THE UNIVERSITY OF MAINE

2021 RESEARCH REPORT

Global Impact | Local Relevance

Maine's Research University at Work

Developing solutions to grand challenges of global impact and local relevance

We are happy to present the 2021 Research Report for the University of Maine. This has been a remarkable year for research and scholarly achievements at Maine's land, sea, and space grant university, despite the continuation of a global pandemic and the significant difficulties that have resulted from it. Through this annual report, we celebrate the great achievements of our talented and resilient faculty, staff, and students. Their high level of accomplishments has been exemplary and has enabled the university to reach new heights as Maine's flagship research university of global impact and local relevance.

In fiscal year 2021, among the major accomplishments, the university community set a new record by generating $133.6 million in external funding in support of research and development activities, as compared to $56.9 million in fiscal year 2017, corresponding to a 135% increase over the given five-year period, and an all-time high record by the university. In fiscal year 2021, research and development expenditures also reached a new all-time high record of $179.3 million as compared to $99.5 million in fiscal year 2017, corresponding to an increase of 80.2% over the given five-year period. Moreover, with respect to graduate enrollment, in spring 2021 doctoral student enrollment for the first time in the university's history exceeded 500, and in fall 2021, both overall graduate student enrollment and doctoral student enrollment reached new all-time highs for the university at 2,542 and 532, respectively.

These accomplishments stem from the university's pursuit of growth and advancement in research and graduate studies, as part of a strategic roadmap that has been pursued for the realization of a modern 21st century research university, with close alignment and connection between academic and research programs, removal of barriers to collaboration, and investment in people and infrastructure. Through these efforts and as shown by the examples highlighted in this annual report, major university-wide programs and initiatives have been realized in diverse areas, ranging from artificial intelligence, marine sciences, and forest economy, to visual and performing arts, health and life sciences, and medicine.

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

Joan Ferrini-Mundy
President

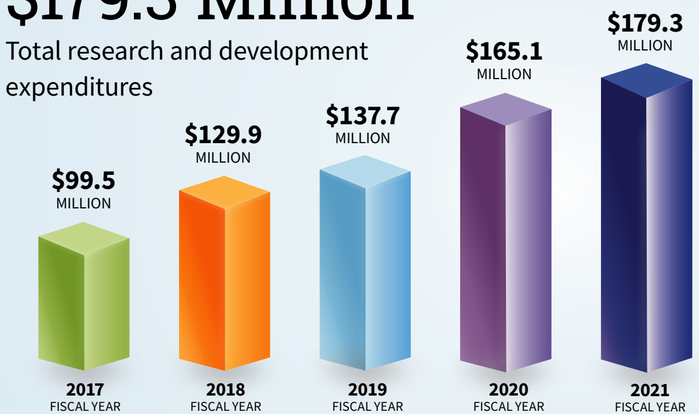
Kody Varahramyan
Vice President for Research and Dean of the Graduate School

Top 20%

of universities for National Science Foundation (NSF) Funding

$179.3 Million

Total research and development expenditures



$133.6 Million

Total research and development funding

2021
ALL-TIME
HIGH
RESEARCH AWARDS
AND EXPENDITURES

106% Increase

in federal funding over five years

Top 20%

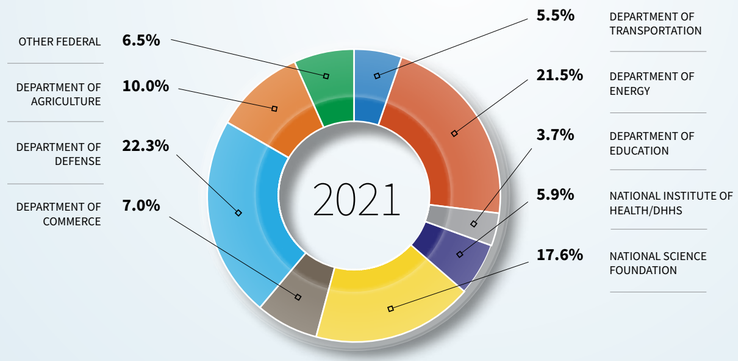
of universities for research expenditures by NSF HERD ranking

A Modern 21st Century Research University

100% Increase

in awards greater than $1 million over 5 years

Total Federal Awards



87%

of all university research in Maine

150+

research institutes, centers, and labs

87%

of Ph.D.s conferred in Maine*

**Reported on the 2020 NSF Survey of Earned Doctorates*

44

new faculty hired

Portland Gateway Open for Business

A new Portland Gateway for the University of Maine has been established to provide a one-stop connection and point of access to the vast array of innovative research, education and outreach resources, programs and services at the state's research university headquartered in Orono and its facilities statewide. The Portland Gateway offers opportunities for tailored partnerships to advance specific business or corporate needs, outreach and community engagement opportunities, and professional careers in connection with the UMaine Research enterprise.

Alice "Pips" Veazey is the inaugural director of the Portland Gateway. She joins UMaine from the University of Alaska Fairbanks, where she was the principal investigator and project director of the Alaska National Science Foundation Established Program to Stimulate Competitive Research (NSF EPSCoR).

"We are delighted that Dr. Veazey has returned to her native Maine to direct efforts at the University of Maine Portland Gateway," says UMaine President Joan Ferrini-Mundy. "This will be the front door to university research engagement in Portland and beyond, comprehensively serving the R&D and business needs, preparing the knowledge and innovation workforce, and being a major contributor to societal advancement and economic development."

Veazey received a bachelor's degree in psychology from Bates College, and holds a master's degree in oceanography and Ph.D. in team science leadership, both from the University of Alaska at Fairbanks. Her research focuses on fostering the development of large interdisciplinary initiatives. Over the past decade, she has led numerous teams of students, educators, scientists, decision makers and community partners to increase research competitiveness, promote economic development efforts and expand statewide workforce programs.

"I am eager to bring my collective experiences to the UMaine Portland Gateway and to dive into the exciting work that is taking place across the state," Veazey says. "We have a unique opportunity to help shape a sustainable future for Maine by collaborating across disciplines, organizations, and economic sectors, addressing our shared challenges and creating opportunities for all Mainers."

Veazey currently serves on the Board of Directors of the Arctic Research Consortium of the United States (ARCUS). In addition to being an ARCUS board member, she is an executive board member and founding member of the International Network of the Science of Team Science (INSciTS). ■

Alice "Pips" Veazey is the Director of the UMaine Portland Gateway.

We have a unique opportunity to help shape a sustainable future for Maine by collaborating across disciplines, organizations, and economic sectors, addressing our shared challenges and creating opportunities for all Mainers.

In September, Alice "Pips" Veazey presented her talk titled "Team Science and Lessons from Kindergarten — The Essence of Collaborative Research" at the Senator George J. Mitchell Center for Sustainability Solutions at the University of Maine headquartered in Orono, part of the center's fall 2021 Sustainability Talks series.

As society continues to manage dynamic and complex global issues, we clearly see that no single person, approach, or way of knowing can adequately address them single-handedly. From climate change to the current coronavirus pandemic, humanity seeks answers to challenges fundamental to our survival.

