2020 RESEARCH REPORT

Global Impact

Local Relevance

Maine's Research University at Work

Impacting Our Future Now

For many, 2020 will be marked by COVID-19 and the considerable challenges that come with a global pandemic. For us, 2020 also will be marked by the great accomplishments and the inspiring collaborations that have taken place at the University of Maine, where we are proud of our university community for its dedication, teamwork, and resilience in the face of the pandemic.

As Maine's research university, it is the distinguishing part of our mission. Research impacts all areas — from student success and cutting-edge academic programs, to workforce development, innovation and economic advancement. In recent years, while advancing as a modern 21st century research university, we have placed considerable emphasis on the growth and development of the research enterprise, and its resulting impact on Maine and beyond.

We are pleased to report that significant advances have been made in the realization of the above-mentioned goals, and despite the daunting challenges caused by the pandemic, this has been an outstanding year for research and scholarly achievements at Maine's land, sea, and space grant university. It has set a new record, by generating $125.2 million in external funding during fiscal year 2020, in support of research and development activities. This corresponds to a 120% increase over the past four years, and an all-time high record realized by the university. During the same period of time, R&D expenditures have also reached a new all-time high record of $165.1 million, corresponding to a 66% increase over the past four years. Moreover, doctoral student enrollment for the first time in the university's history has exceeded 500, by setting an all-time high record of 517, as compared to the previous record of 463 set in 2012.

These achievements stem from the university's strategic pursuit of growth in research and its talented and dedicated faculty, staff, and students, in conjunction with its research centers and institutes, in partnership with its academic units and external collaborators. Moreover, the research development and administration resources and services that have been developed and grown in recent years have contributed to the realization of the given achievements.

Together, we have been creating a modern 21st century research university, with nationally and internationally recognized programs that have global impact and local relevance in diverse areas, ranging from the energy, environment, advanced structures, marine and forestry sectors, to human health, food and agriculture, community revitalization, and cultural preservation. These are highlighted by the examples provided in this annual report.

To obtain additional information 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.
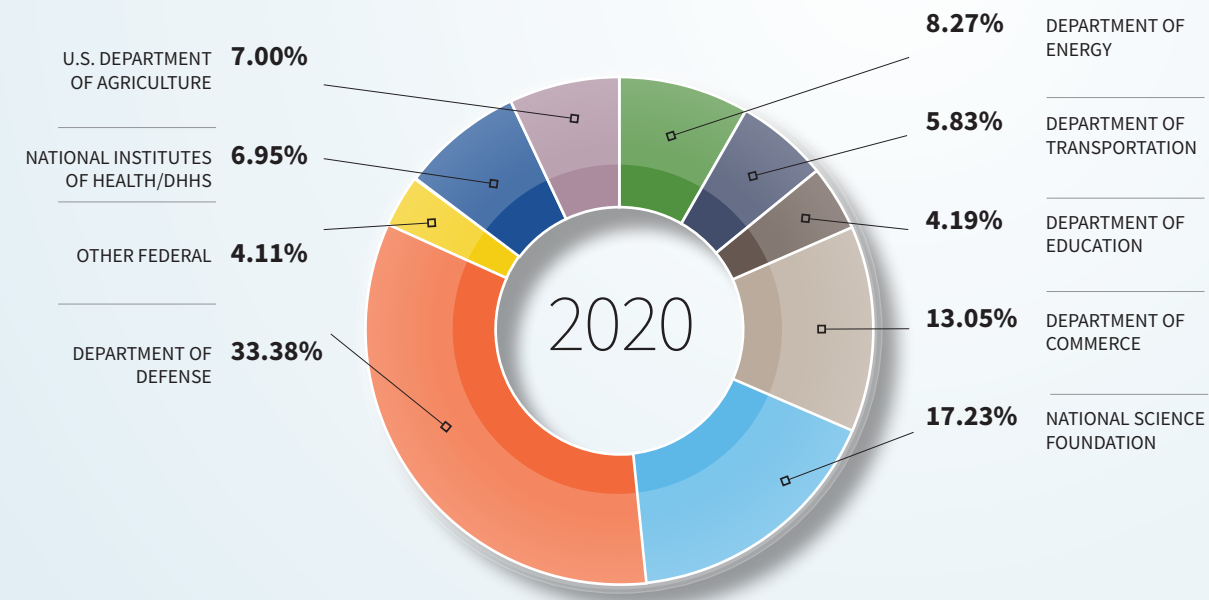
Joan Ferrini-Mundy
President

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

A Modern 21st Century Research University

64% Increase
in awards greater than $1 million over previous year

Total Awards

U.S. DEPARTMENT OF AGRICULTURE — 7.00%

NATIONAL INSTITUTES OF HEALTH/DHHS — 6.95%

OTHER FEDERAL — 4.11%

DEPARTMENT OF DEFENSE — 33.38%

2020

8.27% — DEPARTMENT OF ENERGY

5.83% — DEPARTMENT OF TRANSPORTATION

4.19% — DEPARTMENT OF EDUCATION

13.05% — DEPARTMENT OF COMMERCE

17.23% — NATIONAL SCIENCE FOUNDATION

86%
of all university research in Maine

150+
research institutes, centers, and labs

100%
of Ph.D.s conferred in Maine*

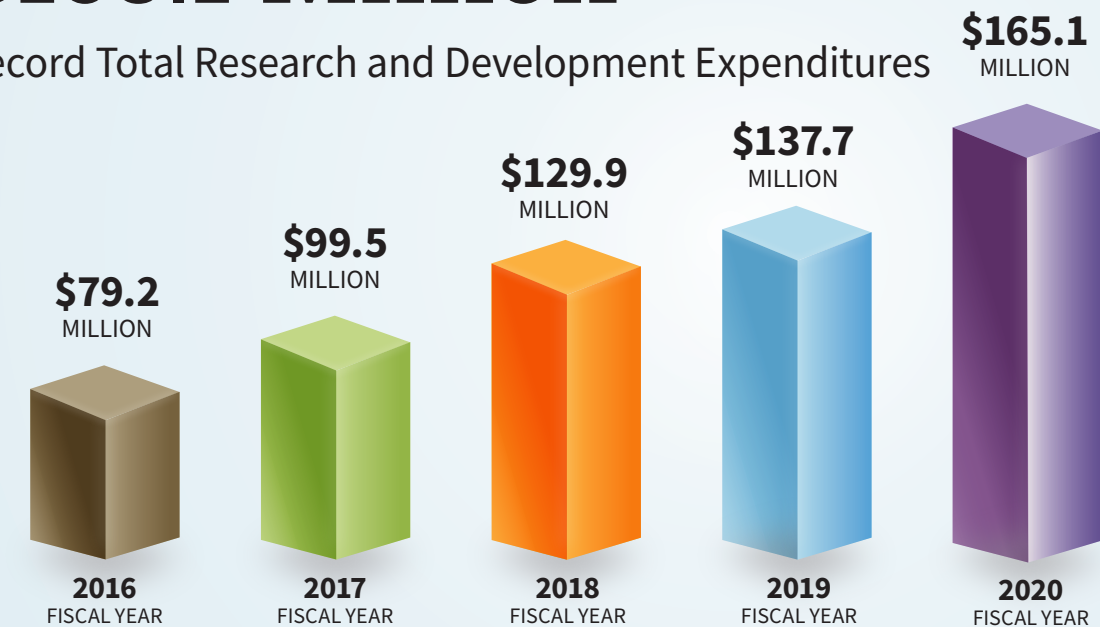*Reported on the 2018 NSF Survey of Earned Doctorates

