 10,000 images to make information about China's cultural and artistic traditions accessible to an English-language audience.

Hicks continues to examine how photographers act as active and intentional interpreters of the world; how they communicate particular views of the world and how they decide what is important to record — and what is not. *Carrying Bricks in Lijiang, China*, documents the process of construction workers selecting and transporting bricks to build a wall. ■

Carrying Bricks in Lijiang, China, Laurie E. Hicks, 2010 Digital photograph

Poetry as Therapy

Kim Crowley has personally experienced the therapeutic benefit of writing poetry during difficult times. Her Honors thesis, "The Personal is Poetic: A Case for Poetry Therapy," aims to further advance the method of using poetry as therapy for individuals who seek to process traumatic or otherwise difficult personal events.

As an inaugural recipient of the Clement and Linda McGillicuddy Humanities Center (MHC) Undergraduate Fellowship, Crowley conducted an in-depth literature review into the field of poetry therapy. She wanted to see if there was a scientific basis for the therapeutic effects writing poetry has for her.

She found a substantial gap in the current literature on poetry as self-help — and hopes that will soon change.

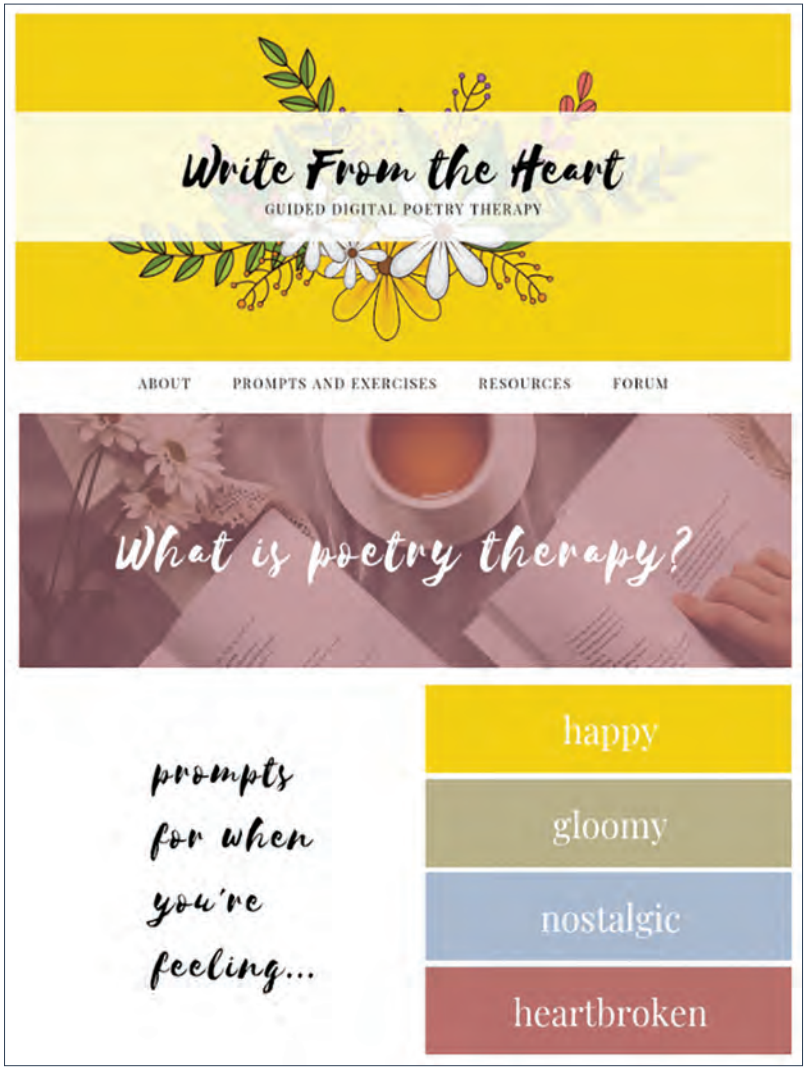
Crowley believes poetry can reach individuals who are unwilling or unable to engage in traditional therapeutic settings. Poetry can help control the fragmented narrative for people who feel out of control of their own thoughts.

"Traumatic memories are often more disorganized than regular memories," explains Crowley. "In creating a narrative, you are helping piece together the structure of that memory and make it easier for your brain to process — and regain control of your own narrative."

For those who feel poetry is intimidating, Crowley encourages them to embrace the free-form model of writing without following literary rules.

"This isn't about the writing, it's about what you're creating for yourself," she says. "If there is something you want to express but you don't want to be super explicit, you can express it using metaphor. It's very freeing for a lot of people."

Crowley earned her bachelor's degree in English in 2019 and now works as an Honors Associate for the UMaine Honors College. She plans to turn her undergraduate research into a poetry therapy workbook and other online materials for therapeutic use. ■



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Leading in Telepractice Therapy

Judy Walker travels to many places during a typical day: from several spots in Maine, and all the way to Fiji. All without leaving her lab.

Walker is an associate professor in Communication Sciences and Disorders and coordinator of the University of Maine Speech Therapy Telepractice Program. She oversees services provided by students and faculty to clients around the world in need of speech therapy, such as those with language disorders or brain injuries. Most of these clients live in rural areas and do not have easy access to health care services.

The telepractice method, conducting therapy online, is cost-effective and allows sessions to take place with minimal technology. To attend, users must only have a device that can connect to high-speed internet.

Walker says there is more to using this method than simply setting up video chats with clients and pathologists. Curriculum must be developed and infrastructure must be in place.

And she should know. The program is the only one in the state of Maine that trains speech pathologists and continues to expand and evolve to meet demand.

"We are cutting-edge," says Walker. "And we do some of the most creative speech therapy for our clients."

To date, the program has provided one-on-one services to individuals ranging in age from 4 to 85 years old in convenient locations, including schools and their own homes. A powerful advantage of telepractice is that parents or other caregivers can join the sessions to observe from anywhere — allowing the client's support system to become more engaged in therapy and track progress.