Research teams have great capacity to develop novel and effective approaches and solutions, but there are challenges to working in a team environment. To promote broad collaborations, we must offer experiences that initiate, encourage, and extend ways that we can all work together.

Veazey's doctoral work at the University of Alaska at Fairbanks focused on the competencies required to lead large, interdisciplinary science teams, and she has worked with dozens of research teams across the country to facilitate the co-development of research collaboration plans.

In her talk, Veazey points out that lessons we learned in kindergarten can be pulled forward and expanded upon, and used to maximize our work in collaborative settings.

She points out that at an early age we learn about sharing, respect, and kindness and have an innate drive to understand the world around us. These ideas hold true throughout life and can be mindfully incorporated in large, interdisciplinary research activities to enhance the effectiveness, trust, and collaborative nature of our team research projects. ■

PORTLAND GATEWAY

Creating Opportunities

Blind Dog Photo, courtesy of Wright-Ryan Construction

300 Fore Street, Portland, Maine

Graduate School Sets Records

In spite of the continuing pandemic, the University of Maine's graduate enrollment has consistently increased over the past few years, setting records in the 2020-21 academic year, and then breaking those records this fall term.

A total of 2,542 graduate students were enrolled in classes for the 2021 fall semester, surpassing the previous record enrollment in the spring 2021 semester by about 100 students.

Enrollment increases were seen in all degree categories (certificate, master's and doctoral) with doctoral enrollment also setting an all-time high of 532 students.

The reasons for success in graduate enrollment differ by degree type. In doctoral programs, the University of Maine's success in attracting more external funding as it strives to attain Carnegie R1 status has greatly contributed to UMaine's doctoral numbers. At the master's level, the enrollment growth has been focused in online programs with the MBA and IT-related master's and certificate programs, demonstrating significant growth.

A common contributing factor to the graduate enrollment growth at all levels is the Graduate School's success in attracting more applicants. Between 2019 and 2021, total graduate applications increased from 1,789 to 2,659, nearly 50% increase. Three new graduate initiatives have helped to increase the number of students entering UMaine graduate programs, including waivers for application fees and GRE, and the use of a holistic application review process rather than employing hard cutoffs. This has increased access to graduate education and presented opportunities to a wider group of candidates.

The progress in improving access to graduate education has strengthened UMaine's research and graduate mission, and helped advance the university's diversity, equity and inclusion goals. This is reflected in the number of applications from students of color, which increased from 331 to 750 (127%) between 2019 and 2021, while admission and enrollment of minority students in graduate programs also demonstrated significant increases of 97% and 64%, respectively in the same time period.

Associate Vice President for Graduate Studies Scott Delcourt says the work of the Graduate School team and graduate program coordinators over the last year and a half has been extraordinary. ■

Advancing Research Learning

Center for Undergraduate Research

The Center for Undergraduate Research's primary mission is to increase, improve, and enhance undergraduate student participation and experiences in research, scholarship and creative activity.

Undergraduate research allows motivated and interested students to become critically engaged in a culture of independent learning and participate in the creation of new knowledge. Through student-faculty collaborations and mentoring partnerships, students develop the tools and resources needed to achieve an authentic understanding of the research endeavor, the pinnacle of an educational experience.

Undergraduate research, broadly defined and understood, incorporates current students into the fabric of UMaine and attracts prospective students who want to be active participants in their education. Undergraduate research also provides an opportunity for faculty to expand their own research programs and enhance mentoring skills through training new members of their disciplines.

CUGR achieves its mission by providing leadership, coordination and support for research activities across campus. It builds upon UMaine's strengths and strategic goals as the state's leading research university, taking advantage of the hundreds of faculty and graduate students involved in research and creative projects who can teach and mentor undergraduate researchers and scholars. ■

Rosemary Thayer, zoology major and 2021 Summer Research and Creative Activities Fellowship awardee.

Record Number of Undergraduate Student Award Winners

The University of Maine's Center for Undergraduate Research (CUGR) has reported a record number of student project awards this year.

Despite the challenges related to the COVID-19 pandemic, this year continues to be an outstanding one for research and scholarly achievements at Maine's land, sea and space grant university.

Supported by the Office of Vice President for Research and Dean of the Graduate School, CUGR provides several fellowship programs in collaboration with the UMaine Institute of Medicine, UMaine Artificial Intelligence and Maine Space Grant Consortium (MSGC).

This year CUGR named seventy-five undergraduate award winners, with projects spanning various disciplines, including history, art, new media, climate science, biochemistry and various fields in engineering. Each undergraduate proposal was awarded $1,500.

Four winners of MSGC graduate research fellowships were also announced. The purpose of the MSGC fellowship and scholarship programs is to provide research opportunities to undergraduate and graduate students in aerospace technology, space science, human exploration/space development, Earth science and other science- or engineering-related fields. The focus of proposed projects must be aligned with the research priorities of NASA's Earth and space science strategic enterprises. Each MSGC project was awarded $6,000. ■

CUGR
CENTER FOR
UNDERGRADUATE RESEARCH

Student dancers participate in UMaine's International Dance Festival.

UMaine Arts Initiative

Enriching lives through the arts

The University of Maine Arts Initiative (UMAI) brings together faculty, administrators, staff and students committed to the principle that the arts play an integral role in public research institutions. The primary purpose of the new initiative is to increase resources and support for the arts, reinforce their significance, and enhance visibility on campus and beyond through strategic collaborations.

UMAI is founded on the principle that the arts play a fundamental role in public research institutions. The new initiative will advance this role of the arts in enriching the lives of individuals and communities through the creation, experience, research and enjoyment of art.

Through innovative and interdisciplinary collaborations, UMAI seeks to build a diverse, inclusive, sustainable, and equitable community of art researchers, practitioners, supporters and promoters. The new initiative is dedicated to societal well-being and enriching the lives of individuals and communities in the state of Maine and beyond.

"The UMaine Arts Initiative is part of a series of recently launched university-wide initiatives that are strategically linked to University of Maine System's Research and Development Plan, and are supporting the realization of an innovation-driven Maine economy for the 21st century and, as part of this, addressing the workforce, and social and economic needs," says Kody Varahramyan, vice president for research and dean of the Graduate School.

George Kinghorn, the executive director and curator of the Linda G. and Donald N. Zillman Art Museum–University of Maine, and Laura Artesani, chair of the Division of Music both serve as co-chairs, leading a steering committee composed of representatives from the visual, literary, and performing arts sectors from across UMaine and the University of Maine at Machias.

"In recent months the UMAI steering committee has developed a thorough framework for this new initiative that will advance UMaine's creative research and visibility for the arts through innovative and collaborative projects," says Kinghorn.

Through collaborations across multiple academic units, centers, museums and galleries, the UMaine Arts Initiative addresses the social and ecological challenges facing our world, while providing students with hands-on experience in the arts, a deeper understanding of arts research, and opportunities to learn from exhibitions, performances, programs and events.

"This exciting initiative will provide new opportunities and recognition for our thriving and vibrant arts community," says Artesani.

The new effort will serve to bring greater visibility to the ways that the arts at the University of Maine can serve, enrich, and empower the people of the state of Maine, and work to provide funding for innovative and collaborative arts programming and research initiatives that foster a diverse, inclusive, and equitable arts community.