54
new faculty hired

Top 20%
of Universities for National Science Foundation (NSF) Funding

$165.1 Million
Record Total Research and Development Expenditures

$165.1 MILLION

$137.7 MILLION

$129.9 MILLION

$99.5 MILLION

$79.2 MILLION

2016 FISCAL YEAR

2017 FISCAL YEAR

2018 FISCAL YEAR

2019 FISCAL YEAR

2020 FISCAL YEAR

$125.2 Million
Record Total Research and Development Funding

Serving Maine and Beyond

27% Increase
in Federal Funding from Previous Year

Top 20%
of Universities for Research Expenditures by NSF HERD ranking

MAINE

New Institute of Medicine Provides Foundation for Collaborative Advancement in Health Care in Maine and Beyond

Institute of Medicine Director and Research Professor of Medicine, David Harder, joined the University of Maine in 2019.

A new Institute of Medicine at the University of Maine will coordinate and support the research and public outreach efforts of some of the state's leading experts whose research and scholarly work at UMaine advances rural health care, diagnostic medicine, immune system diseases and disorders, and medical humanities.

The newly formed institute will serve as a bridge connecting the health care community with the university, and in doing so, it will provide guidance related to medical research, medical device development, rural health care and outreach, community engagement and workforce development.

By bringing together ideas from the state's research university and health care providers, it is expected that new strategies for therapeutics, medical devices, rural outreach and counseling will be developed, having significant positive impact on health care for people in Maine, says Institute Director and Research Professor of Medicine David Harder, who joined the university in 2019.

Through the institute, new initiatives and partnerships will benefit the state and beyond. A joint sponsorship with the Center on Aging to host weekly health chats geared for Maine's elder population will discuss topics related to the COVID-19 pandemic, healthy living and other health-related issues. The institute provides the structure for over 100 faculty engaged in biological and medical research, biomedical engineering, food science/nutrition, clinical psychology, social sciences and nursing to interact, share resources and develop joint programs. Moreover, the development of a formal research agreement between UMaine and Northern Light Eastern Maine Medical Center involves the creation of a joint study on genetic mechanisms related to chronic kidney disease in Maine's rural populations.

The institute provides the structure for over 100 faculty engaged in biological and medical research, biomedical engineering, food science/nutrition, clinical psychology, social sciences and nursing to interact, share resources and develop joint programs.

The institute is built on a foundation established by the UMaine Medicine initiative launched in fall 2018. The initiative supported and coordinated the growth and development of research and scholarly activity in health and life sciences, and helped advance related community outreach and engagement efforts.

The initiative also included some of the state's strongest university-based health care programs, including UMaine's Center on Aging; and Maine's University Center for Excellence in Developmental Disabilities Education, Research, and Service.

Today, the institute includes a community of collaborating interdisciplinary researchers and educators who, in partnership with health care providers and other stakeholders, are dedicated to discovery and learning in health and life sciences, and health care workforce development.

The institute is working closely with UMaine and University of Maine System researchers, as well as medical professionals in institutions statewide, to develop transformative solutions that enhance human health and well-being. Planned collaborations include biomedical scientists, social scientists and physicians with Northern Light Health, St. Joseph Healthcare, Penobscot Community Health Care, MDI Biological Laboratory, The Jackson Laboratory, and Maine Medical Center Research Institute.

The innovative and coordinated research and scholarly activity and education, in conjunction with strategic partnerships, will advance a national model for rural medicine, Harder says. Moreover, the institute's vision and mission align well with the University of Maine System Research and Development Plan.

State flagship universities have a responsibility to be primary social and economic drivers, says Vice President for Research and Dean of the Graduate School Kody Varahramyan. UMaine Medicine was created in 2018 to help UMaine become a leader in health care and related economic growth in Maine, with specific focus on rural sectors. Now the Institute of Medicine will continue and intensify these efforts. ■

Maginnis Awarded NIH Grant to Examine Virus Fatal in People with Weakened Immune Systems

Melissa Maginnis and her team study the biology of the human JC polyomavirus.

More than half the human population is infected with a virus that resides undetected in the kidneys of healthy people.

But when a carrier of the human JC polyomavirus, or JCPyV, has a weakened immune system, the virus can migrate to the brain, where it becomes fatal.

The virus spreads through contaminated food or water and from person to person — as it settles in a person's urinary tract and bone marrow and can be shed in urine. The virus stays in these sites for a lifetime, and many people never know they have it, says Melissa Maginnis, associate professor of microbiology at the University of Maine.

In people with weak immune systems, the virus can travel to the brain and cause a serious infection called progressive multifocal leukoencephalopathy (PML), which damages the outer coating of nerve cells, causing permanent disabilities and death.

Maginnis examines the biology of JCPyV seeking to identify ways to prevent the virus from causing PML in people with suppressed immune systems.

She has been awarded more than $435,000 through the National Institutes of Health Research Enhancement Award (AREA) program for the project, "Characterization of viral receptors and signaling networks in JC polyomavirus infection."

AREA projects support meritorious research and provide research opportunities for students. Maginnis, a recipient of the 2018 UMaine Graduate Mentor of the Year Award, is dedicated to providing high-quality student training opportunities in biomedical research. The Maginnis Lab supports the efforts of undergraduate and graduate students examining how the virus invades host cells.

"This research will pave the way forward to better understand how viruses are able to sneak into cells and cause infection," Maginnis says. "This NIH award represents hard work and contributions from my entire team, and we are very excited to continue moving this research forward."

The team hopes its findings will improve the understanding of JCPyV and possible treatments for PML, and enhance the knowledge of how viruses invade cells, which can be applied more broadly to the study of other viruses.

It's known that the virus infects glial cells in the brain, which produce the myelin sheath that covers nerve cells. When the virus invades and multiplies in these cells, it damages the protective covering, which impairs nerve transmission.

Currently, there's no cure for PML, highlighting the critical nature of the research.

People with JCPyV who are immune-deficient are at more risk for developing PML because the virus is able to travel unhindered on a path to the central nervous system. People with HIV/AIDS are at risk for PML, as are people taking immunomodulatory drugs for immune-mediated diseases such as multiple sclerosis.

Maginnis and her team recently published an article in the Journal of Virology that identifies specific components of the cellular pathway usurped by JCPyV to invade cells in the kidneys and nervous system.

This study, led by Colleen Mayberry, a Ph.D. student in the Maginnis Lab and alum of UMaine's undergraduate program in biochemistry, also was selected as a "Spotlight article" of significant interest in the journal.

