



The Orono Bog Boardwalk is a living laboratory for University of Maine students in ecology and environmental sciences classes. The mile-long boardwalk provides spectacular views of the fascinating flora and fauna of a Maine bog. The habitat is particularly striking during September field trips.

WHAT A vibrant community we have at the University of Maine!

Our community comprises students, faculty, staff, administration, alumni, parents and donors, and further extends to the residents of this beautiful state. As we say in our mission statement: “The University of Maine advances learning and discovery through excellence and innovation in undergraduate and graduate academic programs while addressing the complex challenges and opportunities of the 21st century through research-based knowledge ... (and) improves the quality of life for people in Maine and around the world, and promotes responsible stewardship of human, natural and financial resources.”

Throughout my first few months, I have been struck by the extraordinary sense of community and caring that exists on our campus. That stems from the commitment and dedication that our members have to the work in which they are engaged, whether pursuing degrees, teaching, conducting research, maintaining facilities, helping all of us be safe and successful, or the myriad of other activities that drive this outstanding institution forward.

Communities are made up of individuals and we celebrate dozens of them in this Fall/Winter 2018 issue. When you read their stories, you will understand the true passion they have for advancing learning and discovery, improving quality of life, and promoting responsible stewardship. This issue of *UMaine Today* is a good demonstration of the breadth of issues we encounter and care about as a community. Naturally, I was pleased to find the cover story on work going on across the state in the STEM field, as that has been my career focus, but I’m equally excited to learn of many other initiatives and projects. UMaine is such a dynamic institution!

As always, I welcome your comments on what we do well as a community, along with your suggestions for improvements. Please address your thoughts to president@umaine.edu.

Joan Ferrini-Mundy
Joan Ferrini-Mundy
President



Features

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Through ChildLINK, UMaine partners with Maine CDC's Children with Special Health Needs Program to monitor newborn screening information. For more than a decade, ChildLINK has been key to critical early intervention. Milford native Jessica Hayden is proof positive of the importance of receiving timely services for hearing loss.
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To encourage engaged learning in classrooms statewide, the Maine Center for Research in STEM Education (RiSE) provides teachers with access to large tubs with abundant materials — from golf balls to maple syrup and from goggles and calculators to potting soil, Matchbox cars and measuring tape. RiSE provides coordinated professional learning for teachers using these materials. A story about the RiSE Center begins on page 40.

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ENSURING THAT qualified students have access to the University of Maine, and that they have the support they need to achieve success will allow UMaine to catalyze the state's economy and accelerate the path from discovery to impact.



Scholarship success

THE MATCHING gift program of the University of Maine's Vision for Tomorrow campaign has raised more than \$4.8 million, according to the University of Maine Foundation.

A \$1 million bequest from an anonymous donor leveraged \$3.8 million in additional support for UMaine. The now-completed program was part of the public phase of the Vision for Tomorrow comprehensive campaign, a \$200 million fundraising drive.

The majority of the matching gift support is directed to undergraduate scholarships. Donors have used the match to leverage support for existing endowments and to create 45 new ones.

Financial aid for students is a top priority for the campaign, which has already raised more than \$160 million for scholarships, a new Engineering Education and Design Center, and other needs on and off campus, including at the Darling Marine Center in Walpole and the Hutchinson Center in Belfast.

Financial support for students advances all four of the campaign's priorities — fostering student success, ensuring access for all of Maine, catalyzing Maine's economy and accelerating discovery to impact. From the moment students are accepted to UMaine, the goal is timely graduation. Ongoing, reliable scholarship support is essential to achieving that goal. ■

Students in biomedicine

UNDERSTANDING THE creation of new nerve cells in adult brains while engaging more Maine college students in biomedical research is the focus of a \$1 million, five-year National Science Foundation CAREER Award to Kristy Townsend, a University of Maine assistant professor of neurobiology.

The research focuses on adult neural plasticity and neurogenesis that is key to energy balance regulation. UMaine seniors will collaborate with Townsend to conduct original biomedical research for capstone projects. And in an outreach program and summer fellowship with community colleges and other underrepresented groups in Maine, additional students will be engaged in the research to increase their access to biomedical careers.

"Biotechnology and biopharma are two growing industries in Maine," says Townsend, a UMaine alumna. "We need to be part of the pipeline that keeps this industry growing in Maine, encouraging students to stay here or come back here for their careers, which will also serve to enhance our own research here at UMaine."

In early 2017, Townsend created a weeklong biomedical course for students from Southern Maine Community College. The course, which was offered again in January 2018, led to the initiation of the outreach program with community college and other underrepresented students in Maine, with the goal of increasing biomedical training and supporting community college students to transition to UMaine.

The new program will allow students statewide who normally would not easily gain access to biomedical research fellowships to apply to take part in a summer fellowship in Townsend's lab. It also will allow UMaine graduate and undergraduate students to lead research seminars at the Maine community college schools and mentor peers transitioning to the university. ■



EARLIER THIS year, Kristy Townsend also received two other national research awards. The National Institutes of Health awarded nearly \$713,000 for a two-year study investigating brain-adipose communication and how peripheral nerves in fat tissue function. Townsend is interested in how the brain talks to fat tissue, because nerves are important for proper control of metabolic processes, as chemical and surgical denervation experiments in fat, or adipose tissue, have demonstrated. In addition, the American Heart Association awarded \$750,000 for a three-year study looking at the aging of fat tissue and its effects on cardiovascular and metabolic conditions. Townsend, an expert on brain-adipose communication, energy balance regulation and cardiometabolic disease, is collaborating in the research with David Harrison, an expert on mechanisms of aging and a senior faculty member at The Jackson Laboratory in Bar Harbor, Maine.

Roads and bridges

SINCE 1987, the University Transportation Center (UTC) program has advanced transportation research and technology at colleges and universities across the country. Every five years, academic institutions nationwide compete to form their region's UTC. UMaine and the other member universities of the new Transportation Infrastructure Durability Center have an extensive record of accomplishments in transportation infrastructure research, education and technology transfer.

THE U.S. Department of Transportation (DOT) has selected the University of Maine to lead the creation of a highly competitive University Transportation Center called the Transportation Infrastructure Durability Center (TIDC). TIDC aims to save taxpayer dollars by extending the life of transportation assets, including bridges, roads and rail.

The DOT will provide as much as \$14.2 million over five years for the UMaine-led coalition that includes the University of Rhode Island, University of Connecticut, University of Massachusetts Lowell, University of Vermont and Western New England University.

Additional partners include the Maine Department of Transportation, Vermont Agency of Transportation, Massachusetts Department of Transportation, Connecticut Department of Transportation, Rhode Island Department of Transportation, and the American Society of Civil Engineers Transportation and Development Institute.

This is the first time UMaine was selected from a highly competitive group of other colleges and universities to lead U.S. DOT transportation research in New England, says Habib Dagher, founding executive director of the UMaine Advanced Structures and Composites Center, and director of the new TIDC. Ten technical experts from across the country reviewed and ranked competing proposals, which led to UMaine's selection.

"Along with our partners from all New England states, we look forward to leading research to extend the life of existing bridges, construct longer-lasting assets, and reduce costs for the DOT and the public. Our New England DOT partners will help guide our research efforts to focus on real DOT needs that will make a real difference to the public," Dagher says. ■



Penobscot heritage

THE UNIVERSITY of Maine and the Penobscot Nation signed a memorandum of understanding (MOU) in May, formalizing their collaborations in the past decade to help manage the tribe's cultural heritage.

The MOU focuses on five UMaine areas, in keeping with "a new model of collaboration with universities that hold and care for collections considered important and vital to the present and future cultural life of the Penobscot Nation." The Penobscot Nation will help integrate the tribe's perspectives into UMaine research processes and collections that involve Penobscot people and their heritage. UMaine will work to begin implementing the new Penobscot Traditional Knowledge (TK) Labels to aid in the respectful and appropriate use of cultural materials.

UMaine's Anthropology Department holds collections of Penobscot archaeological heritage. In addition, Penobscot collections and cultural heritage items are held at the Hudson Museum and Special Collections of Raymond H. Fogler Library.

"The MOU demonstrates that the University of Maine is an international leader in collaborating with indigenous peoples," says Darren Ranco, UMaine associate professor of anthropology, chair of Native American Programs and faculty fellow at the Mitchell Center for Sustainability Solutions. "Only a small number of universities in North America have made similar commitments to work directly with a tribal nation to protect its cultural heritage." ■

AMONG THE Hudson Museum's holdings are over 900 examples of the material culture of Maine's Maliseet, Micmac, Passamaquoddy and Penobscot peoples, and hundreds of historic images. The assemblage includes brown ash splint and sweetgrass basketry dating from 1850 to the present, along with an important collection of basket making tools and molds, birchbark containers, root clubs, crooked knives, snowshoes, beadwork and three full-size canoes. More than 400 of the objects in the collection are Penobscot.

Penobscot Root Club by master carver Senabeh (Roland Augustus Francis) c. 1950-1960. HM167





Being **there**

“

I want to **make the invisible world visible.** They will see mammoths walking across the landscape, knocking down trees, pooping, eating plants and other things they would have done, which will **inspire more rural, low-income kids to become scientists.**” Jacquelyn Gill

WITH THE help of virtual reality technology, University of Maine paleoecologist Jacquelyn Gill aims to use the valuable field data collected by her research team for the creation of a unique and powerful tool for educators and their students to become ice age forensic scientists in their school classrooms.

Gill, an assistant professor of paleoecology and plant ecology, has been awarded a nearly \$800,000, five-year National Science Foundation CAREER Award to fund her research project. She and her team of student researchers will travel to various locations in Russia and Alaska to obtain sediment core samples from Wrangel Island — the last known location of woolly mammoths on Earth.

“We’re especially interested in how the environment was changing when the ice age megafauna went extinct. Did climate play a role? Or did the extinction cause surviving ecosystems to be more sensitive to climate change?” Gill says.