Marking the launch of the new initiative, the University of Maine Arts Initiative Seed Grant has been established. Grants will range from $5,000 to $15,000 and are intended to support new collaborations, with priority given to applicants from arts-oriented units.

For more detailed information about the initiative visit the UMaine Arts Initiative website. ■

Lord Hall Gallery at the University of Maine

Monotype ornaments sitting in a type drawer.

Creating an Impression in Machias and Beyond

Bernie Vinzani's love of teaching the art of printmaking began when he delivered a hands-on lesson to his peers in an undergraduate speech class at Indiana State University. He demonstrated how to make a print using a piece of cardboard and a potato.

Now, Vinzani is a professor of art and book arts at the University of Maine at Machias, where he continues to teach, as well as conduct research and refine his papermaking and printmaking skills. And, while at home on sabbatical during the pandemic, he added building a printing press to his repertoire.

Vinzani moved Down East in the early 1980s. He was ready for a change in scenery after earning a bachelor's and a Master of Fine Arts in printmaking at Indiana State University, setting up a printmaking program at Vincennes University in Indiana, and working as a papermaker at Twinrocker Handmade Paper.

"I had two places that I really wanted to live; that was upper Minnesota and Maine. It was one of those things as a kid, I just loved the North Woods, everything about it," he says.

According to papermaking legend, if fireflies float around a water source, it's a good omen for papermaking. Vinzani saw fireflies while looking at property near Machias, so Maine won out.

He has gained an audience both in Machias and far beyond. Vinzani's pieces have been featured in "The Book of Fine Paper," Hand Papermaking, American Craft magazine, and The Boston Globe. And his work has been exhibited at The VI International Print Bicentennial in Cracow, Poland, and at the Maine Invitational in Portland.

In 1993, Vinzani and a few other papermakers were chosen to curate paper for a Library of Congress collection. "It was quite an honor to know that our paper had been tested at that point, it was really sound paper and they could use it," he says.

Vinzani was selected to be UMaine Machias art gallery director, which eventually led to a full-time teaching position. Colleagues had encouraged Vinzani, now a tenured professor, to get a press and begin teaching book arts classes.

More than two decades ago, he applied for and received a grant from the Stephen and Tabitha King Foundation to set up a facility on campus for bookmaking. The studio started out in a basement next to a boiler room. It's since found a permanent home in Dorward Hall, and contains equipment from a letterpress shop once owned by a woman in Portland, Maine, as well as equipment that Vinzani built.

Bernie Vinzani, professor of art and book arts at the University of Maine at Machias, working with students Mirielle Uwase, left, and Praise Maker, right, in the book arts studio.

UMaine Machias offers a bachelor's degree in Creative Arts with concentrations in visual arts and creative writing. Both concentrations share a core curriculum, ensuring everybody gets to take a book arts course. "The core of the program centers around the study of the book," Vinzani explains. A one-year Book Arts Certificate Program also is available.

Students learn how to make paper by hand, create watermarks, and use colored pulp to create artwork. Some also have created book covers and paper for their own books.

"In the age of electronic media, we are still a culture dependent on paper and print as elements of communication. Both are crucial elements to graphic design, which is a very strong communicative medium we depend on to get our ideas out to others," he says.

Vinzani is interested in the history of presses and papermaking, including how early currencies were printed, how stamps were made, and how fine books were made and printed. His research uncovers a deeper story. Vinzani says historical aspects offer insights into current use of printmaking and papermaking, and often can expand our understanding of contemporary innovation. Throughout his home and shop, he has archives of pieces of paper; the oldest pieces date back to the 1300s.

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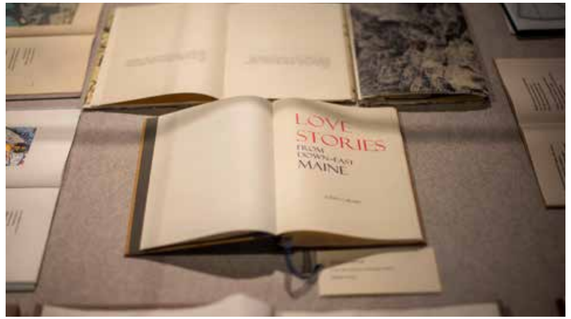
The history of printmaking, including the beginnings of printing in the Western world, is of great interest to Vinzani. That includes Johann Gutenberg's press, which had movable type and, for the first time, could relatively inexpensively print a large number of books.

He thought it would be beneficial for UMaine Machias students to print on a handpress, similar to Gutenberg's. So, he began building one.

Vinzani studied dozens of different presses online, examined photographs, and contacted people who built presses. And he systematically critiqued each one. "Out of all of that, I came up with what I would do for consideration for building the press and what I probably would not do."

The new "Common Press" press currently sits in Powers Hall, where he and students can create prints on it. It has 3-inch-thick maple barn beams, which are heavy enough to exert sufficient pressure so the type is solid and the print turns out correctly. ■



Student pieces from the Book Arts course.

FORest Economy, Sustainability and Technology (FOREST) Initiative

Advancing the forest-based economy in Maine and beyond

The University of Maine has established the FORest Economy, Sustainability and Technology (FOREST) initiative, a university-wide multidisciplinary effort to bring together university, industry, government, and community collaborators for the advancement of the forest-based economy in Maine.

Composed of representatives from more than two dozen departments, colleges and organized research units within UMaine, FOREST is working to coordinate, communicate and collaborate across the University of Maine System (UMS) with local, state, federal and international partners to develop and deliver integrated research, education and outreach solutions that enhance the economic and ecological sustainability of forest-based communities.

"UMaine FOREST is part of a series of recently launched university-wide initiatives that are strategically linked to the University of Maine System's Research and Development Plan, and are supporting the realization of an innovation-driven Maine economy for the 21st century and, as part of this, addressing the workforce, and social and economic needs," says Kody Varahramyan, vice president for research and dean of the Graduate School.

Maine's forest resource is unique in many ways. Measuring over 17 million acres and covering nearly 90% of the state, it forms the largest contiguous block of undeveloped forestland east of the Mississippi.

Largely privately owned and naturally regenerated, this economic keystone for many of our rural communities has been continually managed for wood products since before our nation's founding. Maine remains the highest percent forested state in the country through resource management and sustainable harvesting practices rooted in prevailing scientific understanding.

Understanding, quantifying and optimizing the increasingly complex and interconnected relationship between resource management, harvesting practices, utilization, forest health, wildlife habitat and rural economic prosperity is a concept known as the forest bioeconomy. It bridges current forest-based businesses and policies with visionary thinking on sustainability, product applications and resource utilization.

To further advance this transformation, a better understanding of the trends and drivers within the global forest bioeconomy is needed. A combined knowledge of technological advances in concert with economic, social, political and environmental aspects of forest resource usage are paramount to the long-term success and prosperity of Maine's forest bioeconomy.