Leading Biomedical Research

The Graduate School of Biomedical Science and Engineering, founded in 2006, is a unique collaborative graduate program comprising the five institutions which represent the biomedical research community within the state of Maine, with four private partnering institutions: The Jackson Laboratory, MDI Biological Laboratory, Maine Medical Center Research Institute, and the University of New England.

The program currently has 75 students, 71 alumni, and 195 faculty. It is the largest STEM Ph.D. program in Maine.

Current degree programs offered:
- Ph.D. in Biomedical Science
- Ph.D. in Biomedical Engineering
- Professional Science Master in Bioinformatics

The GSBSE received a five-year $1.07 million NIH Institutional Research Training Grant (T32), titled "Transdisciplinary predoctoral training in biomedical science and engineering" in 2019. The predoctoral trainees of this program will be well-positioned to make fundamental discoveries and breakthroughs leading to significant advancements in human health and well-being.

GSBSE is providing the biomedical workforce of the future, supplying industry and academia in Maine and beyond with highly trained graduates. The graduates of the GSBSE programs go on to have successful careers in industry and academia, with 42% staying in Maine. ∎

Improving Muscle Retention

Elisabeth Kilroy's dissertation project explored a novel approach to improving muscle retention in people affected by muscular dystrophy. To develop support for her research, Kilroy engaged with the public, garnering international media attention and a research award from the Morgan Hoffman Foundation. She spoke to U.S. senators and representatives as an advocate for federal support of muscular dystrophy research.

In the spring of 2020, Kilroy received the College of Natural Sciences, Forestry, and Agriculture's Outstanding Service Award before graduating.

"My goal is to cure muscular dystrophy," she says. "Thousands of individuals are losing the fight against muscle wasting and weakness, and I know that I can help them." Her project adviser, Clarissa Henry, is a professor of biological sciences in the School of Biology and Ecology.

Kilroy graduated earlier this year with a Ph.D. in biomedical science, and is now a Post-Doctoral Scientist in the Flanigan Lab at Nationwide Children's Hospital. ∎

Detecting and Deterring Biological Threats

Daniel Regan is a Ph.D. candidate in the Graduate School of Biomedical Science and Engineering (GSBSE). His research is focused on the development of platforms for the detection and deterrence of biological threats. Regan works in assistant professor of Biomedical Engineering Caitlin Howell's Biointerface and Biomimetics Lab.

A year into his work, Regan approached Howell about an idea for a new type of catch-and-release filter for use in medevacs. This original concept combined his passion for military biodefense and biomedical engineering. His goal was to monitor against biological threats while improving patient care and overall cleanliness. Little did he know that his project would be highly applicable to a rapidly emerging pandemic: SARS-CoV-2, otherwise known as COVID-19.

"Bio threats are only going to become more problematic as time goes on, but it doesn't stop at manmade threats. For decades, scientists have been suggesting that a major pandemic may be imminent," Regan explains. With COVID-19, those hypotheses were proven correct. It quickly became clear that the catch-and-release filter originally planned for military use could be useful in other environments, such as nursing homes, emergency rooms, schools, and more.

"Everyone is pretty familiar with HEPA filters, which catch allergens," Regan says. "However, they were designed to keep airborne particulates trapped for an extended period and then disposed, presenting challenges to monitoring the status of biological threats."

"We engineered a filter that addressed the need for easily transferring the trapped pathogens while maintaining viability." The result is a liquid-infused membrane filter. "The pathogens get caught in the liquid, which makes it easier to manipulate and take samples for further analysis."

According to Regan, this will help scientists to rapidly identify potential exposure to infectious diseases, progressing toward early warning systems. Regan has been working to get this design patented, while testing the efficacy of the filter. The idea of not only being able to block dangerous pathogens, but also utilize them to create assays and better understand what is present in the environment is a potential game changer.

This potential was recognized during the 2020 UMaine Student Symposium, which was held virtually on October 2. Regan received the Dr. Susan J. Hunter Presidential Research Impact Award for the top graduate presentation and was selected as the top graduate presenter in the category of Engineering and Information Sciences for his presentation titled "Optimizing Liquid-Gated Membranes for Bioaerosol Capture and Release."

"Maine has some really great researchers and I was fortunate enough to have them pick me for this award," Regan says. "When you're working on a Ph.D., you don't necessarily get that recognition until the work is done, so it's exciting to be recognized for the impact my research has made and will make." ∎
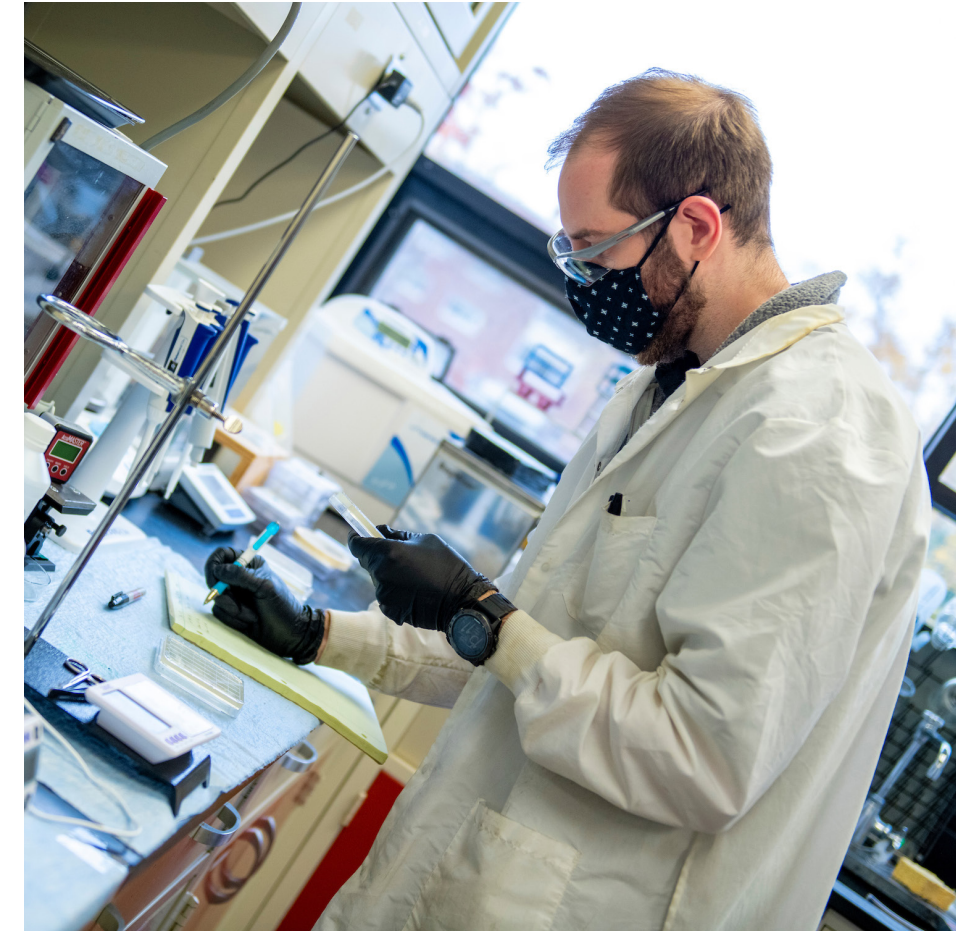
Daniel Regan is a Ph.D. candidate in the Graduate School of Biomedical Science and Engineering, researching the development of platforms for the detection and deterrence of biological threats.