UMaine students also benefit from the clinical practicum experience while learning the telepractice model of medical service delivery. They provide a tremendous service for the state — and beyond.

"It's a win-win situation," says Walker.

Other areas of the world in need of speech pathologists are exploring this novel approach to therapy. Walker publishes her research findings, training manuals and book chapters so other practitioners can have the information needed to begin similar programs in their locations.

The treatment techniques for telepractice are unique. "In working with people with aphasia, [the loss of ability to express or understand speech], telepractice has literally changed the way I do therapy," says Walker.

Practitioners can provide real-world scenarios during a session. For example, they can have a client "drive" through their neighborhood using local 3D maps to gauge how they would react to situations encountered on the road — reading signs, following directions and more.

"We are helping people every day. Each day brings joy in some capacity," says Walker. ■

A powerful advantage of telepractice is that caregivers can join the sessions to observe from anywhere — allowing the client's support system to become more engaged.

Judy Walker and graduate students Taylor Poli and Nicole Donnelly provide care to clients in rural settings in the Speech Therapy Telepractice Program.

Connecting Cultures through Art

Artist Titi de Baccarat leaves exhausted but focused after a month-long residency at the Innovative Media Research and Commercialization Center (IMRC).

"This opened up lots of possibilities. I had twenty-four-hour access to the facilities without pressure and a collaborative atmosphere," he explains.

De Baccarat hands over a 3D printed set of ears — exact replicas of those of the Intermedia Program graduate student who helped him with the equipment — to prove the collaborative nature of the "Researcher in Residence" program.

"I wanted the students to feel part of my project," he says, smiling.

The result of his focus is a new collection of almost two dozen sculptures that have emerged as figurative extensions of how he sees human potential. Through these colorful works, de Baccarat wants to bring attention to issues such as justice and privilege. Often working with found and recycled objects, he incorporates bottles with various metal and carved wooden elements.

"I like the idea that a bottle can be opened or closed, filled or empty. Some bottles are transparent and let light through, and a bottle is both resistant and fragile like human life," he explains. "Like bottles, we have the choice to open our lives to others, to fill our hearts with love and compassion."

Looking over the series of sculptures, he fondly refers to them as his children.

AN IMMIGRANT ARTIST OVERCOMING CHALLENGES AS IN AMERICA

De Baccarat's hope for compassion is rooted in his experiences coming to America as an immigrant. He arrived in New York from Gabon in 2014, where he immediately felt overwhelmed. Afraid and penniless, he met a kind church member who offered him a place to stay in Providence, Rhode Island. Though it was an improvement, he spent the next three months trying to find a place he could really call home.

Finding a new community that would welcome him as an immigrant without money or connections was difficult. De Baccarat decided to settle in Portland, Maine in early 2015, a city with a strong sense of community and resources to help him navigate his new life in America.

As he tackles the challenges of living in a new country, he faces the usual difficulties every artist has to support himself while continuing to produce artwork. Balancing artists' residencies while finding steady income can be a challenge.

Through all of this he has emerged as a rising star in the Portland art scene. In 2018, de Baccarat had a solo exhibition at Berwick Academy, titled "True Me in My Community" in the school's Jackson Library Gallery, and a show in Railroad Square's "Art in the Lobby" show, as part of the statewide initiative Making Migration Visible: Traces, Tracks, and Pathways. He also has given numerous talks around Maine.

DE BACCARAT EXPLAINS THE VISION HE HAS FOR HIS WORK

"Through my artwork, I want to create connectivity, bring my light and culture to Maine, find my place in society and to have an impact. As a voice for my community, I can create a connection with Africa."

His pieces are colorful extensions of his personality.

"I love music, it inspires me," he says. "I listen to songs from my home while I work."

Unsurprisingly, he misses his home and his family, where he is one of six brothers. Though he tries to not look back, he does not want to forget his culture and his history.

"When I came here I tried to think about what I wanted to contribute, what I could bring to America, he says. "All I have to share is my culture and my artwork."

As Researcher in Residence for the month of February, he was able to do just that. De Baccarat looks forward to some rest after the intense period of creativity and leaves with a new series of artworks — and a great many 3D printed ears. ■

Artist Titi de Baccarat was the Researcher in Residence in February 2019 at UMaine's IMRC.

Wild Blueberries Aid in Wound-healing

University of Maine professor of clinical nutrition Dorothy Klimis-Zacas has been awarded a $25,000 grant from the Maine Technology Institute (MTI) to support research into the wound-healing properties of bioactive compounds found in Maine wild blueberries.

Klimis-Zacas has been researching the favorable effects of wild blueberries on human health for more than 20 years. Her recent work focuses on two classes of compounds extracted from wild blueberries — anthocyanins and phenolic acids — that have documented benefits in the treatment of chronic diseases.