To support the complex interconnected challenges and opportunities within the State, the FOREST Initiative will serve as a platform for available resources across UMS to advance the following strategic goals:

- Conducting responsive research among all disciplines and fields that touch the forests, land they occupy, and people and technology they support.
- Preparing tomorrow's workforce across all aspects of how we engage, serve and live with the forests.
- Delivering relevant services to all who rely on our forests and their land for work, life and prosperity.
- Meaningfully engaging all stakeholders to increase opportunities for scientists, businesses, communities and individuals to have an impact.
- Clearly communicating outcomes and opportunities across technical and non-technical audiences to increase overall awareness and understanding of forest-related topics.

For more detailed information about the initiative, visit the UMaine FOREST website, umaine.edu/forest. ■

The Dwight B. Demeritt Forest located in Orono and Old Town, Maine spans 1,478 acres of mixed forest stands, fields, and water. Leased and then deeded to the university to be managed by the Forestry Department in 1939, the land is used for education, demonstrations, research, and recreation.

Marine Aligned Research, Innovation, and Nationally-recognized Education (MARINE) Initiative

Advancing the Blue Economy in Maine and beyond

The state of Maine has 3,500 miles of beautiful coastlines and many other inland waterways. And thriving spaces for outdoor recreation and tourism. Maine's marine environment is also home to an essential fishing and aquaculture industry.

The UMaine MARINE Initiative pulls together researchers from across the University of Maine System, industry, government, and community collaborators to engage in innovative and interdisciplinary research, education, and outreach related to the marine area. These efforts are designed to enhance the social, environmental, and economic well-being of the state of Maine.

The initiative was started with regular convenings of the leadership of the School of Marine Sciences, Maine Sea Grant, the Lobster Institute, Aquaculture Research Institute, Center for Cooperative Aquaculture Research, Cooperative Extension, Darling Marine Center, and UMaine Machias, among others.

These schools, centers, and institutes are working on a diverse array of marine-related topics, including lobster populations and marine ecosystem responses to climate change, assessments of collaborative models to enable fisheries and climate change action partnerships, and the social dimensions of aquaculture.

"I look at the UMaine MARINE initiative as an opportunity to make people on campus who are doing this kind of scientific research or education in marine-related activities more available to the people of Maine," says Gayle Zydlewski, director of the Maine Sea Grant and chair of the UMaine MARINE Steering Committee. A major goal of UMaine MARINE is to advance the coastal and marine-related needs of Maine businesses and communities. The initiative serves to host collaborative, interdisciplinary research on issues that impact the state of Maine and the people who live there.

"There are many areas where Maine people are seeking support, especially in light of our rapidly changing environment. Coastal communities are facing important decisions related to infrastructure, workforce, and working waterfronts," Zydlewski says. Scientists, researchers, and educators at UMaine are thinking about those issues as well.

One of the initiative's objectives is to identify ways to exchange information between the communities and the university. It is also important to take community needs to the university to help ensure that what scientists, researchers, and educators are doing is applicable to the people of the state. And it is important to ensure that the University's network of expertise and facilities statewide reaches the communities that need it.

The University of Maine MARINE initiative began as a series of conversations and meetings between researchers across UMaine to discuss the work that was being done on marine-related issues.

"Maine and the Gulf of Maine are much bigger than the University of Maine alone, and working all together across the entire state is an important place for UMaine MARINE to be heading, and to drop the "U" of UMaine MARINE and make it a Maine MARINE initiative," Zydlewski says.

The UMaine MARINE initiative has and will continue to host events to bring together stakeholders across the state. Visit marine.umaine.edu/events for more information. ■

Sustainability in Land-based Salmon Aquaculture

The University of Maine Aquaculture Research Institute (ARI), in collaboration with the University of Maryland Baltimore County (UMBC), has been awarded a $10 million U.S. Department of Agriculture (USDA) grant to research land-based salmon aquaculture.

The Sustainable Aquaculture Systems Supporting Atlantic Salmon project, or SAS^2, brings together several academic and federal research institutions and nine industry partners from the U.S., Iceland and Norway as part of a National Institute of Food and Agriculture (NIFA) program, which provides funding to advance sustainability in agricultural sciences. The project builds on the Sea Grant-funded RAS-N Network, a three-year project designed to network stakeholders and develop a strategic roadmap for Atlantic Salmon RAS in the U.S. UMaine plays a leadership role in both projects.

Recirculating Aquaculture Systems (RAS) have the potential to expand production and add resilience to domestic finfish aquaculture. These land-based systems decrease reliance of finfish production on coastal ecosystems and reduce vulnerability to environmental conditions. RAS optimizes site selection based on parameters such as proximity to markets, affordable land, and water availability, and other market factors.

Managed effectively, domestic RAS operations could reduce the seafood trade deficit and address increased market demand. The long-term goal of the SAS^2 is to support a sustainable U.S. Atlantic salmon RAS industry that expands the domestic production of finfish with decreased environmental impacts, increased waste capture, enhanced biosecurity, improved control of pathogens, and better disease mitigation. SAS^2 integrates research, education, and outreach to address the major challenges and roadblocks to RAS as defined by industry partners and community stakeholders.

Affiliated ARI faculty in engineering and marine sciences will concentrate on techno-economic modeling, water quality monitoring, and broodstock management. ARI, in collaboration with UMaine's Cooperative Extension 4-H, Wabanaki Youth in Science Program (WaYS), and Center for Cooperative Aquaculture Research (CCAR), will lead the educational objectives of the project. Working with Maine Sea Grant, ARI will advance the outreach objectives.

"The Aquaculture Research Institute is eager to expand upon the work of the RAS-N network," says Deborah Bouchard, director of ARI. "ARI will lead the RAS finfish health program as well as the workforce development and community outreach efforts for the project. This new funding is key to helping prioritize sustainability and the inclusive values that are important to advancing equitable rural development in Maine." ■

Andrew Holmes, Ph.D., Biocontainment Research Associate and Laurel Anderson, Undergraduate Research Assistant work with Atlantic Salmon in the Aquaculture Research Institute located at the Cooperative Extension Diagnostic & Research Lab.

The Blue Economy

At the core of Maine's coastal communities is the Blue Economy, but in a warming climate, the state of Maine faces difficult challenges. The Gulf of Maine has and will continue to change rapidly. This change threatens the Blue Economy and the communities that rely on it.

How the University of Maine harnesses and directs its research and development capabilities will be crucial to the state's future in the Blue Economy. Through driving workforce development and research, and cultivating new opportunities, UMaine supports the sustainability of the state's marine resources.

A flourishing working coast is vital to Maine's being and initiatives like UMaine MARINE are essential to maintaining them. By connecting and working with government, industry, the public and other stakeholders, UMaine is able to provide the necessary resources and expertise to cultivate thriving coastal communities that engage with the Blue Economy. ■

Experiential Programs Innovation Central (EPIC)

Cutting-edge student-centered undergraduate education is the key focal point of the University of Maine Experiential Programs Innovation Central, or UMaine EPIC.

EPIC takes experiential learning to new heights. It is indicative of UMaine's commitment to excellence in undergraduate education, where learning goes beyond the classroom, and undergraduates from their first year through senior year have the opportunity to experience a unique and highly effective student-centered learning environment, getting in-depth learning and gaining highly desirable skills and experiences, which prepare them well to succeed after graduation.