Tackling Biodiversity Loss Through COVID-19 Recovery

Two University of Maine professors contributed to a report that explores how governments can help mitigate ecosystem and species loss through their COVID-19 stimulus and recovery plans.

While many countries hope to implement regulatory and funding measures to help "return to normal," the authors of a Rutgers University-led paper, including Michael Howard and Cynthia Isenhour from UMaine, urge officials to take measures that would help halt decades of biodiversity degradation exacerbated by previous policy decisions. Their recommendations include incentives, regulations, fiscal policy and employment programs that would support ecosystem resilience and prohibit actions that threaten various animals, plants and other wildlife.

"A widely recognized policy that would reduce carbon emissions and put us on a more sustainable path is a carbon tax," Howard says. "One way to address the impact of such a tax on low-income households would be to distribute the revenue as a dividend."

Howard, a professor of philosophy, Isenhour, an associate professor of anthropology and climate change, and their colleagues from institutions worldwide also found that most countries have not implemented environmental preservation-related economic reforms or investments during the pandemic. Some, including the United States, Brazil and Australia, have relaxed laws created to protect nature. The 2019 Global Assessment Report on Biodiversity and Ecosystem Services from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), however, found that about 1 million species face extinction, some in decades, unless policy changes are enacted.

"As disastrous as the pandemic has been, the disruption does provide an opportunity to reconsider our path and to design economic systems that are more sustainable, healthy and resilient," Isenhour says.

Pamela McElwee, an associate professor in the School of Environmental and Biological Sciences at Rutgers University–New Brunswick, served as lead author of the report, which was published in the journal One Earth. ■

Serving Rural Communities

In an effort to investigate best practices for tackling food insecurity in Washington County, students in the psychology and community studies program at the University of Maine at Machias surveyed area residents about food-related volunteer work.

The surveys were part of a course on research methods and design in which students develop a project on an issue impacting the community. UMM professor Lois-Ann Kuntz says the project comes at a crucial time when the COVID-19 pandemic has exacerbated ongoing problems with food security in Washington County.

In one survey, residents who volunteered in the past were invited to anonymously evaluate their experiences. Another survey for residents aimed to gauge interest in donating supplies, land and/or labor to a possible community garden project in Machias. Survey participants also had the option to add their contact information to a list of available volunteers for local food pantries and delivery networks.

Results from the surveys, which were conducted virtually through social media and other online community networks, will be shared with Regina Grabrovac, a food programs manager for Healthy Acadia. Through its "Healthy Food for All" project, the nonprofit organization coordinates a number of community nutrition initiatives throughout Washington County.

"There's currently a desperate need for volunteers to deliver and provide meals for elderly folks, folks with compromised immune systems, and other food pantry recipients," says Kuntz. "We hope our research will help by connecting willing volunteers with Healthy Acadia and providing data about how to improve the volunteer experience." ∎

Forecasting the Economic Impact of COVID-19

A University of Maine researcher and six graduate students are helping Maine state officials estimate the economic fallout from the coronavirus pandemic.

Andrew Crawley, an assistant professor of regional economic development with the UMaine School of Economics, and his students are working with the state economist's office to develop forecasts for how much COVID-19 will affect Maine's economy. They will create five models to evaluate the possible loss in tourism spending, travel-related spending, cruise ship spending, state revenues and overall sectoral output changes. The forecasts will also include prospects for recovery.

Developing forecasts will help those who are trying to grapple with the issues posed by the outbreak and guide policymakers' decision-making as the state reopens the economy, Crawley says. "Each project we tackle is something the state expressed an interest in knowing more about," he says. "We are trying to better understand the aggregate impact of COVID-19."

The effects of the pandemic can ripple through the state economy in many ways, some of which have yet to be quantified or even revealed, Crawley says. Several economic forces also are interconnected, meaning COVID-19 damaging one sector can cause a domino effect.

For example, unemployment increasing beyond 100,000 residents results in a drop in state income tax, cutting state revenue, according to Crawley. A decrease in travel also results in a decrease in gasoline purchases, thus a drop in gasoline tax revenue, store purchases and other pertinent expenditures.

"Those areas (tourism and travel) are highly impacted by COVID-19," Crawley says.

The UMaine assistant professor and his team of graduate student volunteers from his Regional Economic Modeling class are designing their forecasts using present and historic data for unemployment, tourism, business output and driving patterns. They are utilizing professional economic impact and modeling tools.

Crawley says his class tasks students with performing analyses using "complex, often dirty, imperfect data" that replicates the challenges researchers face in most professional settings. Creating models to predict the economic damage wrought by COVID-19 using current and dynamic information is a perfect case in point when data is not perfect. It provides hands-on experience for his students, better preparing them to tackle real-world problems.

"To see students get gripped, and get really enthusiastic and driven to complete a task is really rewarding," Crawley says. "It's really been incredibly fulfilling to see students get to do this."

The results from this research were presented to the State Economist, Amanda Rector, and the Associate Commissioner for Tax Policy, Michael Allen. Following this project, Crawley continued his involvement with the state over the summer with the Maine Rapid Business Climate Survey. The survey ran from June through July and provided key information to the state on what challenges businesses were facing as the pandemic developed.

This work yielded weekly reports available through the School of Economics website. These reports and other supplementary data were also disseminated to the state economist each week. ∎

Working Together to Solve Problems
Senator George J. Mitchell Center for Sustainability Solutions

The Senator George J. Mitchell Center for Sustainability Solutions builds partnerships in which teams of students and faculty with diverse expertise collaborate with communities to find solutions to complex problems. Although sustainability challenges arise in many different contexts — municipal planning, coastal fisheries, public health, forest management — all require a focus on a combination of economic, environmental, and social issues. Created in 2014, the Mitchell Center for Sustainability Solutions is widely recognized for stakeholder-engaged, solutions-driven, interdisciplinary research to improve human well-being while protecting the environment. In collaboration with diverse stakeholders, the center links knowledge with action to create a brighter economic, social and environmental future in and beyond Maine. ∎

ALONG MAINE'S COAST

Building networks – Led by Bridie McGreavy and her research team, the Maine Shellfish Learning Network connects stakeholders from more than 20 coastal communities spanning the entire coast to strengthen shellfisheries and livelihoods.

Preparing for change – Josh Stoll and his colleagues are conducting research to help lobstermen and coastal communities prepare for potential challenges in the fishery such as climate change and trade.