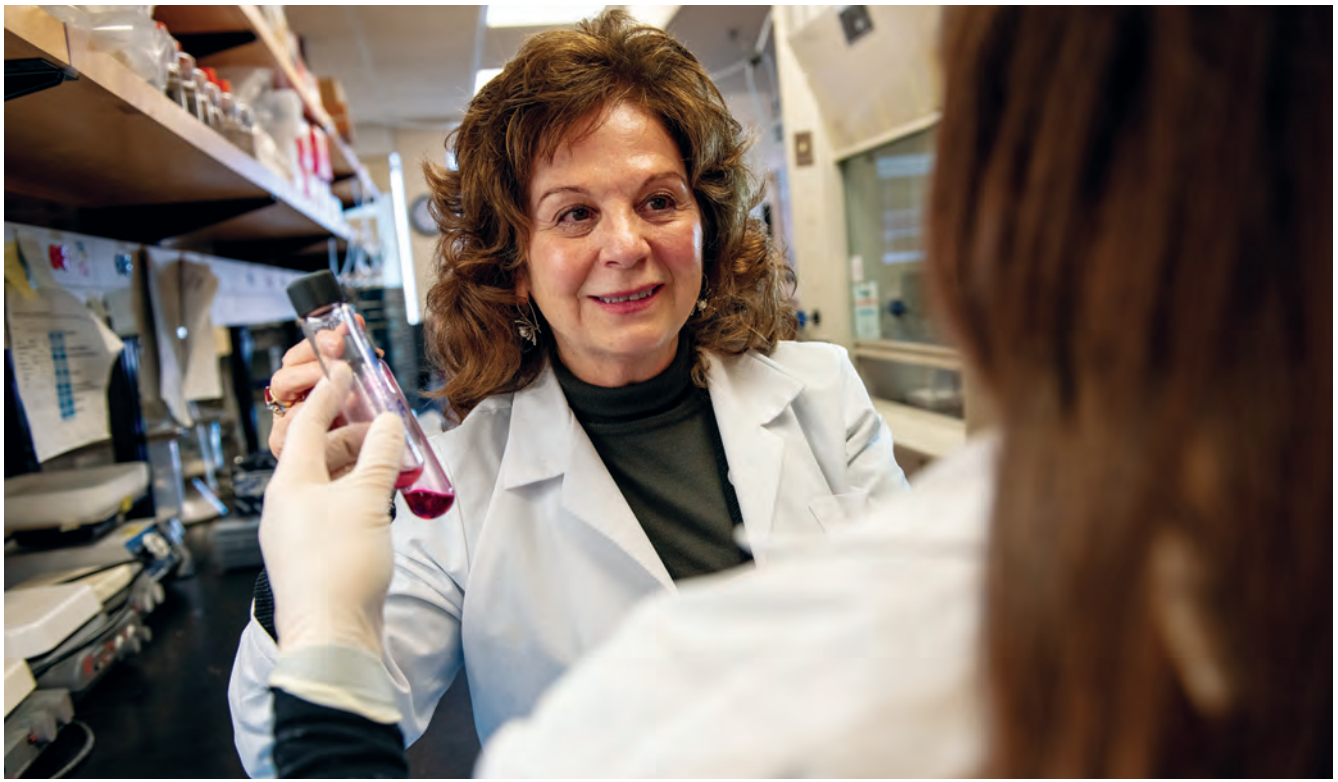
Specifically, Klimis-Zacas has found that phenolic acids extracted from wild blueberries significantly promote cell migration and the speed of wound closure. Research on this topic was published last year in the Journal of Cellular Biochemistry and the journal Nutrients, with a third manuscript under review for publication. All three papers are co-authored by former Ph.D. student Panagiotis Tsakiroglou as part of his doctoral research. A patent for the extracts and methods used in this research is pending.

Klimis-Zacas' research has potential to contribute to the field of wound healing and skin regeneration, including the treatment of burns and chronic diabetic wounds. Diabetic patients are prone to reduced blood flow to their extremities, which often results in impaired wound healing, infirmity, increased health care costs and lower quality of life.

The MTI grant will support Klimis-Zacas' efforts to develop a biomedical product prototype with embedded bioactive compounds for the commercial marketplace. These funds serve as a partial match to a $40,000 UMaine Medicine Seed Grant she received, which is dedicated to funding preclinical studies into this technology. The Wild Blueberry Association of North America and the USDA's National Institute of Food and Agriculture also have supported the research.

Klimis-Zacas has partnered with Dr. James Weber, UMaine associate professor of animal and veterinary sciences, and doctoral student Natalie VandenAkker, to develop a path to commercialization. The team participated in UMaine's I-Corps program in spring 2019, a six-week workshop funded by the National Science Foundation that focuses on identifying market opportunities for STEM-based research.

The team also was recently accepted into the spring cohort of the Maine Innovation, Research and Technology Accelerator (MIRTA), the university's commercialization accelerator. MIRTA is an intensive program that guides participants through market and intellectual property analysis to develop a business model and, ultimately, a commercialization plan with a strategy for bringing the research to market. This could include starting a company, licensing to an existing company, or forming an extended research collaboration with an industry partner. ■



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CORE MAINE
Coordinated Operating Research Entities

CORE centralizes major research equipment and facilities at the University of Maine to make it easier for anyone to find and use — whether it's internal research faculty or staff, or external clients who want access to this equipment for their own research. The goal is to become a one-stop shop for access to these critical research tools.

MICROFABRICATION CLEANROOM FACILITY

The Microfabrication Cleanroom is a 3500 ft^2 class 1000 clean room that maintains dedicated instrumentation for micro- and nano-fabrication of microsensor technologies, and for atomic- scale materials synthesis research. This is a state-of-the-art nanotechnology facility that is part of the Frontier Institute for Research in Sensor Technologies (FIRST) research center.

INNOVATIVE MEDIA, RESEARCH AND COMMERCIALIZATION CENTER

In addition to general support, workforce training and workshops, the IMRC provides a full range of specialty services for individual, groups and businesses. Technical services include material cutting/shaping with the laser or CNC equipment, digital output and printing, one-on-one instruction, audio recording and post production, video editing and post production, product testing, performances and presentation technical support, exhibitions and trade shows.

eDNA SERVICE CENTER

The eDNA laboratory conducts all aspects of eDNA research and testing. Staff develop assays, collect, process and test samples and are available to consult for sample design. Technical services include sample design consultation, sample collection, sample filtration, DNA extraction, inhibition clean-up, sample qPCR testing, starting copy number calculation, report of findings and training.

ZEBRAFISH LABORATORY

The Zebrafish Facility is outfitted with the Aquatic Habitats for Accelerated Bioresearch (AHAB) fish rearing system (Aquatic Habitats, Apopka, FL). This system is composed of five-foot wide, five-level, stainless steel racks using any combination of tank sizes (3 and 10 liter). Water input lines deliver UV-sterilized water to each tank through an independent valve. The fish tanks have self-cleaning bottoms and the effluent system features an optically clear design. The filter system requires minimal maintenance, and maintains high water quality and dramatically reduced disease and mortality.