Participating EPIC units provide integrated high-impact experiential learning through exposure to research, interdisciplinary experiences, new technologies, innovation, and design and prototyping. These centers include:

- Center for Undergraduate Research
- Advanced Manufacturing Center
- Center for Innovation in Teaching and Learning
- Foster Center for Innovation
- Innovative Media Research and Commercialization Center

EPIC offers a Certificate in Research, Innovation, and Strategy (CRIS) for undergraduate students, designed to complement a student's core curriculum, and provide them with tangible skills to meet the needs of employers throughout Maine and across the world. ■

EPIC students create affordable crop monitoring system for small farms

A team of students making up the first cohort at the UMaine Experiential Learning Innovation Central (EPIC) engineered a low-cost monitoring system for local farmers. Guided by mentors Peter Schilling, Sean Taylor, and professor Ali Abedi, the multidisciplinary team included junior in civil and environmental engineering Kettie Cormier, first-year mechanical engineering student Camden Sawyer, and Walter Lange, a junior studying finance.

According to the students' research, current crop monitoring systems are catered toward larger industrial farms. But for start-up farms and small business owners, these systems are costly and not suitable for their scale of production. The team is solving the need to have low-cost systems as the "locally grown" movement highlights the importance of small agriculture businesses. The demand for locally sourced agricultural products is likely to increase as the environmental impact of shipping long distances continues to grow.

Cormier explains that small farms like orchards and woodlots struggle to compete with the expensive technology of industrial agriculture. "Small agricultural businesses need inexpensive technology solutions to monitor their fields, forests, orchards, and greenhouses," says Cormier.

The team studied two technologies for prototypes: a wireless temperature monitoring system that scans crops with an infrared sensor, and a Wireless Sensor Network (WSN). WSN technology is used in agriculture to provide remote monitoring of temperature, humidity, soil moisture, and luminosity. Infrared temperature monitoring is a non-contact measurement of plant temperature. Both of these technologies were incorporated into the team's proposal.

The proposed system is made up of four major parts that retrieve the variable data from the plants and then store it into computer software. Solar panels and a generator power the system while the sensors do their work capturing plant data. A router using an Arduino board then pushes up all the sensor data to a computer database where it can be analyzed by the farmer.

"The system is important for smaller farms because it would even the playing field," says Sawyer. "It can provide insight to let farmers know when to water their crops, when to harvest, or just to check the plant's health and environmental conditions."

Future development of the team's proposal includes a predictive data model designed to forecast conditions for crops. The students are also looking at developing a mobile application that displays the sensor information for farmers to use in the field. ■

Morgan Oehler, civil and environmental engineering major and 2021 MSGC Summer Undergraduate Fellowship awardee.

Rachel Lasley-Rasher, assistant professor of biology at the University of Southern Maine, conducting Maine-eDNA field sampling in summer 2021.

EPSCoR's Impact on the State of Maine

In 2021, Maine EPSCoR continued its mission to enhance the state's research and development capacity and competitiveness through execution of the NSF EPSCoR RII Track-1 grant, Maine-eDNA.

The Maine-eDNA project is a statewide, multi-institutional initiative aimed at establishing Maine as a national leader in environmental monitoring, ecological understanding and sustainability of coastal ecosystems.

Maine-eDNA executed a successful field season in 2021, collecting thousands of water samples along Maine's coastal ecosystems, and developing new bioinformatics pipeline analysis capabilities to process these samples, leveraging national supercomputing resources. The project continues to gain momentum, exhibited by securing more than $15.8 million of follow-on funding. Serving to develop workforce capacity in Maine, this grant supported 30 faculty, 22 graduate students and 20 undergraduate students in 2021.

EPSCoR programming engages stakeholders and develops partnerships through public outreach, including workshops and conferences. For example, Maine-eDNA led an eDNA session at the 2021 Maine Sustainability and Water Conference, involving diverse academic, agency, non-governmental organization and industry participants.

Maine Innovation Economy Advisory Board (MIEAB) oversees EPSCoR activities in Maine to ensure that project activities align with the specific needs of the jurisdiction. With guidance from MIEAB, Maine EPSCoR provides support and resources that enable researchers to engage the complex questions that face the state, such as climate change resilience of the Gulf of Maine ecosystem. ■

Harsh Environment Wireless Sensor DOE EPSCoR Award

The next generation of harsh environment materials and wireless sensor techniques are the focus of a $2.34 million Department of Energy (DOE) EPSCoR award for research led by University of Maine researchers Mauricio Pereira da Cunha and Robert Lad.

The DOE award was one of nine initiatives funded nationwide for a total of $22 million. The UMaine research project received a DOE EPSCoR implementation grant in 2019.

Pereira da Cunha, professor of electrical and computer engineering, and Lad, professor of physics, will lead an interdisciplinary, multi-institution team of researchers. They include eight UMaine faculty members and other researchers from the University of New Hampshire, Bates College and the University of Southern Maine. The research will employ the Frontier Institute for Research in Sensor Technologies (FIRST) facilities and equipment, which is the university's premier research center for conducting nanotechnology and advanced sensor research.

Their primary goal is to address the pressing need for a new generation of sensor materials, devices and systems that can operate under extreme temperatures (up to 2000° F) and harsh environments that may consist of erosive particles and oxidizing, reducing or corrosive gases. These types of conditions are often found in the rapidly expanding energy sector, such as power plants, gas turbine generators, renewable power generation and advanced manufacturing.

Cost savings and overall efficiency and safety improvements can be achieved with advanced sensor devices and packaging materials, such as those proposed for this project, according to the researchers. Those sensor devices and packaging materials must meet a demanding set of operational requirements, which will be extensively researched over the life of the project.

In the past two decades, Pereira da Cunha and Lad have collaborated on similar projects and are nationally recognized leaders in the research and development of harsh environment wireless sensor technology. This latest DOE award will allow the research team to advance new technology in harsh environment and wireless sensor research, and make UMaine a go-to hub for this expanding technology.

The Established Program to Stimulate Competitive Research (EPSCoR) is intended to improve geographic distribution of federal research and development funding, strengthen research capabilities in underserved regions of the country, and enable institutions in those regions to better compete for federal funding. Maine is one of 28 jurisdictions designated under EPSCoR. ■

MAINE EPSCoR

Innovative Media Research and Commercialization Center

Intersection of Arts and Humanities, Sciences, and Technology

The Innovative Media Research and Commercialization (IMRC) Center is an interdisciplinary research and experiential learning facility located in Stewart Commons at the University of Maine. The Center builds and supports emerging projects and programs that reflect intersections among the arts and humanities, sciences, and technology.

The IMRC Center workspaces encompass research and prototyping laboratories, maker spaces, adaptive presentation environments, and classrooms. The high-performance research, design, media production, and prototyping tools offered in these spaces, along with access to in-house technical training, mentorship, and vocational guidance, are available to welcome, support, and engage all learners.