The project will provide multiple opportunities for students, local teachers and researchers to collaborate in the field and lab. The results will benefit the education, mentoring and training of students as they incorporate data and technology research into a student-designed ice age virtual reality game. ■



Healthy forests



A TEAM of University of Maine researchers has been awarded \$1.17 million from the U.S. Department of Agriculture to develop and test land management practices to protect Maine forest workers from exposure to tick-borne diseases. The three-year project, “Developing adaptive forest management practices to mitigate impacts of climate change on human health,” is led by Allison Gardner, an assistant professor of arthropod vector biology, and Carly Sponarski, an assistant professor of human dimensions of wildlife and fisheries conservation.

Other researchers involved in the study are Jessica Leahy, a professor of human dimensions of natural resources; Anne Lichtenwalner, a professor, veterinarian and director of the Animal Health Laboratory; and Laura Kenefic, a research forester with the U.S. Forest Service Northern Research Station.

The team aims to develop and test adaptive land management practices to protect private forest owners, foresters and loggers against exposure to tick-borne diseases. They also hope their recommendations will manage the spread and persistence of tick-borne diseases in Maine’s forests.

“Our forest management decisions can have dramatic effects on the abundance and behavior of vertebrate hosts of tick-borne pathogens and also the abiotic conditions that influence tick survival during the large proportion of the tick life cycle spent off-host,” Gardner says. “Because our state is dominated by forest land cover, it is important that Mainers understand the numerous ecosystem services provided by healthy forests, including buffering zoonotic disease transmission.” ■

MAINE HAS experienced a fivefold increase in Lyme disease cases over the past decade, likely due to climate change and land use change, according to the researchers. The increase in cases, combined with the high percentage of nonindustrial private land ownership in southern Maine, provides an urgent need and a unique socio-ecological context to investigate the effects of forest management on infectious disease.

Wallflower or risk-taker?

**Wildlife habitat ecologist
Alessio Mortelliti examines how
personalities of wild small mammals
affect their responses to a
changing environment**

By Elyse Catalina / Photographs by Holland Haverkamp



A MOUSE scampers through the forest, stopping suddenly at the sight of a tree seed on the ground. A potential meal. And a dilemma.

The mouse must decide if it should eat the seed immediately. Or hide it in a safe place for consumption when food is scarce. Or pass it up in hopes of something better.

Many factors determine what the mouse will do next, including how abundant the seeds are and if the rodent is a fan of that variety.

Another element that might play a role in what the mouse decides, according to a University of Maine researcher, is its personality.

How animals react to an environment that is transforming due to human behavior and climate change is at the core of research being conducted by Alessio Mortelliti, a UMaine assistant professor of wildlife habitat ecology.

One study Mortelliti and his students are pursuing focuses on how individual personalities of wild small mammals affect their response to global change.

Like humans, animals have a personality, says Mortelliti. “Anyone that has a pet knows they have a personality,” he says. “It’s the same for squirrels, mice and voles.”

Within a species, individuals can be aggressive or shy, more or less social, Mortelliti explains.

“We’re looking at how this individuality — their own way of being — affects the way they respond to changes in their environment made by humans,” he says.

When a mouse finds a seed, the decision it makes affects

When a mouse finds a seed, **the decision it makes affects more than just the small mammal.** If the seed is eaten immediately, any chance of a plant sprouting from that seed is gone. If the mouse decides to move and store the seed, a plant has a chance to grow.

Wallflower or risk-taker?

more than just the small mammal. If the seed is eaten immediately, any chance of a plant sprouting from that seed is gone. If the mouse decides to move and store the seed, a plant has a chance to grow.

Mortelliti believes that by modifying the environment, humans may be favoring certain personality types over others and, in turn, altering the course of evolution and the shape of the forest.

“By changing the proportion of different personalities in a population, we’re changing the capability of that population to react to future changes in the environment,” he says.

In the same way that a human’s personality affects his or her professional success, an animal’s personality affects its chance of survival, Mortelliti says.

To test his theory, Mortelliti and his students set up a study in the Penobscot Experimental Forest in Bradley and Eddington, Maine. For five months each year, the researchers capture and tag mammals, and measure their personalities using tests to determine how shy, aggressive or active they are.

The animals are then followed over time to see which are at more of an advantage in their environment — the wallflowers or the risk-takers.

Personality refers to individual-level differences in behavior that are consistent over time, says Allison Brehm, a UMaine master’s student in wildlife ecology on the research team. She is helping evaluate behavior by conducting tests that look at traits such as boldness, activity, exploration and docility.

For the main personality test, the researchers catch the animal in the field and place it in a white box with a square marked in the center. Software tracks the animal and determines how much time it spends moving around, staying in the corner or venturing into the middle. The test measures the tendency of an animal to emerge from a safe or enclosed area to enter a more exposed or risky space.

“We found if a mouse was really curious and went

around and crossed the center, it tends to do the same thing months later,” Mortelliti says. “That shows it’s really their own personality. It’s not their mood of the day. That’s how they act.”

Mortelliti compares the repeat behavior to that of humans. A shy person, for example, behaves in a relatively shy manner consistently, he says.

““

It’s like going to a party, getting in the center and dancing. You have to be brave to do such a thing.

It’s exactly the same for a mouse, but some individuals do it.”

Alessio Mortelliti

“From a perspective of a mouse, vole or squirrel, you’re scared, you’re being put in a new environment, you will think twice before going in the center,” he says. “It’s like going to a party, getting in the center and dancing. You have to be brave to do such a thing. It’s exactly the same for a mouse, but some individuals do it.”

SINCE THE start of the project about two years ago, the researchers have tagged around 1,500 mice, voles, shrews, squirrels and chipmunks.

The researchers are measuring a variety of personality traits and have found variations in each species. Although they haven’t yet quantified the results, they have observed strong differences between species and plan to compare variations in personality.

Another aspect of the project relates to how individuals with different personality types make decisions about seeds and how those decisions affect the composition of Maine’s forests.

“Small mammals exist to predate or disperse seeds; that’s their job in the ecosystem,” Mortelliti says. “The whole life of a plant is about trying to use the service of rodents as much as possible.”

What a mouse or other small mammal decides to do when it encounters a seed links back to personality, according to Mortelliti, who says he believes this is the first study looking at personality and seed dispersal.

For one of the experiments, microchipped animals are presented with artificial seeds (ground pumpkin seeds and gelatin). Seeds are flagged and tracked to determine if they were eaten immediately or cached.



Allison Brehm, a master’s student in wildlife ecology whose research paper was recently accepted in the international journal *Animal Behaviour*, evaluates small mammal behavior in the Penobscot Experimental Forest. One aspect of the project relates to how individuals with different personality types make decisions about seeds. For one of the experiments, microchipped animals are presented with artificial seeds, right, that are flagged and tracked.

“Spending a summer crawling around the forest looking for small mammal caches teaches you a lot about the way these animals think — and I learned to see the forest a bit differently,” says Brehm, of Pembroke, New Hampshire.

When the animal passes under an antenna, the researchers can tell who the animal is and its personality based on previous tests. The researchers also observe the decisions that are made in front of the fake seeds.

When it comes to real seeds, Mortelliti and his students have found the animals don’t care for paper birch or balsam fir, which may explain why these are the most common trees in the Penobscot Experimental Forest. The animals seem to prefer spruce and white pine.

“What we’re looking at specifically — on top of what they like and what they don’t like — is how different indi-

viduals act in front of seeds,” Mortelliti says. “Does a risk-taker tend to hide more seeds? How does a shy individual act?”

“Which individual will behave differently in front of a seed?”

Sara Boone, another graduate student working on the project, says the personality of a small mammal may influence its behavior in different situations.

“Bolder individuals may be more willing to take risks to find seeds than shy individuals, or choose seeds based on different nutrient contents or sizes. Shy individuals may consume fewer seeds overall than bolder individuals, and have less of an impact on seedling recruitment,” says Boone, of Greenfield, Wisconsin, who is pursuing a master’s degree in wildlife ecology.



University of Maine students, from left, Sara Boone, Allison Brehm and Noah Baskin walk through the Penobscot Experimental Forest to track, tag and evaluate mice, voles, shrews, squirrels and chipmunks. The researchers are measuring a variety of personality traits such as boldness, activity, exploration and docility.

The project marks Boone's first time delving into personalities while studying animal behavior. She is interested in the community dynamics of research sites, and how the personality and behavior of small mammals influence community structure.

"If humans are modifying the environment, they're modifying the composition of personality within a population, then this, in turn, will have effects on the forest, because we're favoring certain individuals which make certain decisions in front of seeds," Mortelliti says. "If we're favoring personalities that are going to predate more than cache, then this will have an effect how forests regenerate."

Understanding how individual animals and populations

are affected by global change is important, Brehm says, especially in a state such as Maine that represents either the northern or southern edge of the range of many species.

"If land-use change gives an advantage to individuals with certain personality types — for example, the bold ones — over time, populations experiencing these changes will be less behaviorally heterogeneous, and ultimately less resistant to global change," she says.

While personality has a genetic component, nature also has promoted its existence, according to Mortelliti.

"If it wasn't useful for us to have personalities, we wouldn't have this variation in individuals. Natural selection has made sure that within a population we have diversity of

behavior. If natural selection has promoted variation in personality through millions of years of evolution, that suggests this variation is important for species and ecosystems," he says.

If, through land-use change, certain personalities in a species population become homogenized, the capability of populations to adapt will become affected, Mortelliti says. In the long term, species need variation in personality to preserve their evolutionary potential, he adds.

"In some years and circumstances, certain personalities might be advantaged, versus in others when other personality types might be advantaged. But for a species to be able to face environmental challenges of the future, this richness and variation in behaviors has to be maintained," he says. "If land use affects different personalities, then we might be modifying the evolutionary potential of populations."