TECHNICAL AND ADMINISTRATIVE SERVICES CENTRAL

The mission of TASC is to provide timely, professional business and technical support for the university community to increase service and operational efficiency that allows the organization to focus on its mission of delivering world-class research and teaching.

ADVANCED RESEARCH COMPUTING

As the University's central high-performance computing support resource, UMaine ARC strives to provide its user community the best-possible service in the most timely and cost-effective manner. Its primary goal is to support the advancement of research and discoveries of global impact and local relevance that are enabled through advanced high-performance computing.

ELECTRON MICROSCOPY LABORATORY

The Electron Microscopy Laboratory offers the tools and technical expertise for research and training in microscopy with both light and electron microscopes. We maintain and operate electron microscopes (TEM and SEM with EDS), a confocal laser scanning microscope, and the ancillary equipment needed for the preparation of specimens for EM and other microscopy. Our multiple light microscopes encompass optics for bright-field, phase-contrast, differential-interference, and fluorescence imaging. ■

New Program Combines Medicine and Arts

The proposed Maine Arts and Humanities in Medicine Certificate is unique in its collaborative relationship between a community hospital and state university. It has the potential to raise the profile and recruiting potential of both organizations, and attract an outstanding array of students to both campuses.

Doctors who complete their residency requirements at Northern Light Family Medicine and Residency in Bangor will have the opportunity to obtain a certificate of advanced learning from UMaine through the year-long certificate.

The certificate is open to graduate students or residency program graduates. Fellows will take courses on creativity and research methodology, attend a weekly seminar to discuss various contemporary topics in medicine with their other fellows, and produce a project worthy of publication or public display. The display could be a musical or theatrical performance, a graphic arts presentation, or a fine arts exhibition. The medical residents continue to keep up their clinical skills by attending a clinic two days a week where they are actively treating patients and implementing what they learn in real-life situations.

Owen Smith, director of UMaine's Master of Fine Arts program, pioneered the idea for the certificate with Patrick McFarlane, MSN, MSW, MA, director of Behavioral Health at Northern Light Family Medicine & Residency, and David Loxterkamp, MD, also on faculty at Northern Light Health in Bangor.

Smith believes the program would provide benefits to both the residency students and their patients. The certificate will involve courses that challenge students in the way they think about problem solving.

He says creating a program that integrates students from the medical fields with those from arts and humanities will create a unique set of opportunities and challenges that will shape how we think about wellness in the future.

"In our personal lives we have discovered the importance of the arts and the humanities, and we are deeply committed to making that available to graduate students," says Loxterkamp. "These interests [in the arts and humanities] are often put on the back-burner during medical training and we are trying to move that interest to the front burner." ■

Fellows will take courses on creativity and research methodology, attend a weekly seminar to discuss various contemporary topics in medicine with their other fellows, and produce a project worthy of publication or public display. The display could be a musical or theatrical performance, a graphic arts presentation, or a fine arts exhibition.

NIH T32 Award Supports Biomedical Research

The University of Maine Graduate School of Biomedical Science and Engineering (GSBSE) has received a five-year, $1.07 million Institutional Research Training Grant (T32) from the National Institutes of Health.

This funding is the first of its kind to be awarded in the state of Maine from the National Institute of General Medical Sciences.

According to the NIH, the T32 program supports broad and fundamental, early stage research training for predoctoral participants in centers that have significant impact on the health-related research needs of the US.

The UMaine GSBSE is uniquely positioned to train doctoral students interested in life science and medical-related careers. The doctoral program utilizes its partnerships with renowned research institutions that span the state of Maine in transdisciplinary methods of collaboration and team science. The awarded T32 grant is on "Transdisciplinary predoctoral training in biomedical science and engineering."

In addition to the $1.07 million received from NIH, UMaine is providing $0.5 million in direct contribution to the award, resulting in the total amount of $1.57 million in support of this initiative.

The first cohort of six students was chosen based on the applicants' proposals demonstrating significant impact, innovation, approach and transdisciplinary nature of their proposed research.

The trainees will be well-positioned to make fundamental discoveries and breakthroughs leading to significant advancements in human health and wellbeing. ■

UMaine Medicine Initiative

A transformative and coordinated community of collaborating researchers and educators that in partnership with health care providers and other stakeholders are dedicated to the advancement of human health and wellbeing in the state of Maine and beyond, through discovery and learning in health and life sciences, from basic and translational research, to clinical practices and healthcare workforce development. ■

CUGR

CENTER FOR
UNDERGRADUATE RESEARCH

CREATING KNOWLEDGE. PROMOTING SCHOLARSHIP. INSPIRING CREATIVE ACTIVITY.

The Center for Undergraduate Research provides unique opportunities each year for hundreds of undergraduate students to assist world-class faculty and gain skills to conduct their own research.

From left are Charlotte Rhodes, MacKenzie Conant, Morelys Rodriguez Alfonso, Brooke MacDonald, Sara McBride, Shayla Miller, Molly Bennett and Jessica Beneski. **Below, top to bottom** are Olinai Bradstreet and Lindsey Lagerstrom

CUGR's primary mission is to increase, improve and enhance undergraduate students' participation and experiences in research, scholarship and creative activity across all academic disciplines. Students are supported with internal research funding and resources for external funding — allowing them to obtain research experiences that may not be available at other institutions.

Through the Maine Space Grant Consortium program managed by CUGR, students and faculty work collaboratively on new aerospace technologies, space developments, and other engineering prospects.

Undergraduate researcher spotlights:

Olivia Bradstreet, Studio Art

Paper, Pulp, and Place: Investigating Connection Through Process Art
Mentored by Ronald Nadeau

Olivia Bradstreet aims to build bridges and understand the connections between traditional research and aesthetic arts experiences. In a small studio, Bradstreet explores the process art of papermaking — focusing on the making of the work itself — to study the connections made through fiber, setting and time. Her work involves making archival-quality materials and studying the aesthetic qualities of handmade paper as a medium for 2D and 3D works.