Over the past year, IMRC Center has worked to provide increased support to the research and academic initiatives of the university. It has also established new stakeholder onboarding strategies, increased transparency, consistency, and accessibility for services. The center has updated diversity, equity, and inclusion practices into operating guidelines, support and showcase opportunities for diverse and interdisciplinary experiences, and applied and navigated successful change and relationship management alongside affiliate constituencies to strengthen the alignment of IMRC Center processes and goals with those of the greater university body.

The IMRC Center is a unit under the Coordinated Operating Research Entities (CORE) and a University Academic Center, with strong integrations with the Center for Undergraduate Research (CUGR), Foster Center for Innovation, the Intermedia Master of Fine Arts Program, and the Office of Research Development. This positions the IMRC Center in a thriving community of research, art, media, commercialization, entrepreneurship, and creative innovation. ■

Christina Closson, an undergraduate IMRC Center laboratory technician, completes the 3D modeling for a prototype Cube Satellite, which was printed from polylactic acid plastic on the TAZ Extrusion 3D printer in the IMRC Center Prototyping Lab. The rapid prototype model was used by the electrical and computer engineering team at the WiSe-Net Lab to build the flight model enclosure. The unit is set to be launched to the polar orbit in June 2022, in collaboration with NASA and Nanoracks, and Firefly launch services. Copies of this prototype were given to several K-12 schools in Maine to engage students.

Supporting Research Innovation

Since transitioning to a unit under the Coordinating Operating Research Entities (CORE) in 2020, the IMRC Center has embraced new opportunities to support research initiatives, academic curricula, and external commercial projects with access to resources and services. The 2021-22 academic year, has seen a 100% increase in IMRC Center lab and resource access by undergraduate and graduate students, as well as faculty, staff, and community members.

Drivers for this growth in usage include:

- Streamlined pathways to both assisted and self-service activities.
- New contact-free training opportunities.
- Expanded hours of access to resources.
- Increased integration with undergraduate and graduate coursework.
- New pathways to facility usage for Center for Undergraduate Research (CUGR) fellowships.
- Expanded opportunities for Coordinated Operating Research Entities voucher recipients.

IMRC Center's event space usage has also grown by approximately 50%, providing increasing support for various campus-based activities, including student organization meetings use, academic capstones, critiques, theses presentations, student and departmental exhibitions, event series, and new coordination with the Center for Student Involvement.

Upcoming events include a symposium for the Institute of Arts in Medicine, the Intermedia Master of Fine Arts Program Visiting Artist Lecture Series, and the Middle Atlantic Planetarium Society Conference.

In addition to growing the facility usage, IMRC Center has also developed new opportunities to support research. For example, students in the first cohort of UMaine's Experiential Learning Innovation Central program used physical computing to propose a smart climate control system for buildings. The course is led by professor of electrical and computer engineering Ali Abedi, IMRC Center operations manager Drew Hooke, and IMRC Center project manager Sean Taylor. The student team included Noah Lambert, an incoming first-year student in computer engineering. Lambert went on to win a CUGR fellowship to continue the team's research and will begin gathering data for the project at the IMRC Center this spring.

Another research highlight is the SunRule sundial prototypes printed in the IMRC Center Prototyping Labs. This project was undertaken in collaboration with the Department of Art Sculpture Studio, the Advanced Structures and Composites Center, the Maine Innovation Research and Technology Accelerator, the Office of Innovation and Economic Development, and the Town of Orono. The SunRule team developed both a handheld design that could be used by students in K-12 math classes, and an interactive mathematical sculpture suitable for parks and museums. The SunRule sundial will be installed soon in Webster Park in Orono. ■

Examining Health Factors on Cognitive Function

Maine is the country's oldest state and has been for years. The median age in Maine is 44.6 years old, over six years older than the nation-wide average of 38, according to the U.S. Census Bureau. Maine also has the largest percentage of people over the age of 65.

UMaine's Fayeza Ahmed is trained in clinical neuropsychology and is particularly interested in how cardiovascular health and modifiable health behaviors impact the risk for developing dementia and Alzheimer's disease in middle-aged and older patients. Clinical neuropsychology, a subspecialty of clinical psychology, is the study of brain-behavior relationships that includes diagnosis and treatment planning among psychiatric and neurologic populations.

Ahmed, an assistant professor in the Psychology Department, runs the UMaine Health, Aging and Lifestyle Lab, or HAL Lab. Along with her graduate students, she is studying how health behaviors, such as exercise, impact cognitive function.

"I've been interested in Alzheimer's, in particular, for a number of years now. And what we know is the unfortunate part, which is that by the time you start to see symptoms of Alzheimer's disease, the actual disease process in the brain has been going on for quite some time. So, the main goal of the HAL Lab is to advance science on these modifiable risk factors," Ahmed says.

Ahmed says that people generally understand that exercise is beneficial. But the more nuanced question is for which population is exercise most beneficial? She is currently focusing her own research on physical exercise and its impact on cognitive function in middle-aged people, because if a person develops Alzheimer's disease, small brain changes start to happen around middle age.

Ahmed is also collaborating with Gareth Howell, an associate professor at the Jackson Laboratory, or JAX. Together they have started working on a project that looks at not only the impact of exercise on cognitive function, but also the genetic expression of proteins in blood that could indicate Alzheimer's in a patient. Howell is looking at the impact of exercise on middle-aged mice. He is evaluating a group of mice that exercise and a group that does not and comparing the genetic data between the groups.

Ahmed is running the same experiment with middle-aged humans. "We're actually doing a pilot project right now where I'm looking at human adults in terms of their exercise activity and their cognitive function. But more importantly the gene expression of certain key proteins of interest among humans," Ahmed says.

Amanda Wain is a graduate student pursuing a master's degree in the Psychological Sciences program at UMaine, and is working as Howell's Lab Manager at JAX. The

Members of the Health, Aging, and Lifestyle (HAL) Lab are, left to right, Fayeza Ahmed, Taylor McMillan, Ethan Lowell, Jaclyn Hazlewood, Amanda Wain, Lindsey Lagerstom and Jennifer Thompson. Not pictured: Sarrah Marcotte.

overlap in research across both labs places Wain in a unique position to serve as a liaison.

At JAX, Wain works with mouse models that have been genetically modified with Alzheimer's disease risk variants, while the HAL Lab uses human participants from the general population. The goal of the collaboration is to verify that humanized mouse models replicate the human population.

"I quickly learned how much I didn't know about research on humans even though the goal at JAX is to alleviate human disease. It was at this point that I asked Dr. Ahmed if I could complete a master's using the work that we would be doing at JAX as part of our collaboration," Wain says.

Taylor McMillan is a doctoral student in the Clinical Psychology Ph.D. program at UMaine who is advised by Ahmed. She has a particular interest in the role of nutrition as a modifiable risk factor for cognitive decline. "I have always been interested in the impacts of health on our brain, and I was excited to be a part of a lab that did just that." McMillan says.

In addition to Wain and McMillan, the HAL lab includes second-year doctoral students Jennifer Thompson and Lindsey Lagerstrom and has mentored numerous undergraduate research assistants. ■

Advancing Understanding of Marine Microbiomes

Lee Karp-Boss and Emmanuel Boss, professors at the University of Maine School of Marine Sciences, completed a month-long research cruise in the western South Atlantic Ocean as part of Tara Ocean Foundation's Mission Microbiomes project.