Safer roads, searun fish – A research team led by Sam Roy is developing cost-effective strategies for culvert replacement that result in both safer roads and improved fish passage.

Student Focus – Engineering student Sohaib Alahmed is collaborating with oyster and mussel farmers in Frenchman Bay to identify pollution problems and strategies for minimizing their impacts on both wild-harvest and aquaculture fisheries.

ACROSS MAINE'S FORESTS AND FARMLANDS

Improving agriculture, reducing climate change Adam Daigneault and his colleagues are assessing strategies for promoting soil health and lowering greenhouse gas emissions.

Mobilizing to fight an invasive insect – A team led by Darren Ranco and John Daigle continues their collaboration with Wabanaki basketmakers to fight the emerald ash borer. This invasive insect could decimate Maine's brown ash trees, jeopardizing the livelihoods of basketmakers.

Student focus – Economics student Joey Reed conducted research focused on community resilience in the Katahdin region. His research included survey design, data collection, statistical analysis and in-person surveys. One highlight was getting to interact with local residents.

TOWARD HEALTH & WELL-BEING

Reducing food insecurity – Rachel Schattman is involved in a study to see how food security in Maine has been affected by COVID-19 and how food insecurity can be alleviated.

Ticks and tourists – A team led by Sandra De Urioste-Stone and Allison Gardner is assessing the abundance of ticks in Acadia National Park and helping park staff reduce exposure risks to visitors.

Student focus – In collaboration with a 37-member stakeholder group, including representatives from Hannaford and Good Shepherd Food Bank, a team of undergraduate students helped identify six solutions to reduce food waste and food insecurity.

ENHANCING EQUITY OUTCOMES FOR MAINE

In response to a request from the Governor's Office of Policy Innovation and the Future, graduate student Sara Kelemen helped lead a project focused on improving the equity outcomes of Maine's Climate Action Plan.

PATHWAYS FOR NATIVE STUDENTS

Darren Ranco and his colleagues are leading a new initiative with the Wabanaki Youth in Science (WaYS) Program in which Native American students will guide their peers through research projects and professional development activities.
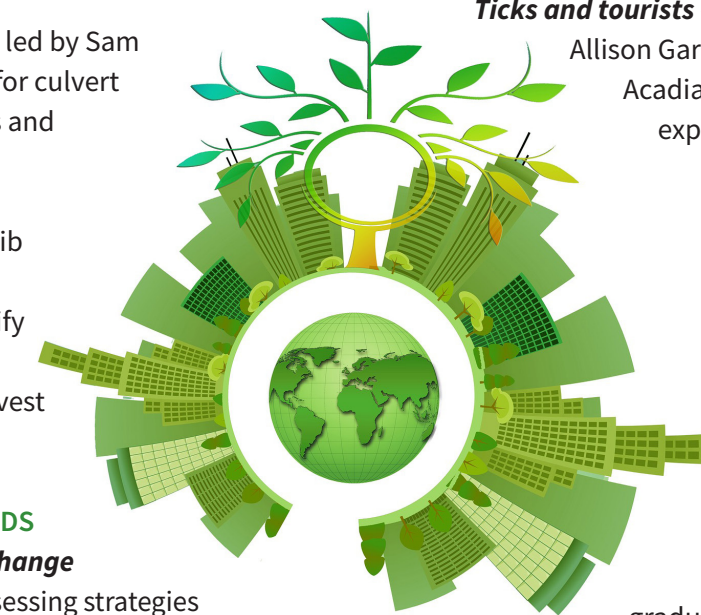
Developing Research Success

The Office of Research Development (ORD) helps faculty, staff, and students at the University of Maine secure the resources they need to deliver on the promise of ground-breaking research and scholarship.

In FY 2020, ORD provided support to faculty and researchers in the submission of over 115 proposals to extramural sponsors requesting a total of over $105 million. Prior efforts from ORD were evident in many of the awards received in FY2020: at least 25 of UMaine's funded projects totaling $35 million involved major support from ORD staff.

Staff focus on large-scale interdisciplinary funding proposals, highly competitive student research training grants, and the provision of grant-writing workshops and consultations with the research community.

The Office of Research Development, directed by Jason Charland, takes a keen interest in supporting faculty new to the university and orienting them to resources, initiatives, and funding opportunities. The department offers professional development and ongoing training to support members of the university community in building competitive research programs.

In FY 2020, ORD provided hundreds of research consultations to University of Maine System faculty, staff, and students. Over 300 meetings with researchers were conducted, covering project management, proposal editing, opportunity identification, research program consultation, and guidance for internal funding and/or limited submission.

This year, ORD launched a Grants Academy, which recruited 10 participants from three UMS campuses for a seven-month guided journey toward proposal development. Eight faculty members completed the program, developing projects bound for NIH, NSF, USDA, and DoD.

The University of Maine plays a vital role serving the people of Maine, and ORD assistance boosts the diversity, sustainability, and growth of research operations.

The year 2020 witnessed unprecedented success for UMaine researchers, and ORD is proud to have supported their efforts. ∎

From aiding successful funding requests for highly relevant COVID-related research to supporting efforts to secure major federal funding for research and graduate training, ORD works in tandem with other research support units of the university to deliver on UMaine's mission: advancing learning and discovery while addressing complex challenges with research-based knowledge.

Maine's First Small Satellite

The University of Maine Wireless Sensing Laboratory (WiSe-Net Lab) and the Radio Amateur Satellite Corporation (AMSAT) have signed an agreement to collaborate on the building and operating of MESAT1, Maine's first small satellite, to be launched in space in the next three years.

MESAT1 is the state's first CubeSat — one of 18 small research satellites selected by NASA to carry auxiliary payloads into space between 2021–23. It is part of NASA's CubeSat Launch Initiative that provides opportunities for nanosatellite science and technology payloads built by universities, schools and nonprofit organizations to ride-share on space launches.

MESAT1 is being led by UMaine, in partnership with the University of Southern Maine and a trio of K–12 schools — Saco Middle School, Fryeburg Academy and Falmouth High School.

AMSAT is an educational organization that advances amateur radio participation in space research and communication. Since 1970, it has constructed and/or operated more than 20 amateur satellites, and has been a major influence on the "small satellite revolution."

UMaine's WiSe-Net Lab, established in 2005, is involved in aerospace and space research. The lab was founded by Ali Abedi, assistant vice president for research and director of the Center for Undergraduate Research. Lab researchers have developed the first wireless sensor network for NASA's lunar habitation project and launched wireless leak-detection for the International Space station.

The MESAT1 initiative will enable K–12 students and teachers in Maine to access space data for educational and research purposes, and encourage students to pursue STEM careers. ∎

Supporting Research Goals Through Advanced Computing

When working on a research project, it's important to not only collect and analyze data, but to also make sure the data is saved and backed up. Depending on the research area, there is a spectrum of data storage and computing needs. Some only need a data back-up service, while others require large-scale parallel computing capabilities. In order to help researchers overcome difficulties related to high-performance computing needs, UMaine's Advanced Research Computing (ARC) was created in 2019.