IN ANOTHER project, Mortelliti is studying how small mammals may affect the expansion of plants due to climate change in Acadia National Park.

In April 2017, Mortelliti was one of three scientists awarded a fellowship to conduct research in Acadia. The fellowships were granted as part of Second Century Stewardship, an initiative of the National Park Service, Schoodic Institute at Acadia National Park, and the American Association for the Advancement of Science (AAAS).

Over the last 100 years, Acadia's forest composition has transformed due to climate change, according to Mortelliti.

"In the next 100 years, it will change completely again," he says. "The whole plant community is going to change because it's really on the border of the distribution range of many plants."

By favoring certain plant seeds over others, small mammals will shape the forest composition, Mortelliti says.

"As these plants move northward, rodents are going to be critical. They're going to be the gatekeepers of Acadia National Park," he says.

To help plan for the future forest landscape, Mortelliti and his students collected about 20 different seeds of plants that are expected to invade Acadia in the next 10–20 years. The researchers are evaluating which types the small mammals prefer, and which ones they don't.



Photo by Alessio Mortelliti

A rat for Christina

IN 2011 while Alessio Mortelliti was a postdoctoral research fellow at the Sapienza University of Rome, he conducted an inventory of the small mammals found in the Mekongga Mountains of Sulawesi, Indonesia.

There, he discovered a new rodent species. *Margaretamys christinae*, now named after Mortelliti's wife Christina, is a type of rat.

"Some people name flowers after their wife, I named a rat," jokes Mortelliti, who is now an assistant professor of wildlife habitat ecology at the University of Maine. He is working with recently graduated Ph.D. student Bayu Broto to identify potential research opportunities in Indonesia.

"My dream is to go back to learn more about my species," Mortelliti says. "We discovered it, but we know absolutely nothing about it."

Broto, who earned a master's degree in wildlife conservation, is originally from Yogyakarta, Indonesia, and has worked as a government officer in Sulawesi, Indonesia, the same region where Mortelliti made his discovery.

Sulawesi is one of Indonesia's large islands, according to Broto, who compares it to the size of New England. It is mountainous and relatively humid with average temperatures around 70–95 degrees F.

"Sulawesi encompasses high numbers of endemic and threatened mammals," says Broto. "The island is widely considered a biodiversity hot spot and high-priority area for mammal conservation."

Broto and Mortelliti have determined that knowledge of Sulawesi mammals is still at a preliminary stage, with the majority of Sulawesi research being led by foreign researchers and focusing on charismatic animals in well-known provinces.

A journal article by Broto and Mortelliti on the status of research on mammals of Sulawesi will be published in *Mammal Review*.



This research will feed into a longer-term study that **will help forestry managers better understand the role seed predators have on the regeneration of Maine's forests**, and can help inform decisions about long-term forest management to maximize the success of target tree species.”

Sara Boone

“We want to identify the winners and the losers,” he says. “Which are the plants that are going to be favored by rodents, which are the ones that are going to be blocked?”

The goal is to provide Acadia with a list of the types of plants it can expect in the coming years.

“The results of our field experiments will allow managers to predict how local forest communities might change in the coming years and allow them to take the appropriate actions in time,” Mortelliti says.

In Acadia, just like any other forest, small mammals have the biggest effect on which plant species are more dominant, and researchers have often ignored this, according to Mortelliti.

Research has shown that small mammals can consume and/or remove up to 95 percent of the seeds available in their given territory, Brehm says. It's important, she adds, to shed some light on this process, especially in a state that relies so heavily on the forest industry.

“In Maine, forests and forest products play a major role in the economy. Maine is the most forested state in the U.S., and 97 percent of the forest area in Maine is subject to natural regeneration,” she says. “Because small mammals play a fundamental role in the process of forest regeneration, understanding the impact they can have on the structure and species composition of the forest is critical.”

The data collected by Brehm and Boone will be used for both their theses, as well as by future students and forestry industry employees.

“This research will feed into a longer-term study that will help forestry managers better understand the role seed predators have on the regeneration of Maine's forests, and can help inform decisions about long-term forest management to maximize the success of target tree species,” Boone says. “Healthy forests are beneficial for outdoor recreation, economically valuable and beautiful to look at.”

Mortelliti says the results of his research may not necessarily be of immediate use, but they could make a difference in conservation and the long-term survival of a population.

Having healthy and viable populations of animals is even more important in today's rapidly changing climate, and it's up to humans to maintain this diversity of behaviors within populations, he says. ■



Carnivores on camera

BRYN EVANS, who is pursuing a Ph.D. in wildlife ecology at the University of Maine, is working with wildlife habitat ecology professor Alessio Mortelliti to develop a protocol for monitoring carnivores in northern Maine.

By luring animals to camera traps using bait, the researchers are gaining a better understanding of some of Maine's more stealthy creatures, such as martens, fishers, coyotes, bobcats, lynx and bears.

UMaine and the Maine Department of Inland Fisheries and Wildlife (IF&W) initiated the project, which also has received support from the Collaborative Forestry Research Unit.

The researchers hope to establish baseline estimates for the occupancy probability, or the likelihood that a species is using an area. Also important: the detection probability — the likelihood the researchers will see it if it is present, for several carnivore species across different habitat types and management regimes in northern Maine, according to Evans.

Marten and fisher are the top-priority species in the project. The researchers hope the camera traps can provide valuable information to supplement the harvest reports and other tools currently available to IF&W, says Evans of Santa Cruz, California.

After four years of data collection, the researchers aim to provide guidelines on the number of camera stations and the length of deployment required to reach a desired level of certainty for several different species in a variety of habitat types, Evans says.

In June 2017, after working with map data, contacting landowners for access and choosing random target locations, the researchers set 121 survey stations. Starting in January 2018, Evans returned to the sites to collect matching winter data.

“I have been truly lucky to receive really positive responses from so many people I've reached out to; everything from public parks to private landowners and conservation groups, game wardens, tribal authorities and numerous commercial forest management companies,” Evans says. “Everyone has been extremely helpful, whether it's granting access to land to place camera sites, providing maps and knowledge of timber harvest zones, even offering housing during my field seasons. Much of the time it feels like the entire state is involved.”

When she's not in the field, Evans and student volunteers categorize the images — about 80,000 and counting.

Camera traps offer a fascinating peek into the daily lives of animals, Evans says.

“These animals are part of what make Maine such a wonderful place, and everyone in the state benefits from their continued healthy coexistence,” she says. “Management, recreation and industry all benefit when we have a better handle on the ‘what’ and ‘why’ that drive animal populations, and trail cameras are a really exciting tool to help build that knowledge,” she says.



Bryn Evans, a Ph.D. student in wildlife ecology.



A philosopher's life

Clinical ethicist Jessica Miller says it's important to contemplate what life's all about — and why we're here

By Margaret Nagle / Photographs by Adam Küykendall

LADY MACBETH started it. Reading Shakespeare in high school, Jessica Miller found herself thinking deeply about the *Macbeth* character, especially her moral responsibility for her husband's, and her own, evil actions. When does persuasion become coercion? When does madness minimize free will?

Then came *Zen and the Art of Motorcycle Maintenance*. Miller was a political science major at Boston College when she took a philosophy course. What she heard — and read — got to her innate interest. *Zen* asks: What is the difference between our perception of reality and reality itself, and why do we assume there is one? She double-majored, then went on to pursue a doctorate at the University of Connecticut, focused on contemporary moral philosophy.

She came to Maine to put philosophy into practice.

"I felt like the questions being asked were important and vital," says the chair of the University of Maine Department of Philosophy of those early influences and what she still loves about philosophy. "And I wanted to contribute to the conversation."

Miller teaches philosophy courses for majors and non-majors, where they discover the discipline — and themselves. Most nursing and pre-medical students take one of her ethics courses.

Her research focuses on ethics, bioethics and feminist theory, including the theory of trust. Recent writing has included how to break bad news to families in the pediatric intensive care unit, as well as analysis of how death is depicted in contemporary Disney films.

Miller's leadership includes serving as associate dean for faculty affairs and interdisciplinary programs in UMaine's College of Liberal Arts and Sciences.

But her widest — and, arguably, her most profound — influence is as a clinical ethicist in Maine. Since joining the UMaine community in 2000, Miller has been an active health care ethics consultant and educator. Since 2007, she

has been the clinical ethicist at Northern Light Eastern Maine Medical Center in Bangor, Maine. Miller helped establish the medical center's Ethics Advisory Committee, which has been cited as a model for regional hospitals in the United States. It includes a formal ethics consultation service that Miller chairs.

She also has developed and implemented bioethics training and support for clinical ethics programs statewide in health care organizations as diverse as the Maine Department of Health and Human Services; Northern Light Home Care & Hospice; Maine Medical Center and Hanley Center for Health Leadership, both in Portland, Maine; and Northern Light A.R. Gould Hospital in Presque Isle, Maine.

This past summer, Miller and Dr. Jonathan Wood of Northern Light Eastern Maine Medical Center presented a 10-year data analysis of the hospital's ethics consultations at an international conference at Oxford University in England. And this fall, Miller was a panelist at a Boston University forum, Humanities Approaches to the Opioid Crisis.

"An underlying thread is the importance of philosophy — taking a moment to think about what life is all about and why we're here," Miller says. "What does happiness mean to us, and how are health and happiness connected? What decisions do I need to make in terms of what I value?"

"Whether talking genomics or distribution of health care resources or end-of-life decision making, your body and your health are inescapable in pursuing happiness."

MENTION PHILOSOPHY and for most people, images of the bearded philosophers of Ancient Greece pontificating in the marketplace come to mind. Today, philosophers are still in public arenas, Miller says, but now that engagement with society is in K-12 education, medicine, government, corporations, environmental issues and so much more.

Public philosophers are students of community knowledge, learning as much as they teach.