Tara, a French nonprofit that conducts ocean expeditions using its titular research schooner, launched the project in December 2020 to learn more about how marine microbiomes, or assemblies of microorganisms in a given ocean environment, function.

The organization also aims to understand how climate change and plastic pollution affect marine microbiomes. Microbiomes make up two-thirds of marine biomass, support an extensive food chain and play important roles in biogeochemical cycles, yet little is known about their inner workings, according to Tara.

Boss and Karp-Boss joined the Tara schooner in early November for part of the two-year, 40,000-mile voyage along the African, South American and Antarctic coasts. Together with fellow researchers from Brazil, they designed and sampled diverse oceanographic regimes in undersampled regions in Brazilian waters.

Lee Karp-Boss, professor of Marine Sciences, working in the wet lab aboard the Tara.

Emmanuel Boss, professor of oceanography in the School of Marine Sciences.

Funded by a National Aeronautics and Space Administration (NASA) grant, Karp-Boss and Boss also installed the latest generation of ocean instruments on the research vessel to study plankton, tiny unicellular organisms that are the base of the aquatic food chain, and their associated optical properties.

The new instruments include two sensors recently developed at Sequoia Scientific Inc. by, among others, Wayne Slade and Thomas Leeuw, two former students with the UMaine School of Marine Sciences, to measure hyper-spectral backscattering and polarized angular scattering. These instruments provide information about the size and composition of oceanic particles, link it to Ocean Color remote sensing — an area of interest for NASA — and offer a unique view of the organisms comprising the plankton. The UMaine researchers also installed a plankton imaging sensor called an Imaging Flow Cytobot, which allows scientists to detect changes in plankton community composition "on the flight."

Other current and past UMaine students and affiliates are slated to board the vessel along its trajectory to South Africa and along the African coast back to its home port in Lorient, where it will arrive in October 2022. More information about the voyage can be found on the Tara Ocean Foundation website. ■

Fostering Peacebuilding and Conflict Resolution Around the World

Bill Farrell looks at the dynamics of conflict and violent extremism. He has conducted field research in countries across Central Asia, the Caucasus region, and Africa. He has met with government officials, community leaders, stakeholders, and an array of people who have had family members and friends mobilize to violent extremism.

Farrell is an assistant professor in UMaine's School of Policy and International Affairs, where he teaches and conducts research on issues of stability and violent extremism, with a particular interest in Salafi jihadi organizations.

Bill Farrell is an assistant professor at the University of Maine School of Policy and International Affairs.

His doctoral research comparatively examined mobilization patterns and orientation of local violent extremist organizations in the countries of Central Asia and the Caucasus, noting the change in their focus, once engaged in external jihadi theatres, such as Afghanistan and Syria.

Farrell's research is rooted in an ethnographic approach. He spends time interviewing and gaining insights into different people's experiences, perspectives, and thought processes.

"In doing this research, you learn an awful lot about people's mindset," he explains. "You suddenly recognize that it's not as black and white as you might otherwise think. It's not simply terrorist versus non-terrorist. It's perhaps somebody who thinks they're a freedom fighter or they're doing something heroic to save their families."

Navigating the details of these cases is challenging. "It can be eye-opening at times. It can also be quite sad at times when we've talked to people who are confused by the fact that their friend was killed in Syria, and they don't understand why he went there or what he was trying to do. You have the responsibility for not inflaming tensions and not making people feel bad, but trying to clinically understand their story," says Farrell.

Farrell has worked with international donor agencies, non-governmental organizations, and the United States Government for more than two decades. In addition to his role at UMaine, Farrell is also principal consultant at Orono-based Swordfish Consulting International, LLC. At Swordfish he works globally on situation analysis, strategy formulation, and influence mapping in fragile or transitioning countries. He uses his expertise in conflict and violent extremism to help guide strategy and analysis with government, multilateral, and private-sector clients.

Farrell has been focusing on topics of violence and instability for the majority of his professional and academic career. He is interested in what orients people toward violence and ways in which countries can form policy on interventions that might be taken to prevent the spread of violence or help to roll it back. For example, he has just returned from the Caucasus, where he worked with Georgian and Abkhazian civil society organizations on enhanced conflict transformation and peacebuilding skills. ■

Improving Access to Bioinformatics Research Tools through Cloud Computing

Ben King is building a genomics training module in the Cloud for biomedical researchers. The National Institute of Health (NIH) asked the assistant professor of bioinformatics at the University of Maine to lead the development of a training module on cloud computing for genomics.

King is a faculty member in the University of Maine Department of Molecular and Biomedical Sciences and the Institute of Medicine. The Institute of Medicine is 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.

The goal of the project is to develop training materials for biomedical researchers to be able to utilize high-performance computing systems for bioinformatics research using the Google Cloud platform. Bioinformatics applies computational methods to extract knowledge from biological data. King developed a proposal for the project with his colleagues at MDIBL, Joel Graber and Jim Coffman, that was funded by the National Institute of General Medical Sciences (NIGMS) in August.

Using cloud computing technologies, researchers can more easily design analysis environments without any infrastructure. This dramatically impacts the capacity of smaller laboratories to participate in research.

When King has hosted researchers in Maine at courses or week-long workshops, they are able to use the on-premise analysis servers preconfigured with all software and data needed to learn how to apply bioinformatics tools in their research. But once the course is over, those researchers do not always have access to the same analysis environment.

Cloud computing solves this problem. "They can build that same environment at any point later on, and then continue on from what they were doing at a workshop," King says. Beyond just continuing their work in their own laboratories after they leave, the project facilitates collaboration on a new level. Researchers can create identical analysis environments.

King's pilot project utilized a team of consultants from Google, and computing resources provided by the NIH Science and Technology Research Infrastructure for Discovery, Experimentation, and Sustainability (STRIDES) program and NIGMS. It will serve as a model for states in which success rates for NIH grants historically have been low and could potentially be used for all NIH extramural researchers.

Ben King, professor of bioinformatics at the University of Maine, envisions that his project will improve access to research tools and infrastructure, and ultimately increase collaboration among researchers.

At smaller research institutions it can be hard to build what King calls analysis environments, which are powerful computer servers where all analysis software is installed and datasets are available.

"The goals are to build a community of practice around using cloud computing for bioinformatics research and research training. There are different groups that have started, some of them are based in universities, others through different institutes at the NIH," King says. "And part of that is a demonstration project that builds a training module to analyze data from what we call RNA sequencing. It's something where we can walk users through the analysis workflow, but as they're doing that, they're learning about cloud computing in that process."

RNA-sequencing allows researchers to understand the biology of a cell by measuring differences in the expression of all genes under different conditions. For example, King's research lab uses RNA sequencing to understand how the innate immune system responds to influenza A virus infection.