There are a wide variety of services available through ARC. These include providing access to reliable and cost-effective high-performance computing solutions, primary fast-access data storage, data back-up services, consultation and training, and grant-writing assistance. This portfolio of services is deeply rooted in helping clients identify and achieve their high-performance computing goals.

"ARC is filling the gap between stating 'I know I can,' and asking 'but how do I do it?'" Kevin Wentworth, an ARC team member, explains. "We want to provide the best answer on what types of equipment or services would work best for you."

Solutions may originate on campus or from a network of partners established by ARC. Partners such as the Texas Advanced Computing Center (TACC) and the Ohio Supercomputer Center provide advanced, cloud-based computing solutions. Established agreements with these centers allow University of Maine faculty, staff, and students to gain access to massive parallel computing platforms, often eliminating the high cost of purchasing their own hardware.

"Over the last 20 years, there has been ubiquitous growth of centralized computing centers, both in the commercial sector and in academia," says Shane Moeykens, the Advanced Research Computing Director. "On the national scale, a rural state like Maine is not equipped to replicate these types of systems, so TACC and OSC extending their services to Maine is incredibly helpful."

However, cloud computing doesn't negate the need for local computing platform support, so ARC staff are also working with faculty to determine appropriate hardware solutions in local labs, and partnering with local solution providers.

ARC surveyed a wide variety of UMaine researchers to see what needed improvement. One of the identified areas was back-up data storage solutions. With this in mind, ARC partnered with the University of Maine System Advanced Computing Group (ACG) to set up a back-up storage hub housed on the University of Maine campus, with a sister storage system housed at the University of Southern Maine. Adopters have expressed positive feedback for the hub.

The ARC is excited to share their services with the UMaine community and beyond, and believes that UMaine's research enterprise will be strengthened. "The goal is to make UMaine faculty aware of the resources that are already available," Moeykens says. "And to make sure that the process for accessing resources is low effort." ∎

The NSF-funded Frontera supercomputer at TACC debuted on the June 2019 Top500 supercomputer list, ranked as fifth fastest in the world.

ARC's mission is to support the University's research goals by providing advanced high-performance computing expertise and services to researchers from across the University and beyond.

Innovation in Deep Learning

According to Dr. Salimeh Yasaei Sekeh, an assistant professor of computer science at the University of Maine, it's not uncommon for people to mistake Artificial Intelligence (AI) as a technology of the future, when we have already integrated AI into our everyday lives.

"When you have a modern life, you need modern techniques," Sekeh explains. Most recently, Sekeh and her lab tested an algorithm they created for the fast and efficient classification of large collections of data; specifically images. This project is a part of UMaine's AI initiative, which explores real-world applications for innovative AI research.

The algorithm is meant to help a computer learn a variety of standards from a sample collection of images, then use that information to recognize and classify different subsets.

"Any real-world problem that deals with predicting classes or labels could benefit from this type of work," says Sekeh. "Such as climate change and ecosystems research."

But how can an algorithm help a computer sort through such large databases? The answer is a technique known as "deep learning."

Deep learning is a subset of AI machine learning that utilizes artificial neural networks designed to recognize patterns in unstructured or unlabeled data. Simply put, it is a complex simulation of the human brain that can be used to help computers sort through massive amounts of data. Deep learning usually takes a lot of time, but Sekeh's lab proposed to improve the process and accelerate the run times. Next, Sekeh and her lab needed to test their algorithm.

However, most computers are not capable of running such complex algorithms. It requires supercomputers, made with high levels of performance in mind. Sekeh contacted the University of Maine Advanced Research Computing (ARC) for assistance.

ARC connected Sekeh with the Texas Advanced Computing Center (TACC) in Austin, which operates some of the world's most advanced cloud computing resources. Sekeh's lab used a new cluster known as "Longhorn," which is capable of supporting complex workloads that require high GPU (graphics processing unit) density and deep learning. It was a perfect fit.

It ran a large data set of different types of images (animals, objects, etc.) using their classification algorithm, hoping to identify any flaws or areas for improvement, while seeing if the algorithm could perform efficiently.

"Sometimes, you lose accuracy when you speed a process up," Sekeh explains. "[But] this test ran successfully, without any loss of accuracy."

Sekeh is excited about the implications of the test's success, and is already working on new objectives for the algorithm. For example, she hopes to make the algorithm applicable to videos as well. ∎

Growing the Aquaculture Economy

Over the past decade, Maine has seen 2.2% annual growth in aquaculture, which has had an overall economic impact of $140 million annually. Tackling the growing challenges for the sector — from emerging finfish and shellfish diseases to the effects of climate change — is critical.

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

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

"Aquaculture is critical for the future of our coastal communities and for the economic recovery of Maine," says UMaine President Joan Ferrini-Mundy. "For more than a decade, UMaine's nationally and internationally recognized aquaculture researchers and facilities have been dedicated to problem-solving, student experience and workforce development, and advancing this sector to benefit the state's economy. This partnership builds on those strengths, and creates a synergy among cutting-edge expertise, resources and research." ∎

Fostering Entrepreneurship

Aquaculture in Shared Waters, a program that prepares fishermen and others to start aquaculture ventures in Maine, received a Sea Grant 2020 Superior Outreach Programming Award from the Sea Grant Extension Assembly. Superior Outreach Program Awards recognize programs that can serve as an example across the entire National Sea Grant network.

Since 2013, Aquaculture in Shared Waters has provided training, technical support, and networking opportunities to about 250 individuals. Thirty new aquaculture businesses have been established with support from the program, as well as more than 100 jobs established, expanded, or retained as program participants began working in the aquaculture field.

Aquaculture, the practice of farming aquatic plants and animals, is an $88.4 million industry in Maine. Aquaculture provides commercial fishermen the opportunity to expand their businesses and enter new markets.

Aquaculture in Shared Waters was developed in partnership with team member organizations and is now supported by the Maine Aquaculture Hub. Current programming focuses on sustainable practices and has expanded to virtual formats in order to engage potential aquaculturists all along the coast of Maine. ∎

Digital Humanities: New Methods for Engaging Our Past

As the humanities specialist at the McGillicuddy Humanities Center, Karen Sieber helps support the scholarly research and creative activities being undertaken by students and faculty on campus. Working with the center's director, Michael J. Socolow, Sieber produces humanities-centered programming, mentors undergraduate humanities fellows, and promotes humanities projects, programs, and opportunities on campus. She uses her background and training in public history and the digital humanities to encourage students and faculty to think creatively about public engagement.

With a background in community archives, exhibit curation and digital mapping, Sieber has worked on several projects engaging audiences with vital but often forgotten moments of U.S. history. These include the destruction of the Black community of Hayti, the Loray Cotton Mill Strike of 1929, and the Red Summer race riots of 1919. Her website, Visualizing the Red Summer, includes the digital archive she built of 700 items collected from around the country about the lynchings and mob violence against Black Americans that summer, as well as data visualizations about the nationwide series of events. The site is now used in classrooms around the globe, and is a featured resource by the National Archives.