The field of clinical ethics, which helps patients, families

“
What's most rewarding in all the work I do is **bringing the discipline I love to people who won't spend their lives studying it.**” Jessica Miller



Miller talks biomedical ethics at The Jackson Laboratory in Bar Harbor, Maine with high school students enrolled in the summer program funded by the National Science Foundation and National Institutes of Health.

and clinicians address ethical issues that arise in health care, emerged in recent decades as medical decisions became more complex in an increasingly technological society. Those questions can range from when to stop aggressive medical intervention to whether expressed breast milk from a patient who uses medical marijuana should be given to her baby in the neonatal intensive care unit.

As a clinical ethicist, Miller provides training and consultation for physicians, nurses and other medical personnel. She also may be called on to consult with patients and their family members. Unlike urban areas where a city hospital

may have a whole department devoted to clinical ethics, rural health care settings often struggle to find such philosophy-focused resources.

That's why Miller does what she does in Maine.

Miller focuses on "building clinical ethics capacity" in the state's rural health care settings. She provides training, connects hospital personnel to readings and resources, and facilitates opportunities to maintain ongoing exploration of critical issues.

"Clinical ethics consultation provides a safe space for medical professionals, patients and families to have honest



Since 2007, Miller has been the clinical ethicist at Northern Light Eastern Maine Medical Center, where she collaborates with medical staff, and patients and their families. Her work includes serving on a panel for the hospital's bioethics grand rounds.

conversations about what is the right thing to do — presenting the different options, each with different virtues and moral goods, often having to do with minimizing suffering or prolonging life," Miller says.

"I like to think of it as ethics mediation," she says. "We have good people who are trying to do the right thing, and they don't agree on what it is. The focus is on the process and not the 'right' answer. It involves listening to all and coming to an agreement that reflects participatory engagement, fairness and justice. The goal is to move forward with the next right thing for that patient."

The importance of the leadership in this field by Miller and the medical center is underscored in the 10-year longitudinal study — one of the few focused on rural health care — presented at the 14th International Conference on Clinical Ethics Consultation in England. Three findings in the Maine study are particularly revealing.

While physicians were the heaviest users in the early years, over time, nurses increasingly tapped into the clinical ethics services. The decade of data also shows there were more ethics consultations related to patients in their 50s and 60s — ages when people are "collecting chronic con-



It was standing room only for Miller's public talk on the ethics of genomics at Jesup Memorial Library in Bar Harbor this summer. Topics included the popular DNA ancestry test kits on the market.

ditions" — than for those at the beginning or end of life.

And among the leading dilemmas faced by the clinical ethics team: locating and working with the appropriate decision-maker when a patient lacks decision-making capacity.

"Doing clinical ethics in a rural environment is different than in an urban environment, thanks to geography, resources and culture," says Miller. "It's important that the voices of rural bioethics are heard nationally."

MILLER SAYS she enjoys engaging with diverse groups — from UMaine students in class to high school interns in a

summer program at The Jackson Laboratory in Bar Harbor, Maine to older community members attending her lecture on personal genomics at a local library. And medical professionals, and patients and their family members.

"What's most rewarding in all the work I do is bringing the discipline I love to people who won't spend their lives studying it," she says. "But they can be introduced to philosophical perspectives and tools, gain an appreciation for them and bring them into their lives."

This semester, Miller introduced a new one-credit philosophy course called Character, Career and Happiness,



On a warm September day, Miller's new one-credit philosophy course called Character, Career and Happiness took to the Mall. The course is designed to help first-year students and undeclared majors fully engage in the UMaine experience.

designed for first-year students and undeclared majors. Students inventoried their skills, challenges, virtues and interests, and explored how to match their skills with their definition of happiness, or a flourishing life. They read what Aristotle and John Stuart Mill had to say about happiness, as well as some contemporary positive psychology.

The goal by semester's end was to encourage the students to fully engage in the UMaine experience and "take ownership of a coherent academic plan that honors their strengths, accommodates their challenges, and fits with their values and aspirations."

The class was overenrolled with 27.

"I teach a lot of first-year students, and a lot of majors in other disciplines," she says. "That's why I have to meet them where they are. I can't say, 'here's this grand, important tradition.' I have to start with what is of concern to them in their lives, and show them that philosophers have interesting things to say about the human condition."

"I really want philosophy to come from students, not be imposed on them."

Miller says philosophy can enhance students' capacity to think critically, communicate clearly and solve complex



Miller and Dr. Jonathan Wood prepare to present their 10-year study — one of the few focused on rural health care — at the 14th International Conference on Clinical Ethics Consultation in Oxford, England this past June.

problems. Philosophy students can focus on cognitively demanding tasks, a vanishing skill in today's age of digital distractions.

"It drives me nuts when people say philosophy is a useless discipline. The data show that philosophy students are employed, and employed well.

"I am so proud of our UMaine philosophy alumni who became lawyers, Army sergeants, Peace Corps Volunteers, journalists, librarians, teachers, entrepreneurs and, yes, philosophy professors."

Philosophy provides tools for students, health care prac-

tioners and members of the public to question their assumptions, and to critically assess information that's presented to them.

"In today's world, people are bombarded. It's an information fire hose filled with facts, 'alternative facts' and outright falsehoods. But philosophy can help with critical awareness of what is worth grabbing," Miller says.

"What I hope is that people will have a little more thoughtfulness about where their beliefs and values come from, and more understanding of those whose beliefs differ from our own." ■



“

The other possible reason for the decline is that **larval settlement has spread out across a larger range of depths**, effectively reducing settlement densities in the routine shallow-water monitoring locations.”

Richard Wahle

Cool refuge

Young lobsters seeking deeper depths

MAINE FISHERMEN hauled in 110.8 million pounds of lobsters in 2017 with a value of more than \$400 million. While still incredibly large, this volume represented a 16 percent decline and \$100 million loss compared to previous years of record-setting landings.

Since the late 1980s, Maine's lobster landings have multiplied sixfold, while the area of highest landings has shifted Down East to Hancock and Washington counties. The U.S. lobster fishery is now the nation's most valuable single-species fishery.

But last year's decline was the largest in more than 50 years, leading the industry and scientists to wonder whether the boom has come to an end.

The patterns are consistent with forecasts based on juvenile lobster population surveys founded and overseen by professor Richard Wahle in the University of Maine School of Marine Sciences.

In 1989 with support from Maine Sea Grant, Wahle initiated data collection for the American Lobster Settlement Index, a program that monitors the number of baby lobsters that “settle” to the sea floor every year. Counts are made at

some 100 sites from Rhode Island to Atlantic Canada. While the monitoring is now conducted by participating marine resource agencies in the U.S. and Canada, Wahle's lab hosts the collective database, developing and testing the index as a forecasting tool.

There are two prevailing explanations for such little settlement, he says. One is that more larval lobsters are dying before they reach the settlement stage. The other is that they are spreading to new deepwater nursery grounds not covered by current monitoring efforts.

To understand settlement in deepwater out of reach of standard diver-based sampling, Wahle received funding from Maine Sea Grant in 2016 to expand the settlement survey to deeper water. His aim is to examine links between temperature gradients and lobster settlement, both depth-wise and along the coast.

Working with research partners and lobstermen, preliminary data confirm that newly settled lobsters are as deep as 80 meters and in different settlement patterns east to west. Industry partner Ready Seafood has provided funding to continue deepwater settlement monitoring through 2019. ■



Firstsounds

Partnership with Maine CDC key to identifying newborns with hearing loss

By Casey Kelly

FOR TWO years as a high school student, Jessica Hayden of Milford, Maine spent part of her summers in University of Maine research laboratories, working on aquaculture and bioengineering innovations as part of her internship with Maine EPSCoR, the federally funded research and development program.

She did it for the experience — a natural extension of the variety of extracurricular activities she pursued throughout middle and high school.

This fall, Hayden, who graduated third in her Orono High School class, is back on campus, this time as a first-year college student on a Maine Top Scholar Award to study microbiology, collaborate on research with a faculty mentor and participate in the Honors College.

Hayden's ability to succeed in and out of the classroom is due in no small part to the health services she received as a toddler. And the advocacy of her parents.

Hayden was born deaf. She can hear with the help of cochlear implants, which she has had since age 2.

Cochlear implants are surgically inserted electronic devices that provide a sense of sound for those who are deaf or hard of hearing. A microphone and electronic pack

behind her ears send signals to the implants, which stimulate the cochlear nerves.

When she was 15 months old and not yet developing the ability to speak, Hayden was screened for hearing loss. Once diagnosed, her parents were proactive about getting her services, including the cochlear implants and speech-language therapy.

"The good news with hearing loss is if it's caught early and the child receives early intervention, such as learning sign language, using hearing aids or receiving a cochlear implant, the effects can be minimal," says Shihfen Tu, an associate professor of education and applied quantitative methods with UMaine's College of Education and Human Development.

TODAY, THANKS to a partnership between UMaine and the Maine Center for Disease Control and Prevention (Maine CDC), it doesn't take 15 months for children born with hearing loss to be diagnosed.

In a system called ChildLINK, the university gathers data from newborn health screenings on behalf of the Maine CDC Children with Special Health Needs Program. The

state's 30 birthing hospitals send test results for hearing loss, birth defects and metabolic disorders in newborns, and the data is tied to the state's electronic birth certificate information.

In 2016, the most recent year for which data is available, ChildLINK captured newborn screening information on more than 97 percent of the 12,480 babies born in Maine.

"We want to monitor the data to see if there's any kind of trend," Tu says. "And then the other part of it is alerting the Maine Newborn Hearing Program when a baby screens positive, so they can get services as quickly as possible."

Tu helped create ChildLINK more than a decade ago, in collaboration with her husband and UMaine education colleague Craig Mason, and a team of computer programmers. Since 2003, the program has flagged more than 3,600 children born in Maine who initially screened positive for hearing loss.