Demand for collaborative research and shared analysis environments is increasing, while the opportunities presented by cloud computing provide the needed technological prowess to make large-scale collaborative research happen. ■

2021 NSF CAREER Award Recipients

For the first time, four faculty members at the University of Maine were selected in the same year for the prestigious National Science Foundation (NSF) CAREER Award. This is NSF's premier early career funding mechanism, which is intended to support enduring success in scholarship, teaching, and public service. This is a prominent award that recognizes the exceptional potential of the faculty and their research. This year's UMaine awardees are Sheila Edalatpour, Danielle Levesque, Lauren Ross, and Thomas Schwartz.

Sheila Edalatpour

Assistant Professor of Mechanical Engineering

Sheila Edalatpour, an assistant professor of mechanical engineering at the University of Maine, is studying how the emission of heat changes when the materials involved are quantum-sized, or when they are separated by a gap of the same size as one or multiple atoms. The proposal earned her $526,858 from a National Science Foundation CAREER Award.

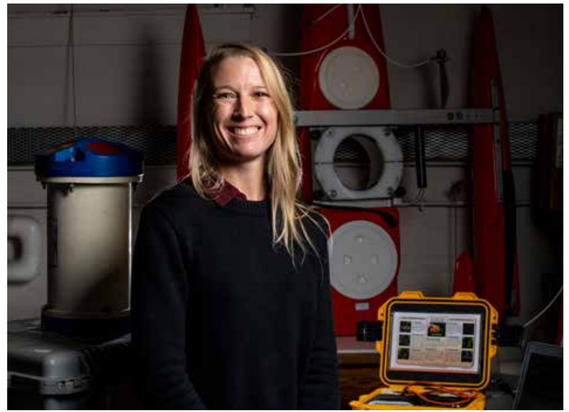
According to Edalatpour, optical and electronic properties can differ between bulk and quantum materials, and therefore, so can how they transfer radiated heat. Determining how material size affects thermal radiation, energy emitted from heated surfaces and transferred from one component to another in the form of electromagnetic waves, can help engineers design new materials to build more efficient, powerful and reliable devices for energy, computing, health care and other purposes. "Quantum size effects provide an excellent opportunity for engineering materials with novel thermal properties suitable for energy conservation and conversion technologies such as thermophotovoltaics, solar cells and smart windows," Edalatpour says. ■

Danielle Levesque

Assistant Professor of Mammalogy and Mammalian Health

Danielle Levesque, a University of Maine assistant professor of mammalogy and mammalian health, will use a National Science Foundation (NSF) CAREER Award of nearly $920,000 to study temperature regulation in diurnal and nocturnal equatorial small mammals in an effort to describe the impacts of climate change on species living in aseasonal tropical environments.

"My research lies at the intersection of comparative physiology, ecology and evolutionary biology," Levesque says. "As an evolutionary and ecological physiologist, I am primarily interested in comparative energetics and evolution of mammalian temperature regulation." The proposed project will fill a void in the scientific knowledge of mammalian thermoregulation, as much of the previous work has been conducted with northern hemisphere species who live in latitudes with low temperatures and a great degree of seasonality. Levesque's work, by contrast, takes place in the consistent equatorial conditions of Borneo. ■



Lauren Ross

Assistant Professor of Hydraulics and Water Resources Engineering

Lauren Ross, a University of Maine assistant professor of hydraulics and water resources engineering, received a CAREER Award of more than $600,000. This project will improve understanding of how estuary shape, river discharge and tides influence fresh and saltwater mixing.

Previous studies into the dynamics of fresh and saltwater blending focus primarily on partially-mixed estuaries, meaning they experience moderate freshwater inflow from rivers, and estuaries with basic dimensions, Ross says. As a result, current research provides less insight into estuaries with complicated topographies like irregular and fluctuating depth and width, headlands and constructions, and estuaries that have relatively large or small freshwater inputs from rivers, all of which can create more or less mixing. Ross, therefore, will use on-site data and numerical model simulations to quantify the mixing processes in more complex estuaries from across the world.

Her research will encompass the Penobscot River Estuary, which experiences moderate river input and tides; the Reloncavi Fjord in the Chilean Patagonia, which has large river input and small tides, and the Gironde Estuary in southwest France, which has large river input and tides. ■

Thomas Schwartz

Associate Professor of Chemical Engineering

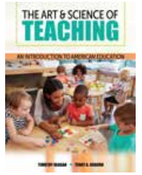
Thomas Schwartz, an associate professor of chemical engineering at the University of Maine, received a $513,995 NSF CAREER Award to advance his ongoing dissection of the Lebedev process. The well-known, multistep chemical reaction is used to make butadiene from biomass-derived ethanol. However, little research has been conducted on the Lebedev process at the molecular level.

Understanding the intricacies of the process would help researchers create new catalysts, which are necessary for the chemical reactions to make goods from both petroleum and biomass, that would increase butadiene yield. The emergence of improved catalysts could help grow the development of biobased, renewable chemicals. "Synthetic rubber is used in all sorts of consumer products, from car tires to paper coatings. Our goal is to enable production of synthetic rubber from renewable resources," Schwartz says.

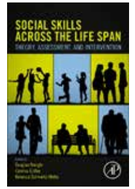
The new study builds on the previous research conducted by Schwartz and his UMaine Catalysis Group. He founded the group in 2015 to explore the intricacies of catalysts and the roles they play in chemical reactions used to make fuels and chemicals from carbon-based feedstocks. ■

Publication Spotlight A Sample of Works by UMaine Faculty

HANDBOOK OF RURAL AGING
Lenard Kaye
Routledge
2021
Social Work

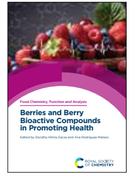


THE ART AND SCIENCE OF TEACHING: AN INTRODUCTION TO AMERICAN EDUCATION
Timothy Reagan
Kendall Hunt Publishing
2021
Education

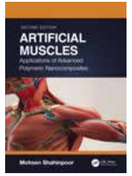


SOCIAL SKILLS ACROSS THE LIFESPAN: THEORY, ASSESSMENT, AND INTERVENTION
Cynthia Gardella
Douglas Nangle
Rebecca Schwartz-Mette
Elsevier
2020
Psychology

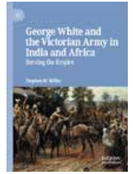
AT WAR WITH GOVERNMENT: HOW CONSERVATIVES WEAPONIZED DISTRUST FROM GOLDWATER TO TRUMP
Amy Fried
Columbia University Press
2021
Political Science



BERRIES AND BERRY BIOACTIVE COMPOUNDS IN PROMOTING HEALTH
Dorothy Klimis-Zacas
Royal Society of Chemistry
2022
Microbiology



ARTIFICIAL MUSCLES: APPLICATIONS OF ADVANCED POLYMERIC NANOCOMPOSITES
Mohsen Shahinpoor
CRC Press
2019
Mechanical Engineering



GEORGE WHITE AND THE VICTORIAN ARMY IN INDIA AND AFRICA
Stephen Miller
Palgrave-MacMillan
2020
History

"STILL THEY REMEMBER ME": PENOBSCOT TRANSFORMER TALES, VOLUME 1
Margo Lukens
University of Massachusetts Press
2021
Language

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Tilan Copson, Tammy Crosby, Cara Doiron, Adam Küykendall, Elizabeth Texeira, Kevin Wentworth

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