"The meaning of materials becomes very important [in process art] — the relationship the artist has with those materials is embedded in the work," says Bradstreet. "I chose fiber because it serves as great material connector for exploring personal narratives."

David Fitzpatrick, Engineering Physics

A Hybrid Thermochemical and Pressure Swing Adsorption process of Air Separation
Mentored by Justin Lapp

David Fitzpatrick is modeling a new type of air separation to see if it could be more efficient than the current standard. He is combining two types of air separation processes to assess whether they are more efficient together or separate. The first process increases pressure to adsorb nitrogen, and the second process is a metal oxidation process.

Fitzpatrick is passionate about this because new developments could "make smaller hospitals more competitive in their markets and could reduce healthcare costs."

Lindsey Lagerstrom, Psychology

Telemental Health Care From the Perspective of Maine Mental Health Professionals
Mentored by Fayeza Ahmed

Lindsey Lagerstrom is assessing telemental health care from the perspective of mental health professionals practicing in Maine. She views the strengths and weaknesses in this rising technology through survey research.

"Telemental health care, videoconferencing with a mental health professional for assessment and psychotherapeutic utility, has been proposed as a solution to the challenges of accessing care in the rural U.S.," says Lagerstrom. "For those who live in rural communities, access to mental health services is most likely limited and, as a result of treatment disparities, poorer treatment outcomes occur more often."

Sophia Palangas, Communication Sciences and Disorders

Assessing Health Related Quality Of Life, Language Impairment, and Psychosocial Factors in Post-Stroke Aphasia
Mentored by Christopher Grindrod

Sophia Palangas studies the quality of life and mood of stroke survivors when they have aphasia, which is the inability to speak and comprehend language. This project will help stroke survivors with aphasia receive mental health services through the development of a screening tool that can be used by speech therapists.

"Becoming a speech-language pathologist allows me to help others to effectively communicate and conduct research to provide better practices," says Palangas. "My project impacts a community that can sometimes be invisible, but they matter. My project will impact someone's world, and that matters."

Madeline Eberly, Forestry

Feedbacks Between Wood Structure and Function Driving Forest Tree Responses to Extreme Drought
Mentored by Jay Wason

Madeline Eberly studies the effect of drought on forest trees in Maine. This will aid professionals in natural resources to better understand how to work with the forests challenged with climate change. There will be shifts in forest composition and this will change the forest industry.

"Our forestry program is awesome," says Eberly. "It is exciting to be a part of the learning process and be able to work hands-on in the lab and field."

Samuel Varga, Finance

How Speculative are Different Sectors of the Stock Market?
Mentored by Grant Miles

Samuel Varga researches what a stock's price is based on — business performance or speculation about future growth. Varga will develop a map about the level of speculation, which will help investors make better financial decisions.

"I hope that the framework I use to create the mispricing variability map will provide an extra risk-consideration for portfolio managers and individuals with personal investments," says Varga. ■

Advancing Space Research

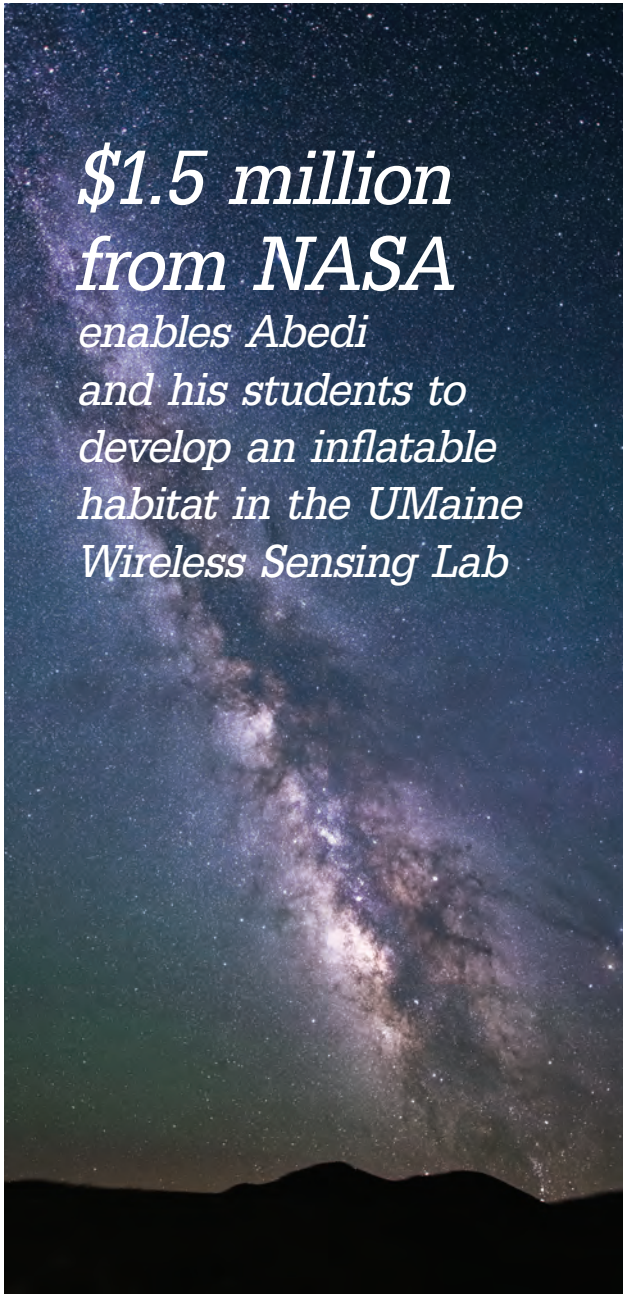
Researchers make meaningful contributions to real-world — and out of this world — topics with funding support from the Maine Space Grant Consortium (MSGC) and NASA's National Space Grant College and Fellowship Program.

Ali Abedi, professor of Electrical and Computer Engineering, works with students to develop cutting-edge technology and discover new ways to explore the universe.

"UMaine has a lot of talent," says Abedi, who also is director of the Center for Undergraduate Research and Assistant Vice President for Research. UMaine graduates have gone on to careers at SpaceX and NASA.