Of those newborns, further diagnostic testing confirmed 330 cases of permanent hearing loss. Tu says they know that 214 of those babies were referred to receive early intervention.

The United States Centers for Disease Control and Prevention's Early Hearing Detection and Intervention (EHDI)

Since 2003, ChildLINK has flagged **more than 3,600 children born in Maine** who initially screened positive for hearing loss. Of those, further diagnostic testing confirmed **330 cases of permanent hearing loss**.



Scott, Jessica and Lori Hayden at home in Milford, Maine. In 2006, *UMaine Today* magazine first wrote about Jessica, then a 5-year-old preparing to enter kindergarten. Today, she is a Maine Top Scholar in her first year at UMaine.

program provides funding to states to support universal newborn hearing screening with the goal that babies with hearing loss receive services as soon as possible.

Tu's research team also is part of a national group that created the EHDI-PALS website (ehdi-pals.org). It features a searchable geo-coded national directory of facilities offering audiology services for children, birth to age 5, so parents can more readily find resources their children need.

Now that the ChildLINK system has collected more than 10 years of data, Tu says she's able to tie some of the information about children born with hearing loss to data on their educational performance.

"What we found is that, on average, the children who received services through EHDI as babies are doing better with mathematics than children who have hearing loss but did not go through the EHDI system," she says.

Tu says they're also in the process of expanding the information collected by ChildLINK to include tests for critical congenital heart defects.

"I see it as the perfect combination of research and service," says Tu. "Our mission is to promote healthy child development, whether cognitive or physical."

AS PART of her summer internship at UMaine, Hayden tested the ability of drones to take temperature readings at 20-second intervals, at varying distances from an object. The trials were designed to see if the remote-operated aircraft could collect and relay information about the condition of lost hikers — including body temperature and breathing rate — to search-and-rescue teams at a base camp or other remote location.

It's not lost on Hayden that these experiments are trying to give rescuers a head start, so they can be ready to provide the medical services needed, as quickly as possible — just

as it was important for her to receive services for hearing loss as soon as possible.

Hayden was fortunate. While born in 1999 before the ChildLINK program began, she was tested for hearing loss at a relatively young age and her parents sought services for her once they had a diagnosis. That included an auditory-verbal speech therapist to work with the family on techniques for teaching her to speak.

After she got her first cochlear implants, Hayden remembers her dad carrying on a running conversation with her in the grocery store so she would get used to the sound of someone speaking and, in turn, learn to speak herself.

"He would pick up a can and describe (it)," Hayden says. "I couldn't talk yet, but I was enthralled with this information. I soaked it up like a sponge."

As a child, Hayden participated in sports, including basketball, track, soccer, swimming and T-ball. She also did gymnastics, despite her old cochlear implants that required a large, brick-like processor, for which her mom sewed special pockets on the back of her shirts.

In 2004, before she entered kindergarten, Hayden's father, Scott, testified before a Maine legislative committee in opposition to a proposal to cut funding for early intervention services. He told lawmakers that early intervention would allow his daughter to enter school not needing special services from the local school district.

"This represents a savings of \$1.2 million to the state of Maine over the next 12 years," Scott Hayden said, and would allow his daughter to be "a fully integrated member of society."

Fourteen years later, Jessica Hayden notes that most people don't realize she is deaf.

"I definitely wouldn't be able to do the same things (without early intervention). I just can't imagine." ■



Professor Shihfen Tu leads ChildLINK's data gathering from newborn health screenings on behalf of the Maine CDC.

Photographs by Adam Küykendall



Meet Dr. Smart

Maine's new plant pathologist reflects on improved diagnostics to help the state — and her passion for the field discovered as a UMaine intern

By Cleo Barker / Photographs by Adam Küykendall and Holland Haverkamp

NEARLY TWO months before the University of Maine Cooperative Extension Diagnostic and Research Laboratory opened in June, Maine's new plant pathologist, Alicyn Smart, moved in.

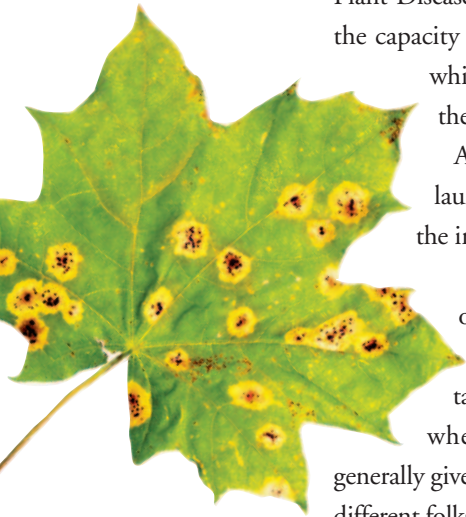
No matter that she and undergraduate lab assistant Abigail Novak were the sole occupants in the 28,000-square-foot facility still under construction. Smart was elated to set up her lab with high-end technology, including a biosafety cabinet and an incubator for bacteria to prevent contamination. Both can expand plant diagnostic capabilities to aid farmers, nursery growers, homeowners and others in Maine.

"The new lab has given us the opportunity to increase the tests we can perform, (and) provided space for our new equipment and the ability to save pathogens to use as controls when doing molecular testing, which we have never been able to do before," says Smart. "Adding molecular testing is a real game changer; we can become certified to test regulated pathogens from across the country and perform research that is needed."

In addition to plant pathogen identification to aid in management recommendations, the new and improved



Alicyn Smart, pictured left, directs the Plant Disease Diagnostic Lab, which accepts mailed and hand-delivered plant samples for disease identification, and nutritional and cultural problem assessment.



Plant Disease Diagnostic Lab directed by Smart now has the capacity to use DNA analysis to identify pathogens, which offers a new level of specificity, down to the species or strain.

And this summer for the first time, the lab launched a statewide survey to better understand the incidence of a strawberry disease.

“We serve all the people of Maine, so I work one-on-one with farmers. I also work with

Master Gardener Volunteers, I give a lot of talks through the winter during the down time when we’re not receiving as many samples. I generally give about five talks a month, interacting with all different folks that want to know more about plant diseases and how to manage them better,” says Smart.

Smart is no stranger to the state or UMaine. Or working in the nation’s newest plant diagnostic labs.

The Foxborough, Massachusetts native attended Norfolk County Agricultural High School, where she was a member of Future Farmers of America and managed the school’s greenhouse. Smart earned a bachelor’s degree in landscape horticulture from Unity College in 2011. During her time there, she interned under Bruce Watt, UMaine Extension plant disease diagnostician and plant pathologist.

The summer before her final undergraduate year and into the fall semester, Smart worked for six months as an assistant in UMaine Extension’s Plant Disease Diagnostic Lab. Since 1989, the lab has provided free services on plant samples, including disease identification, and nutritional and cultural problem assessment.

During her doctoral work in plant medicine at the University of Florida, Smart received a U.S. Department of Agriculture National Institute of Food and Agriculture National Needs Fellowship to support her graduate work and she immersed herself in the world of plant diagnostics. She interned at the Florida Department of Agriculture and Consumer Services, and worked as an assistant diagnostician at the University of Florida Plant Diagnostic Center — the

newest plant diagnostic lab in the country at the time.

Smart returned to Maine in August 2015 to be the executive director of the Maine Farm Bureau. In July 2017, following Watt’s retirement, she was selected from about 40 candidates in a national search for UMaine Extension’s next plant pathologist.

Smart says the position is her dream job and credits Watt with introducing her to a field that is now her passion.

Where did your interest in plants begin?

In my first year of high school, I took a botany course. The teacher told me I had a knack for plant science and I should consider changing my major from animal science.

What drew you to Maine for college and a career?

The atmosphere. I really enjoyed the change from suburban Massachusetts. There is so much undeveloped land in Maine and it was a breath of fresh air. Also, there are not many places that can beat how bright the stars are here.

Let’s talk about the breadth of experience your academic career provided — from undergraduate work in Maine to graduate work in Florida. How did it provide the foundation for your professional work?

It’s provided a great foundation. I know Maine well from my undergraduate work, but can now look at things differently from my experience in Florida, which is ranked second in agricultural production. My graduate degree also encompassed soil fertility, entomology and related subjects. This is helpful when trying to diagnose an issue because it’s not always a pathogen causing the symptom.

How did the UMaine internship influence your career choice? What take-home messages did you learn that continue to resonate with you today?

The internship at the UMaine Extension Plant Disease Diagnostic Lab was instrumental. I realized how much I

enjoyed plant pathology and I knew I wanted to be a diagnostician like Dr. Watt and, inevitably, in Maine. Dr. Watt was passionate about the work he did. He is known nationally for his microscopy work. His microscopy photographs were used in courses I was enrolled in at the University of Florida. He taught me that if you are passionate about something, you can become one of the best in your field if you foster that passion.

Why did you look forward to returning to Maine at this stage in your career?

I was — and still am — excited to bring new technology into the lab that can take diagnostics to the next level. By incorporating this technology, we will have more refined answers for difficult-to-diagnose pathogens and perhaps identify pathogens that we don’t currently know are here. There are pathogens we still don’t know the full life cycle of or how wide a host range some pathogens have. Knowing the answers to these questions can help nurseries, the landscape industry and anyone else in the agriculture field. I have more than a career’s worth of work to help answer as many questions as I can to help Maine agriculture.

What have you focused on in the lab in your first months as a UMaine Extension plant pathologist?

I have integrated new techniques for bacterial testing to improve the identification of pathogenic bacteria, while reducing the turnaround time in reaching a diagnosis. This is important for growers who need to know the steps to take to limit the spread of a disease.

What are the biggest challenges in plant pathology in Maine for homeowners and farmers?