Sieber has also made great contributions to the historical scholarship here at the University of Maine working with students in Professor Liam Riordan's Public History class, and librarians at Fogler Library, to piece hidden campus histories into a digital tour. She's presented her new findings at the Mount Desert Island Historical Society, in classes at the University of Maine, and in other public venues.

In collaboration with Socolow, Sieber launched a pilot oral history project this fall titled "Maine Remembers the Coronavirus Pandemic." The project seeks to capture this current idiosyncratic moment for future historians and scholars. Funded in part with a gift to the center by Doug Baston '69, "Maine Remembers the Coronavirus Pandemic" will expand in 2021 as new subjects, partners, collaborators, and funders are located. Sieber also organized a workshop led by a senior program officer from the National Endowment for the Humanities to help humanities faculty learn about, and plan, future grant applications.

Karen Sieber's humanities work demonstrates how the University of Maine, and the McGillicuddy Humanities Center, remain committed to highlighting the applicability and relevance of humanities research to an array of contemporary social, cultural and political issues. ∎

Advancing Humanities Research and Scholarship

The Clement and Linda McGillicuddy Humanities Center demonstrates the immediacy and applicability of humanities studies by advancing teaching, research and public engagement in the humanities in Maine. The Center supports University of Maine faculty and student scholarship with grants and fellowships. In the Fall of 2020 several creative, imaginative, and vital projects received the center's funding. These included McBride Professor of History Anne Kelly Knowles's project that maps Holocaust victims' experiences across Eastern Europe; "Terrible Sights: American Art and Catastrophe," a book manuscript by Professor of Art History Justin Wolff that analyzes iconic American artworks from a fresh perspective; and Assistant Professor of English Katharine Swacha's "Coping with COVID: A public story-telling project," which examines how people are negotiating this critical moment while incorporating COVID-related public health recommendations into their daily lives. ∎


The Fall 2020-Spring 2021 McGillicuddy Humanities Center Undergraduate Fellows, left to right: Hailey Cedor, Nola Prevost, Nolan Altvater, and Katherine Reardon. Fellows receive $4000 each semester to work on a humanities project of their own devising. They serve as humanities ambassadors to their peers, the campus, and beyond.

# Culture and Community in Interdisciplinary Arts

Arturo Camacho (José Arturo Camacho Quiroz) was born in Mexico State, Mexico, where he spent the majority of his early life. He came to the United States at the age of 19, and traded his pursuit of an engineering degree for a B.F.A. in intermedia with a minor in photography from Endicott College in Beverly, Massachusetts. After graduating, Camacho remained in the U.S., where he adopted a nomadic lifestyle that influenced his search for belonging and, subsequently, his art. Much of his work showcases and catalogs pieces of popular culture, such as video game consoles, toys, and technology from the turn of the millennium. He utilizes media such as photography, video, sculpture, and restoration techniques to focus on relics from millennial childhood and their relationship with psychology and social development. ■

Camacho catalogs popular culture using various media, such as photography (left) and sculpture (below) focused on relics from millennial childhood.
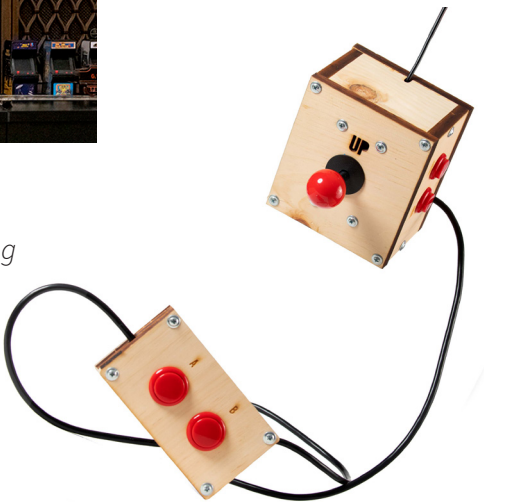
"I can say that my research focuses on a self-reflective process, archiving or documenting my experience of cultural assimilation into the American culture as an outsider. As an immigrant, I suffered certain issues, such as cultural shock, and culture bereavement."

I love it when you make me coffee in the morning.

a cookbook memoir
by Rachel K. Church
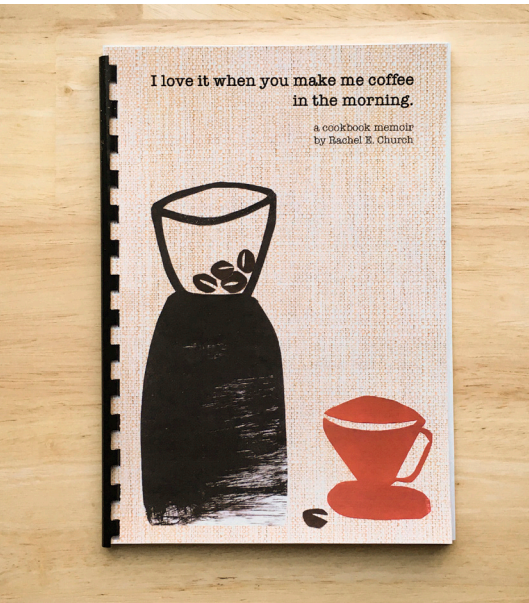
"I love it when you make me coffee in the morning," a cookbook memoir, by Rachel Church, 2020.

Rachel Church is an intermedia artist, book artist, and printmaker. She has a B.A. in art with a concentration in printmaking and entrepreneurial studies and a B.F.A. in studio art with a minor in book arts, both from the University of Southern Maine. In 2008, she was an intern at the Engine House Press, on the island of Vinalhaven, Maine, and in 2009, she spent a year printing with the Peregrine Press in Portland, Maine, thanks to the Kate Mahoney Memorial Scholarship. More recently, she was selected as the Baxter State Park 2018 Artist in Residence. She is currently a member of Running with Scissors Studios and teaches printmaking and bookmaking workshops. Church defended her thesis, titled "I Love It When You Make Me Coffee in The Morning," for her Intermedia M.F.A. degree in August 2020. Her current work explores gender issues through food and material culture, with a particular focus on cookbooks. ■

"Cookbooks have historically been used to create community … to both create and preserve a cultural feminine ideal. And in many cases, they're the only primary source documentation we have of women's lives in certain periods. So, these things have all informed my work as a book artist working with issues of gender and domesticity."

Presenting Art as a Common Experience

Justin Wolff is a professor of art history at the University of Maine. He teaches courses on modern, contemporary, and American art as well as art theory and criticism. His research focuses on 19th and 20th century American art and culture. Wolff's new book, titled "Rufus Porter's Curious World: Art and Invention in America 1815-1860," was published in 2019.

Can you describe the purpose and impact of your work?