With $1.5 million from NASA, Abedi and students developed an inflatable habitat in the UMaine Wireless Sensing Lab. The doughnut-shaped structure could house astronauts when deployed to other planets.

Maine's first produced technology to be sent into space was developed by Abedi and his students. The payload collected data from the International Space Station to wirelessly detect structural leaks — a potentially deadly issue for astronauts.



Students involved in space-related research are from a variety of academic fields.

PATHOGEN COLLECTION AND HANDLING SYSTEM FOR SPACECRAFT BIOSURVEILLANCE

Daniel Regan, doctoral candidate in biomedical engineering, conducts research on pathogen collection and handling systems for spacecraft biosurveillance. The system allows the user to recover airborne pathogens for analysis to address the issue of bacterial contamination onboard the International Space Station. The findings also could be useful for soldiers and first responders.

"Applying our skill-sets into action for a real problem that requires immediate attention is an incredibly humbling experience," says Regan. "I never imagined engineering a system enabling astronauts and support staff to filter and analyze airborne pathogens onboard spacecraft would be part of my graduate school experience, but it certainly will be one of the highlights of my time in Maine."

CALIBRATING ICE CORE, WEATHER STATION, AND NASA MODIS ICE-SURFACE TEMPERATURE RECORDS TO ANALYZE ATMOSPHERIC VARIABILITY IN THE ST. ELIAS MOUNTAINS, YUKON, CANADA

Erin McConnell, graduate student in quaternary and climate sciences, examines chemistry measured in ice cores sampled from glaciers to learn what past climate was like in western Canada/southern Alaska. She uses today's known atmospheric circulation patterns to study the ice chemistry and learn about earlier climate in the region.

"I am passionate about helping vulnerable populations cope with climate change impacts,'' says McConnel. She hopes to communicate the details of climate change so citizens will be educated about this pressing issue. ■

Smart Data for Healthy Forests

Compiling data to better assess, understand and forecast complex forest landscape changes is the goal of a four-year, multidisciplinary regional project led by the University of Maine.

The project was awarded $6 million from the National Science Foundation, with $3 million contingent on project progress and availability of funds.

It will bring together UMaine, the University of New Hampshire, and the University of Vermont to build a digital framework that integrates, analyzes and visualizes complex data streams across the region's vast forest.

"Forests are changing rapidly, while the technology to better monitor them is, too," says Aaron Weiskittel, professor of forest biometrics and modeling and Irving Chair of Forest Ecosystem Management at UMaine, who is leading the project.

Local and regional communities depend on the health of the forest ecosystems to support biodiversity, conservation, recreation and a forest-based workforce.

The region's forests are dynamic and diverse due to changing environmental conditions, varying management objectives related to mixed land ownership, and natural disturbances.

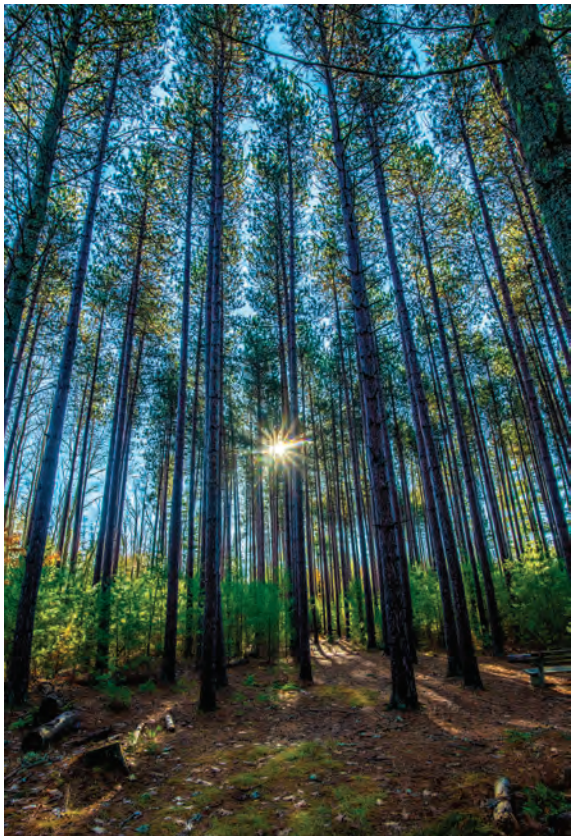
Although forest technology has improved, critical near real-time and high-resolution data on forest health or tree species composition remains highly varied, inconsistently available, and relatively coarse in resolution.

"Forests are complex and highly dynamic due to a number of factors. Traditional ground-based forest inventory data is expensive to collect and often out of date. Satellites and other advanced technologies offer advantages, but translating that data into useful information is not an easy task," says Weiskittel, who directs the Center for Research on Sustainable Forests (CRSF) at UMaine.

The three universities will develop a framework that will provide comprehensive spatial and temporal measurements of the forest that can be readily accessed by scientists, land managers and policymakers.

"Leveraging Intelligent Informatics and Smart Data for Improved Understanding of Northern Forest Ecosystem Resiliency (INSPIRES)" also aims to strengthen workforce development and broaden participation in STEM education.

Participating universities will collaborate on the development of a virtual, regional Complex Systems Research Institute that will facilitate ongoing analysis of natural ecosystem integrity and resilience from multiple scientific perspectives. The institute will include large-scale simulations from alternative features such as climate variability, among other aspects.



More information about the project, which aligns with the University of Maine System "Research and Development Plan," is on the CRSF website.

Other UMaine researchers involved in the project include Kate Beard-Tisdale, professor of spatial information science and engineering; and Ali Abedi, electrical engineering professor, assistant vice president for research, and director of the Center for Undergraduate Research. Scott Ollinger, professor of natural resources and the environment at the University of New Hampshire; and Anthony D'Amato, professor of silviculture and applied forest ecology at the University of Vermont, also are co-principal investigators.