Sanitation is the biggest challenge. Both homeowners and farmers like to reuse material, such as seedling trays from year to year, but many don’t realize they should be sterilized before reusing them. My job is to help them identify how the pathogen I diagnosed came to be an issue so they don’t



Growing penchant for pathogens

ABIGAYL NOVAK discovered her passion for plants in an introductory biology class.

“We did an experiment on photosynthesis, and it kind of got me into plant hormones,” says the third-year ecology and environmental sciences major from Hampden, Maine. “(After that class) I wanted to do something that would familiarize (me) with plants and just how to identify them in general.”

This past summer, Novak worked as a lab technician intern in the Plant Disease Diagnostic Lab of the new University of Maine Cooperative Extension Diagnostic and Research Laboratory.

“It’s my first job in a lab, so it’s been really interesting, and I’m loving it,” says Novak. “I am interested in the environment, but when I graduate I want to do something with plants, so I thought this was a really good opportunity.”

Novak’s tasks ranged from triaging and photographing plant samples, and collecting and entering the information into a database, to making media, streaking bacteria and using immunostrips. She also helped draft standard operating procedures to aid in lab director Alicyn Smart’s efforts to have the facility certified by USDA Animal and Plant Health Inspection Service (APHIS) to receive and test out-of-state plant samples.

Novak was surprised to learn just how many types of fungi and bacteria there are. The lab experience also has prompted her to broaden the focus of her graduate work.

“I was thinking about plant physiology,” she says, “but pathology is really interesting.”

struggle with it next season. Most of the time, it is a sanitation or cultural practice that could have been prevented, which provides the opportunity to help them understand pathology better to reduce the financial impact a disease often causes.

What does the future hold for the field in general and for Maine in particular?

Many people are building greenhouses and hoop houses to extend the growing season in Maine. But a longer growing season also extends the life cycle of plant pathogens. High humidity in a greenhouse enhances pathogen growth and reproduction, so we could see more disease pressure during times we have not seen it in the past. This makes early detection important for the management of pathogens.

What should homeowners, gardeners and other members of the public know about plant pathology?

That they are the best ones at identifying something looking a little off in their field or landscape, and that they don't need to know everything about plant pathology to figure out what the issue is, that we are here to help with any questions they may have.

Do you have a favorite plant pathogen?

Every plant pathologist has a favorite pathogen or two. Mine is *Xylella fastidiosa*, a bacterium transmitted by a leaf hopper insect. It has a wide host range and is very close to being unculturable, making it difficult to work with.

What was your aha moment, when you knew this was your field?

When I learned my first plant pathogen, fire blight. I thought it was so cool that a honeybee could pick up bacteria cells from an infected apple tree and carry them to a noninfected tree and cause disease.

Have people ever noted that you are, indeed, Dr. Smart?

Ha! Yes, but usually saying it the Maine way: Dr. Smaht. ■

New and improved

THE NEW University of Maine Cooperative Extension Diagnostic and Research Laboratory opened this past summer. The Orono facility also is the home of UMaine Extension's Veterinary Diagnostic Lab, the Aquatic Animal Health Lab and the Pest Management Unit — the Tick Lab, Insect Identification Lab, Plant Disease Diagnostic Lab, and Integrated Pest Management and Pesticide Safety Education Programs.

The facility was made possible by an \$8 million bond approved by Maine voters in 2014. Researchers in the lab support the state's natural resource-based industries, and monitor human health risks.

In the Diagnostic and Research Laboratory, UMaine Extension scientists will conduct research on ticks, mosquitoes and other insect pests, as well as plant diseases, including those critical to the potato and wild blueberry industries.

Today, UMaine Extension provides the only tick identification service in the state. With this new lab, it will offer the only public resource for tick pathogen testing in Maine.

The Veterinary Diagnostic Lab also will have expanded capabilities, including the space and equipment to offer diagnostic necropsies on large animals weighing as much as 3,000 pounds, such as cows and moose.



Drive to discover

Ph.D. student's lifelong love of science flourishes in the lab

ON THE path to becoming a biochemistry Ph.D. candidate at the University of Maine, Linda Archambault learned more about her career field and herself. Archambault, who was a curious child, earned a bachelor's degree in biology at Bates College and worked for a year at the Boston University Marine Biological Lab before earning a master's degree in 1986. **ROLE MODELS:** After taking a hiatus from science to start a family, Archambault worked with women scientists at the Lobster Conservancy and Bates. "They trusted me to do the work and were happy with the work I did. My love of science flourished," says Archambault, a Massachusetts native who moved to Maine with her family when she was 16. **SERIOUS SCIENCE:** In the lab of Rob Wheeler, UMaine associate professor of microbiology, Archambault now uses zebrafish to study the human immune system's response to fungal infections, specifically fungi of the genus *Candida* and how they can become pathogens. She seeks to discover the host-pathogen interactions responsible for containment of *Candida* infection at mucosal barriers. **HIGH HONORS:** Archambault was selected as a teaching assistant for an internationally recognized practical course on fungal infectious diseases at the Marine Biological Laboratory and received UMaine's 2018–19 Janet Waldron Doctoral Research Fellowship. "Here at UMaine I've learned so much — the science, of course, but also so much about myself and what it takes to succeed," Archambault says. "The very best thing is to be taken seriously as a scientist." ■





Inventing solutions

New program accelerates commercialization of problem-solving innovations

By Margaret Nagle / Photographs by Adam Küykendall

AT THE University of Maine, faculty and students collaborate to make significant discoveries that solve meaningful problems to improve lives and create jobs. And now a new university technology accelerator program provides the resources and expertise to allow researchers to move their inventions out of the lab and into public and commercial use.

Earlier this year, five inventions created by UMaine faculty-led teams were the first to benefit from the Maine Innovation, Research and Technology Accelerator (MIRTA)

The aha moment: Researchers from UMaine and Sappi North America discovered that an existing technology — patterned paper — can be used for an environmentally friendly diagnostic device.

program. MIRTA was made possible by the University of Maine System 2018 Research Reinvestment Fund, a pool of competitive internal grants allocated to advance research projects along the path from discovery to becoming commercial products with public benefit.

All projects are tied to Maine businesses or industries critical to the future of the state.

MIRTA is part of UMaine's statewide focus on innovation, economic development and workforce development — a commitment to create meaningful employment and help improve the lives of people across Maine and beyond through ongoing research and outreach.

“The goal is to significantly advance research innovation to marketable new products and services,” says Renee Kelly, UMaine assistant vice president for innovation and economic development. “Every day, the University of Maine strives to turn research and development activities into new opportunities that will create jobs and grow Maine's economy.”

The first five MIRTA teams spent 20 hours a week for 16 weeks learning about the market and intellectual property analyses, and business model development needed to bring their inventions to market. Most of the teams included undergraduate and graduate student researchers.

Guiding the research teams were business incubation staff from the university's Office of Innovation and Economic Development, and an advisory committee of industry and technology experts, many of whom are UMaine alumni, who provide feedback and advice.

At the end of their program, all five teams had clear commercialization plans to move forward, from starting a company to licensing and collaborating with business partners.

This fall, MIRTA's second cohort includes teams researching projects ranging from digital visual aids for people with visual disabilities to replacing plastics with biodegradable materials.

Profiles of the first five MIRTA teams led by faculty inventors:

HEALTHY HIVES

In a single year, the successful pollination of crops by honeybees is reflected in the foods found in nearly every average American meal. In particular, the \$28 billion wild Maine blueberry crop is dependent on pollination by commercial honeybees. But in 2014–15, bee losses in Maine reached 60 percent due to colony collapse, a global problem not yet fully understood. To learn more about bee colony health and prevent collapses through early intervention, a radar-based, noninvasive beehive activity monitor was invented to record the insects' movements. Armed with the customer and market knowledge gained through MIRTA activities, Healthy Hives inventor Nuri Emanetoglu plans to launch a startup in late 2018, with companies in Ellsworth and Portland expected to collaborate on manufacturing.

GEOSPATIAL INNOVATIONS SUPPORTING LANDSCAPE MANAGEMENT IN MAINE

The forest industry has a long, rich history in Maine, and continues to have significant economic impact in the state, contributing \$8.5 billion to the gross domestic product and supporting 33,000 jobs. To keep this industry strong and the resources sustainable, forest managers require ongoing, accurate data collection. Currently in Maine, a lack of broad-scale geospatial information about forest and landscape conditions is a barrier to planning and prioritization. The Intelligent Geosolutions mapping approach is gathering this critical information using machine learning algorithms. Inventors Erin Simons-Legaard, Kasey Legaard and Aaron Weiskittel have created a low-cost, high-resolution, near-real time geoinformatics system to better compile broad-scale spatial information about timber and nontimber resources. Those forest attributes can include tree species biomass and relative abundance, forest types, wildlife habitat suitability, disturbance history and canopy change.

BEVERAGE CONTAMINATION DETECTOR

Across the country, demand for beer and wine is on the rise. There are more than 6,000 wineries in the United States — a number that's growing by more than 6 percent a year. And in Maine, the number of breweries has jumped 30 percent in the past year to more than 120. To meet the ever-increasing market demand, wineries and breweries need a faster, more cost-effective means of identifying spoilage than the current costly yeast tests that take days to return results and require specialized equipment.



In professor Caitlin Howell's Biointerface and Biomimetics Laboratory, undergraduate and graduate students collaborate on research that focuses on the intersection of biology, engineering and materials science. UMaine student researchers on the project include, left to right, Jenny Baranker, a biochemistry major from Virginia Commonwealth University; UMaine graduate student Amber Boutiette from Skowhegan, Maine; and UMaine biomedical engineering majors Chris Toothaker from Bradley, Maine and Bailey Corless from Wallingford, Connecticut.

A portable device for point-of-use beverage spoilage yeast testing has been developed by inventors Laurie Connell and Corey Hirn. The technology delivers on-site microbe detection using RNA-related probes to return results in 15 minutes, compared to the industry standard method that takes five days.