Hopefully my work presents the artists and artworks I write about as belonging to common experience. If my scholarship shows art and culture as public matters, then I have succeeded. I am proud of the fact that I have shared my scholarship in different sorts of venues, including academic journals and university presses, popular newspapers and magazines, and academic conferences and public libraries. I am suspicious of cloistered knowledge and am therefore pleased that my publications have been reviewed not just in art history journals but also in popular media, such as the Wall Street Journal, New York Times, and public radio.

Could you explain the nature of your work?

Like many others in my field, I research a diverse range of material productions, including not only so-called "fine art" but also photographs, prints, amateur films, and literature about visual culture. To do so one must be interdisciplinary and methodologically nimble. As an undergraduate and a graduate student, I was taught that art history is driven by interdisciplinary inquiry — the discipline is really an open range where objects and ideas commingle. I study this range through the lenses of art history, American studies, literary history, documentary studies, political history, postmodern theory, and the history of science and technology. Not surprisingly, perhaps, I have found that curiosity is key. Most simply put, I am opposed to false dichotomies — between high and low culture, art and the public, and intellectualism and pragmatism.

**Have you had to pivot your process and/or methods due to COVID-19?**

Yes, for sure. First, like all faculty everywhere, I have had to set research aside to learn new teaching platforms and technologies, and to develop new pedagogies to maximize learning in the virtual classroom. Also, I am just starting a new book project, tentatively titled "Terrible Sights: American Art and Catastrophe" and have been looking forward to making significant progress during my spring 2021 sabbatical. But because of travel restrictions, I will be unable to travel to the museums and archival repositories to conduct the research I had planned on. At the moment I am looking into how I can obtain digital scans of rare manuscript material. I love archival research — visiting libraries and reading rooms, and handling manuscripts, being buried in actual material — so it's an obstacle and definitely discouraging to be on lockdown. But I am doing what I love and am grateful to have uninterrupted time for research.

**What is the most rewarding aspect of teaching for you?**

I love sharing my curiosity and watching students develop their own curiosity. It's deeply satisfying. I also believe that good teaching is absolutely necessary. My classroom is a place where young adults can learn that art, which admittedly can seem far away at times, is in fact intertwined with the politics, ethics, and identities they are fashioning. Not only is art intertwined with these discourses and processes, art literally gives form to them — art materializes ideas, giving us new ways to experience them. Being with students when this becomes apparent is the most rewarding thing I do, because transformative knowledge is inherently communal. It must be shared, back and forth. Nothing I do matters without students. ■

RUFUS PORTER'S CURIOUS WORLD: ART AND INVENTION IN AMERICA, 1815-1860
Laura Fecych Sprague and Justin Wolff
Penn State University Press
2019

Rufus Porter's Curious World
ART AND INVENTION IN AMERICA, 1815–1860

EDITED BY
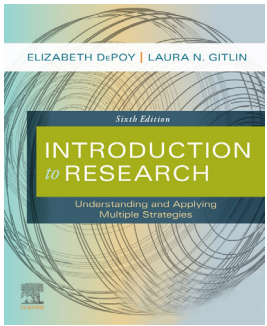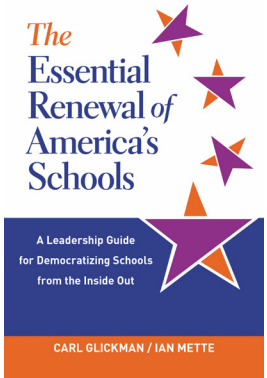Laura Fecych Sprague and Justin Wolff
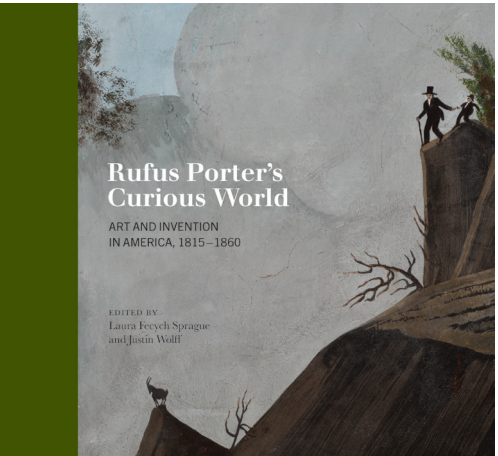
# Publication Spotlight A Sample of Published Works by UMaine Faculty
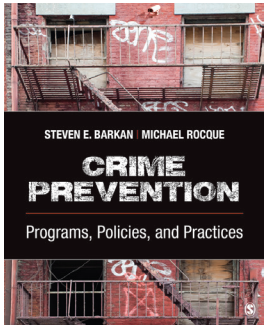
CRIME PREVENTION: PROGRAMS,
POLICIES, AND PRACTICES
Steven E. Barkan and Michael Rocque
SAGE Publications
2020
Sociology

INTRODUCTION TO RESEARCH
Elizabeth Depoy and Laura N. Gitlin
Elsevier
2020
Social Work

THE ESSENTIAL RENEWAL OF
AMERICA'S SCHOOLS
Carl Glickman and Ian Mette
Teachers College Press
2020
Education
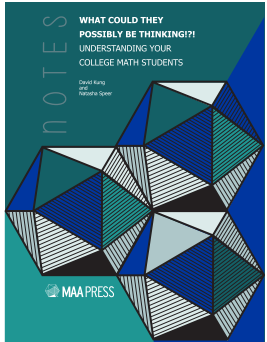
WHAT COULD THEY POSSIBLY BE
THINKING!?! UNDERSTANDING
YOUR COLLEGE MATH STUDENTS
David Kung and Natasha Speer
Mathematical Association of
America
2020
Mathematics
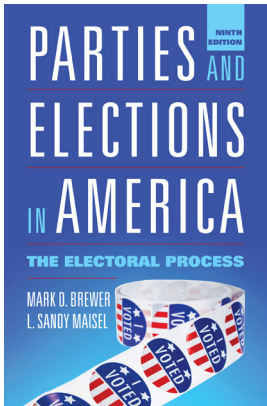
PARTIES AND ELECTIONS IN AMERICA
Mark Brewer
Rowman & Littlefield
2020
Political Science
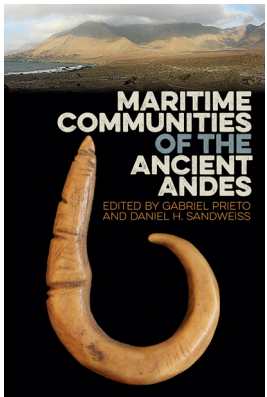
MARITIME COMMUNITIES OF THE
ANCIENT ANDES
Gabriel Prieto and Daniel H.
Sandweiss
University Press of Florida
2020 (Edited volume)
Anthropology

Contributors:

Jeanne Bauer, Tilan Copson, Tammy Crosby, Adam Küykendall, Christel Peters, Marcella Silver, Beth Staples, Kevin Wentworth

Note: Photographs of students and others not wearing masks were taken prior to the coronavirus pandemic. The University of Maine and University of Maine at Machias follow federal and state Centers for Disease Control and Prevention health and safety guidance, which includes social distancing and use of face coverings starting from spring 2020.

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Maine's Research University at Work

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