Funding for the project comes from the National Science Foundation's EPSCoR Research Infrastructure Improvement program. The Established Program to Stimulate Competitive Research (EPSCoR) is designed to fulfill the mandate of NSF to promote scientific progress nationwide. ■

Local and regional communities depend on the health of the forest ecosystems to support biodiversity, conservation, recreation and a forest-based workforce.

Mapping Out a More Flood Resilient Future

University of Maine at Machias researcher finds solutions for community challenges.

Tora Johnson, associate professor of Geographic Information Systems (GIS) at the University of Maine at Machias, conducts research and teaches in the small town of Machias. She also chairs the Environmental and Biological Sciences Division and directs the GIS Service Center.

A social scientist by training, Johnson is interested in how communities make decisions and manage natural resources. Her research incorporates community engagement — which also is a cornerstone of her students' classroom experience.

Johnson believes Machias is the perfect location for doing this kind of work. "There are a lot of really difficult decisions to be made about natural resources — a lot of change and challenge in this region," she says.

And just down the hill from her office, downtown Machias faces several of these challenges. It has experienced no less than three "hundred-year" floods in the last six years.

In 2018, Johnson analyzed the flood resilience of downtown Machias in the study, "How much risk is too much? Geographic and economic analysis to support local decisions about flood resilience in a Downeast Community."

Johnson created a visualization tool by collaborating with the various stakeholders, including Baker Design Consultants and the Washington County Council of Governments. The tool mapped out the elevation and locations of commercial buildings in downtown Machias given various flooding scenarios. The study also estimated the economic impact to the community within those scenarios, by evaluating the number of people who would be put out of work, as well as the cost and the amount of time it would take for the town to recover from each of those different events.

"We were able to create economic estimates of the impact of single storms," says Johnson. "Based on each of those scenarios, we are able to use FEMA guidance and U.S. Army Corps of Engineers' guidance on the potential economic costs."

This research allowed the town of Machias to apply for a FEMA grant for the engineering and permitting work to build a seawall and pump system to protect the downtown against flooding. Outlining thresholds and the economic impact of various flood levels helped determine the ideal size of the seawall.

Students took an active role in the project, including GIS aide Andrew Howland and graduate student David Cisneros, who completed their work in spring 2019. ■

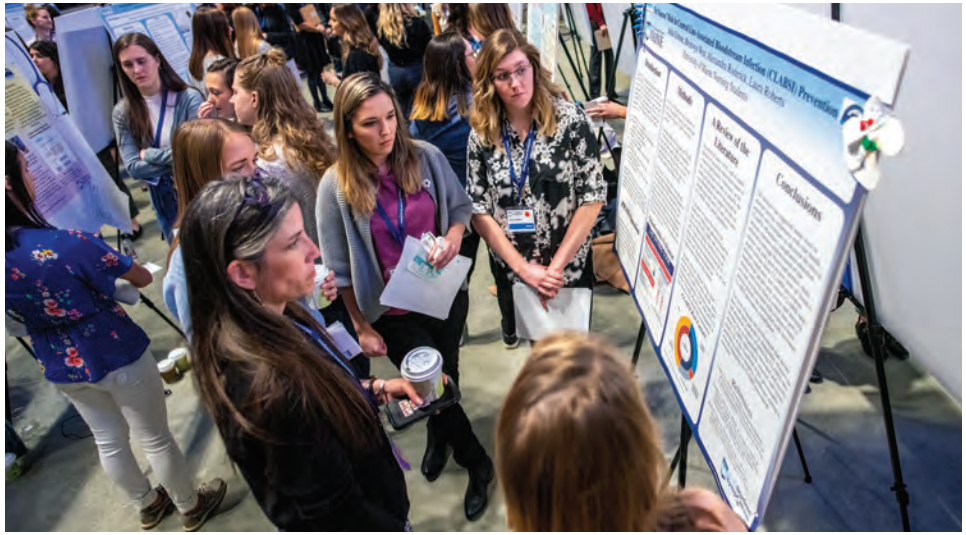
Tora Johnson teaches geographic information systems at the University of Maine at Machias.

Maine Impact Week

Maine Impact Week celebrates University of Maine faculty, students, community and their contributions to the social and economic advancement of the state and beyond.

The 2019 events highlighted the impact of research and creative work produced by Maine's research university the week of April 8–13.

The featured event was the 2019 UMaine Student Symposium, held April 10 at the Cross Insurance Center in Bangor. Several hundred students presented their research and creative works through posters, oral presentations and exhibits. Projects covered a range of topics in the arts, health care, science, engineering and education.



Jordan Miner, a biomedical engineering student from Baldwin, Maine, appreciated the opportunity to share her research on muscular dystrophy with the public.

"I [was] very excited to present at the UMaine Student Symposium and to learn about more research that's going around on campus," Miner says.

The event featured the top three finalists of the Three Minute Thesis competition who performed their winning presentations live on stage.

Stuart Kestenbaum, Maine's poet laureate, was the keynote speaker. He discussed the creative process and had a Q&A with the audience.

"The UMaine Student Symposium is reflective of Maine's flagship university at work, a world-class research university dedicated to workforce development and economic advancement benefiting Maine and beyond," says Kody Varahramyan, vice president for research and dean of the Graduate School.

Other events in the 2019 Maine Impact Week lineup included a Faculty Mentor Appreciation luncheon and awards ceremony and the UMaine Marine Research and Education Open House. ■

MAINE IMPACT WEEK

Greenland Expedition

A multi-disciplinary team of 16 University of Maine System researchers and faculty traveled to southwest Greenland June 21-29 to address 21st century challenges throughout the Arctic, North Atlantic and Maine by experiencing the impacted region first-hand.

The "Arctic Futures Workshop" was organized by the Director of the Climate Change Institute, Paul Mayewski and the Director of the Center for Oceans & Coastal Law and Graduate Law Programs, Charles Norchi.

The team visited Kujatta, a World Heritage Site established to preserve the south Greenland mixture of indigenous and Northern European cultures, says Alice R. Kelley, research associate professor with the Climate Change Institute.