POINT-OF-CARE DIAGNOSTICS, SIMPLIFIED

The need is ever-increasing for handheld point-of-care biomedical diagnostic testing devices, such as those used in blood and urine testing, in the health care and pharmaceuticals arenas. These kinds of tests enable providers to detect diseases earlier and provide diagnostic testing to underserved populations. Despite the numerous benefits these devices bring to the health care community, they are costly to produce. Can the devices be made more cost-effective and environmentally friendly, eliminating the use of plastics and glass? In collaboration with Sappi North America in Westbrook, Maine, a UMaine research team is developing new methods of using patterned release paper in biotechnical applications. The team is led by inventors Caitlin Howell, Amber Boutiette and Matthew Talbot in collaboration with Amy Blakeley of Sappi. The goal is to develop low-cost, paper-

based devices that leverage the existing patented patterning technology and microfluidics engineering in disposable, biodegradable devices that could ultimately increase accessibility to health-related diagnostic testing worldwide.

MAKING PERIPHERAL NEUROPATHY RIGHT

Neuropathy, the death of peripheral nerves, is a health condition that can result in pain and loss of mobility and, in some cases, can lead to amputation. Causes range from diabetes and aging to certain viruses and exposure to some chemicals. It is estimated that, in the U.S. alone, approximately 30 million people are affected and one out of every four Americans will be affected by it. How can peripheral neuropathy be detected and diagnosed as early as possible to avoid extreme measures like amputation? A research team led by Kristy Townsend and Rosemary Smith has developed a microneedle medical device for early detection and diagnosis of small-fiber neuropathy. The device also has the ability to deliver noninvasive, pain-free treatment on and below the skin. The flexible microneedle array is capable of nerve conduction measurements and drug delivery, and has the potential to stimulate nerve regrowth. ■

Doing it all

Early College puts student ahead in her career goals

BALANCING A variety of classes is challenging — especially across three schools while working part time. Zoe Vittum, a junior at Brewer High School, takes classes through the Early College program at the University of Maine and its equivalent at Husson University. She plans to maintain this balance for the next two years to take advantage of the opportunity to take free college courses before graduating with her high school class. **THE NEXT BIG THING:** After finishing the majority of her high school coursework needed for graduation, she looked for a new challenge and found it at UMaine's Advanced Manufacturing Center (AMC). At her school, she is a member of the FIRST (For Inspiration and Recognition of Science and Technology) Robotics Team, part of an international organization that engages youth in science. Vittum says that experience with the team ties closely with the design and robotics work at AMC. At the center, she has worked on projects with Saco, Maine-based Xuron Corp., and on an automated system for drying kelp for commercial purposes. **FUTURE IN FOCUS:** Vittum plans to enroll at UMaine with a double major in biomedical engineering and mechanical engineering, and a minor in robotics. "I think it's a great opportunity to be able to start taking classes within the scope of my major in high school to see if that's what I want to do," Vittum says. "It's an opportunity that many students don't have, which can end up costing them more time in college." ■

Students first





A third-grader at Great Salt Bay Community School reacts while learning about a pumpkin's life cycle.

‘Whooooa’

Maine RiSE Center empowers teachers, transforms student STEM learning statewide

By Beth Staples / Photographs by Holland Haverkamp

SUSAN MCKAY didn't plan to be a physicist when she enrolled at Princeton University. She credits her strong K–12 science and mathematics background as a reason she could make the jump to explore theoretical condensed matter physics, spin glasses and nonlinear systems, and chaos.

Today, McKay is a University of Maine physicist. And she's founding director of the Maine Center for Research in STEM Education (RiSE Center). She leads a team of more than 50 faculty, staff and graduate students that strives to provide students with a robust background in science, technology, engineering and math (STEM) so they'll have multiple career options, just as she did.

The Maine STEM Partnership — a statewide education improvement community that engages more than 1,000 preK–12 and university educators — is one way the RiSE Center pursues its mission. The partnership that encompasses nearly 150 school districts and college campuses uses research-based strategies to improve STEM teaching and learning.

UMaine Today visited schools from Damariscotta to Danforth to learn how the RiSE Center teams with and inspires Maine educators and students. Here are their stories.

‘Whooooo’

In the past eight years, the Maine RiSE Center has received more than **\$19 million** in National Science Foundation grants and **\$1.7 million** in Maine Department of Education grants **to seed research-informed STEM education improvement** preK–16+, including teacher recruitment, preparation and retention.

Hermon Middle School

JIM FRATINI got the teaching bug when he was in high school. His science teacher — whose forte was math — encouraged Fratini and his classmates to choose projects, conduct research, figure out concepts and make presentations.

“I remember her saying, ‘Wow, you’d make a great science teacher someday,’” says Fratini.

Welcome to someday. The Hermon Middle School science teacher wants his students to be similarly engaged and take ownership of their learning. One rainy June morning, that was the case for seventh-graders engrossed in a genetics lesson featuring dragons.

After reviewing vocabulary terms — genes, alleles, dominant, recessive, phenotype, genotype, homozygous, heterozygous and heredity — each student in the life science class flips two pennies.

When a student’s flip results in two heads or a head and a tail, their dragon gets tail spikes, a dominant trait. When both pennies turn up tails, the dragon gets the recessive trait — tails without spikes. Students flip to determine other beastly characteristics, including ear frills, eye color, freckles and fire-breathing capacity. After nearly every coin toss, tablemates compare their dragons-in-progress.

As students draw and color their beasts, one youth does some computations and shares that there are 327 possible dragon combinations, including one resembling the Hungarian Horntail that Harry Potter battled in the Triwizard Tournament.

As the 40-minute class draws to a close, Fratini calls out: “Pencils down. Eyes on me. Your dragon’s name is your last name spelled backward.”

“Whooooo” comes a collective gasp. A student writes “Tteltrab” and tries out pronunciations. Fratini promises the next class will be exciting too, as they’ll be figuring out dominant and recessive traits of the dragons’ offspring.

The bell sounds and, as seventh-graders filter out, Fratini gulps some coffee. Seconds later, incoming eighth-graders glance at a projection screen to see which four-person table they’ve been assigned for the week. Energy transfer is the focus of the day’s physical science lesson. Fratini asks the group to define conduction, convection and radiation, and to give an example of each.

Each student designs and draws a Rube Goldberg machine — named after a cartoonist who sketched complicated, zany contraptions to perform simple tasks. Fratini encourages students to use classroom items — dominoes, for instance — to create machines that demonstrate five energy transfers, resulting in a lightbulb being turned on or off.

Piece of cake for Amber Stokes, who participated in the Maine Invention Convention, and represented the state at the National Invention Convention and Entrepreneurship Expo at the Henry Ford Museum in Michigan. Stokes’ invention — a container with an electromagnet — was designed to thwart the theft of postal packages from porches and backyards.

“I like how we did hands-on stuff (in class) so I decided to build my own thing,” Stokes says. “There (already) are things (built to prevent thefts), but those things aren’t as good as my thing,” she smiles.

Fratini smiles, too. He has taught 31 years in Hermon, and says the training he’s received with the RiSE Center has transformed him as an educator.

He initially balked when offered an opportunity to participate. Hermon Middle School, which has about 300



Jim Fratini, right, talks with a student at Hermon Middle School. The veteran educator says becoming involved with the RiSE Center is “probably one of the best things that has happened to me as a teacher.”

youth in grades 5–8, already had a good science curriculum and students routinely fared well on state tests. In hindsight, he says, “it’s probably one of the best things that has happened to me as a teacher.”

Fratini says the professional development has deepened his understanding of concepts, particularly in physics. And adopting the practice of pre-testing and post-testing students allows him to better track student progress and ascertain

areas to focus on. And whereas Fratini used to buy materials for class experiments, the RiSE Center now supplies him with items he needs for hands-on projects.

When Fratini has a question about a lesson or concept, or he wants to share something that’s worked particularly well in his classes, he appreciates that the RiSE Center staff, as well as numerous teaching colleagues whom he considers friends around Maine, are just an email away.



Top photo: Students in the East Grand School geometry class explore objects in virtual 3D spaces with UMaine's HandWaver program. Justin Dimmel "visits" class via FaceTime. Bottom photo: Algebra II students do equations on a whiteboard desk during a tic-tac-toe competition.

East Grand School

RiSE CENTER staff and math teacher colleagues also are just an email away for Jennifer Gilman.

Good thing. The grade 7–12 math teacher at East Grand School is 84 miles — about a two-hour drive — northeast of Orono. She's considerably closer — 30 miles — to Canada.

East Grand School is situated on a hill in Danforth. Youth from Bancroft, Brookton, Reed Plantation, Weston and Wytovitlock also attend. Gilman refers to the 150 students in preK–12 and the 16 teachers as family. Hallway lockers don't have locks. Her classroom, with comfy chairs, blankets, window valances and a lizard named Alex, resembles a living room.

A sunny, early June school day begins with the Pledge of Allegiance, a moment of silence, a weather report and a snippet from Louis Armstrong's "Bare Necessities": *Wherever I wander, wherever I roam, I couldn't be fonder of my big home.*

Gilman taught in Japan before earning a master's degree in literacy education at UMaine. About 25 years ago, when she accepted the grade 1–2 teaching position at East Grand, she immersed herself in the community, taking a spin in a skidder and advising extracurricular activities.

"Many people live their whole lives in Danforth. Twenty-five years ago, when I came to Danforth, that was an option. With the decline of the woods industry, that isn't as easy an option."

So she strives to provide students with more options. Her classroom is equipped with whiteboard-top tables and almost as many 3D printers as Algebra II students. RiSE Center staff taught her how to incorporate printers into a variety of lessons. The center also introduced Gilman —

the lone middle and high school math teacher at East Grand — to a statewide support system of educators.