The goal was to learn about the area, find common issues and contribute proposals for addressing the challenges and quality of life in the Arctic, and in Maine.

Many disciplines were represented — from the arts, law and sciences.

Erin Roche, from the University of Maine Cooperative Extension, says farmers in both Maine and Greenland are highly vulnerable to outside influences such as fuel costs, labor shortages and environmental quality issues that come with new enterprises, including mining.

According to Yong Chen, University of Maine professor of fisheries sciences, this presents an opportunity to learn how to better manage resources in a changing environment.

Firooza Pavri, director of the University of Southern Maine's Muskie School of Public Service, says in addition to daily field excursions to become familiar with the Greenlandic landscape, participants engaged in discussions with local government officials, private citizens and community members to better understand relevant issues.

Roche, the crop insurance education program manager for Cooperative Extension, "wanted to develop an understanding of the impacts of climate change, such as longer growing seasons, higher average annual temperatures, milder winters and periods of drought, on the existing and future potential for agriculture in the Arctic," she says.

"Warming in south Greenland has already resulted in the decay of organic material in archaeological midden deposits throughout the region and shifting of ruin foundations as permafrost melts," she says.

Because tidewater glaciers are at different stages of retreat, Lee Karp-Boss, associate professor in the School of Marine Sciences, says the area is a natural

Above: A group of 16 participants from the University of Maine, University of Southern Maine, and University of Maine School of Law traveled to Southwest Greenland for the 'Arctic Futures Workshop' in June 2019. **Left:** Climate Change Institute Associate Research Professor Alice R. Kelley sharing her expertise with the National Museum of Greenland Archeology Field School, Igaliku World Heritage Site.

laboratory for studying the responses of marine ecosystems to climate change.

The trip resulted in a variety of proposals that focus on the present as well as future potential of the Kujataa World Heritage Site.

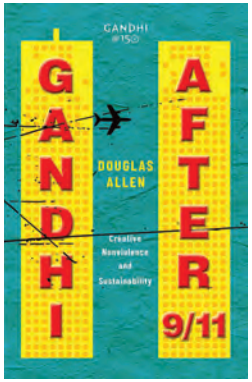
"[They] could explore the role that the arts and humanities can play in building cultural capital and fostering environmental awareness and economic prosperity," says Jan Piribeck, USM professor of digital art and foundations.

The collective proposals from the 16 Arctic Futures Workshop participants include ideas to design courses and field research, create resources to disseminate agricultural production information, design animation series for websites and displays at Kujataa, organize a multi-site symposium, and to engage local communities in citizen science to monitor groundwater.

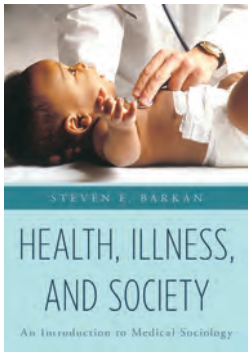
"Climate change impacts everybody," says Mayewski. "Scientific information is now accepted by 99 percent of the scientific community — and now social scientists are becoming engaged; trying to help people understand why this is important and what they can do." ■

Above: Iceberg at Qalerallit Imaa Fjord **Left:** The Arctic Futures Workshop attendees visited many sites with dramatic landscapes, such as this college archaeology field program.

Publication Spotlight



GANDHI AFTER 9/11: CREATIVE NONVIOLENCE AND SUSTAINABILITY
Allen, Douglas M.
Oxford University Press
2019
Philosophy



HEALTH, ILLNESS, AND SOCIETY: AN INTRODUCTION TO MEDICAL SOCIOLOGY
Barkan, Steven E.
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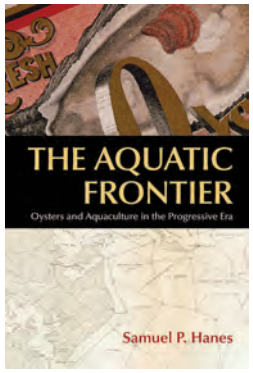
Medicine and Health



THE AQUATIC FRONTIER: OYSTERS AND AQUACULTURE IN THE PROGRESSIVE ERA
Hanes, Samuel
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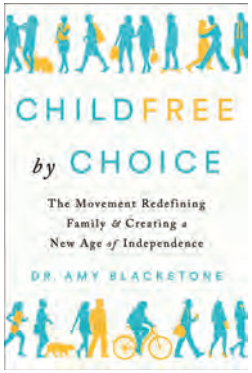

CHILDFREE BY CHOICE: THE MOVEMENT REDEFINING FAMILY AND CREATING A NEW AGE OF INDEPENDENCE
Blackstone, Amy M.
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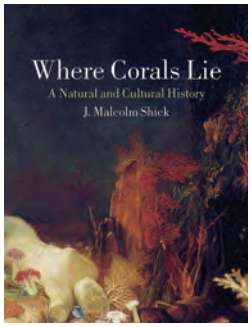

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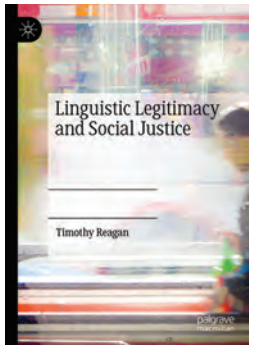

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Rosenbaum, Judith E.
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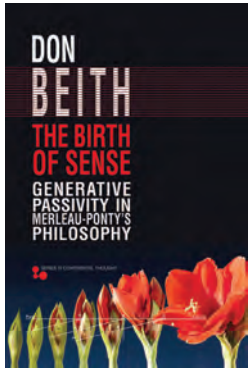

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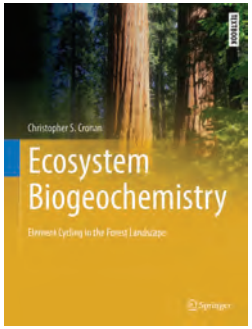

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Cronan, Christopher S.
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