"Collaboration is a key to successful teaching and as the only teacher, I was really struggling," she says. Her first RiSE experience was through the High School Collaborative. Five times a year, she drove two hours to Bangor to meet with other math teachers. They learned about and discussed best practices and innovation in math instruction and technology. In her first RiSE conference about instructional practices, Gilman says she grew as an educator. She continues to learn about impactful classroom strategies, standards-based education and instructional technology.

At East Grand, Gilman says teachers seek imaginative ways to individualize learning experiences. "We are free to be creative and innovative while our grounding is built on academic standards," she says.

One innovation is the virtual reality (VR) lab. A hand-made sign reminds anyone with orange cheese puff-coated fingers to refrain from using the equipment. The lab was built after Gilman met Justin Dimmel and Camden Bock at a RiSE Center conference. Dimmel is a UMaine assistant professor of mathematics education and instructional technology, and Bock is a research assistant in the IMRE (Immersive Mathematics in Rendered Environments) Lab. The lab's mission is "to investigate how virtual and augmented reality technologies can transform STEM education."

When Bock showed Gilman a VR program at the RiSE conference, she vowed to find a way to bring it to East Grand. "He promised that if I found the funding, he would help me implement it in my school."

She found the funding. He kept the promise. Dimmel and Bock set up equipment, and trained staff and students. Dimmel FaceTimes during classes to troubleshoot and



Madison Napoli, a middle-school student at East Grand School, checks the progress of a project on a 3D printer.

provide guidance. "It's inspiring as a teacher," says Gilman. "It keeps me thinking and growing and being creative. And it's super-engaging to the kids."

The geometry class utilizes UMaine's HandWaver program, "a gesture-based virtual mathematical environment in which students make, modify, measure and explore objects in a virtual 3D space." The program is designed to provide learners access to meaningful math experiences.

Gilman says ratios and scale proportions are easier to understand with HandWaver. "We can discuss concepts and really delve deeply into it. We pair it with the work that we do with 3D printers," she says. "It really makes them think in three-dimensional spaces."

Sophomore Bobby Massey says HandWaver suits his hands-on learning style. By making and manipulating objects in 3D, Massey says he better grasps concepts than when listening to a lecture. He plans to study computer science in college.

'Whooooa'



More than **1,000 Maine elementary, middle and high school teachers** are involved in ongoing Maine RiSE Center professional development. Students in participating teachers' classes showed **improved MEA science scores and more interest in science.**

Math used to be a problem for seventh-grader Emma Jo Davis. But hands-on learning and VR programs have helped her progress. "I'm passing, so it's good," she grins.

This spring for a business project, Davis and classmates made and sold "slime" and used 3D printers to make a prototype container. In June, they made a video to share with other schools. Complete with a script and costumes, the video touts the benefits of VR education.

Gilman is thrilled that VR provides youth who may not have traveled far outside of Washington County the opportunity to explore craters on the moon, art in a museum in Italy and organs inside the human body. The RiSE Center, she says, also has dramatically changed who she is as an educator.

"I'm always trying to either bring things into our school or bring our students out. But schools don't have enough money for lots of different things. This (VR) brings opportunities to kids in an engaging and educational platform."

forensic science at Bucksport High School. About 300 students attend the grade 9–12 school near the mouth of the Penobscot River.

Jergenson, who earned a degree in ocean studies at Maine Maritime Academy, was a curious child who enjoyed science. "I like to ask questions and I like that you can sort of work at your own pace, and be wrong, and learn from it. I think that's really why science kind of clicked with me."

Science still clicks with her.

Jergenson says "it was the greatest thing ever" when a former Bucksport colleague introduced her to the RiSE Center. She relishes opportunities to work, plan and share ideas with RiSE Center staff and colleagues around the state, especially since she's the lone Earth science teacher at Bucksport High School.

At RiSE Center conferences, Jergenson still experiments, or plays, as she calls it. She's learned how to incorporate 3D printers into classes and conducts experiments while helping develop and tweak an Earth science curriculum.

Part of ensuring that students have a good experience is incorporating lots of hands-on lessons and labs. The RiSE Center supplies materials for the many projects. Prior to labs, students share educated hypotheses about what may happen. After they've conducted experiments, they talk about and write about their findings and conclusions.

Seeing youth have aha moments when they make discoveries is rewarding for Jergenson.

First-year students Alexis Leeman and Kam Landry are enthusiastic about experiments and their aha moments in honors Earth science class. Science clicks with them, too.

Bucksport High School

TERI JERGENSON is familiar with budgetary limitations. Field trips may not be financially feasible, but making clouds in class is.

So, too, is learning about plate tectonics with chocolate frosting and Fruit Roll-Ups. And so is using salt, food coloring, tap water and thermometers to see how temperature and salinity affect ocean water.

Jergenson teaches Earth science, computer science and

First-year students Kam Landry, left, and Alexis Leeman examine how temperature and salinity affect ocean water. "It shows how fun science can be," says Landry. "It's more of an adventure."

‘Whooooa’



Photos left to right: Jennifer Wright Gregg calls on a student during a Productive Talk session. The Great Salt Bay Community School third-grade teacher says the technique fosters listening, collaboration and curiosity. Third-graders gather around a classroom table to do research and scientific drawings. Nathaniel Hufnagel likes taking part in Productive Talk because “it’s a group of people putting together ideas to make one big idea.”

In one of Landry’s favorite labs, Fruit Roll-Ups represent Earth’s tectonic plates and chocolate frosting is the magma.

In addition to seeing how magma — fluid molten rock — seeps up between spaces of shifting plates, Landry says it’s a bonus to eat the chocolate frosting afterward.

“It makes me more interested,” he says of hands-on learning opportunities. “It’s easy to connect what you’re learning to what you’re seeing.”

Landry also likes connecting with peers and Jergenson during experiments. “We blend well together. It shows how fun science can be. It’s more of an adventure. I really enjoy learning why things work and it’s very interesting to walk outside and see it rain and go, ‘Oh, I know why that happens.’ It makes me connect with the world around me.”

Leeman agrees. She says she retains what she uncovers during hands-on lessons better than when she reads information from a book.

Leeman, who says she may pursue a career in meteorology, liked a lab in which Jergenson made a cloud. She also enjoyed a lab — that highlights the release of carbon

dioxide gas — in which Mentos added to a bottle of carbonated soda inflated a balloon.

“I can go up to my parents and say, ‘Guys, I know why this happens’ and I feel so smart. I think it’s great,” she says.

Jergenson, who has been involved with the RiSE Center for about five of the 10 years she’s taught, employs Productive Talk strategies to develop a classroom culture in which students deepen their understanding of concepts by discussing ideas and theories.

“They vocalize their thoughts without a lot of teacher input,” she says. “It’s really good to get the students to be able to discuss with each other their thoughts and reasoning. It breaks down barriers — (they’re) all on the same page.”

Great Salt Bay Community School

THIRD-GRADERS at Great Salt Bay Community School are adept at conversing. They get lots of practice.

Thanks in part to Productive Talk, they’re budding conversationalists and scientists. Just ask Nathaniel Hufnagel.

“I learn the most from talking because it’s a group of people putting together ideas to make one big idea,” he says. “And then people add on to that to make an even bigger idea, then you sort of get what you’re talking about and understand more about the subject.”

Third-grade teacher Jennifer Wright Gregg was introduced to Productive Talk at the RiSE Center, and shared the concepts and strategies with colleagues at Great Salt Bay, a K–8 school with about 430 students from Damariscotta, Newcastle and Bremen. She’s done the same with HOT (Higher Order Thinking) Skills and Write Science.

“Everybody adopted it in the school,” she says. We now have, in science and in all content areas, students who are very comfortable with that kind of discussion.”

When engaged in Productive Talk, Wright Gregg facilitates a structured discussion so students find answers together. “It’s a different approach than telling your students answers. It gets them curious and wondering and trying to find

answers on their own, and figuring out what steps need to be taken next in order to come to some conclusions about content,” she says.

On a sunny May afternoon in Damariscotta — home of the annual Pumpkinfest — Wright Gregg’s class plants pumpkin seeds and discusses the life cycle of pumpkins.

Students sit in a circle on a purple rug and eagerly raise their hands when Wright Gregg asks questions. “Are there two parents?” “How are pumpkins pollinated?”

They listen, acknowledge their classmates’ thoughts and contribute theirs. Productive Talk is valuable, in part, because during discussions, Wright Gregg hears what her students understand and what they don’t. The approach also boosts language development and social skills, and helps youth remember ideas.

After the directed discussion, children disperse to sit on pillows, in rocking chairs and at small tables to do a scientific drawing of the life cycle of a pumpkin. They use books and computers to look up information.

Drawing diagrams and talking about science topics with

'Whooooa'



Learning while educating

ELIZABETH "BETSY" Trenckmann's science lab at Hermon High School looks lived in. And learned in.

Drawings of food webs and the Coriolis effect decorate walls and cabinets. A class planner and teacher checklist are on her desk. Nearby is the glass aquarium home of a gecko named Otis.

In a late-morning Earth Systems class, first-year students perch on stools around six high octagonal stations. Trenckmann prompts, encourages, jokes, prods and asks questions as she walks around the bright second-floor room. She easily transitions from giving a short lecture to facilitating small-group work to leading a review about carbon atoms.

Trenckmann is the Maine Center for Research in STEM Education's (RiSE) 2017 Outstanding Master of Science in Teaching Student (MST) at the University of Maine and a National Science Foundation Teaching Fellow. She says being a first-year teacher is the most difficult and most rewarding thing she's ever done.

She teaches four sections of Earth Systems for first-year students, one section of Conceptual Biology for sophomores and one section of Ecology of Maine for juniors and seniors.

Trenckmann credits the RiSE Center's MST program with preparing her for challenges. "(It) gave me experience practicing and implementing the techniques shown to help students learn in the classroom," she says. "(It) gave me the confidence to stand in front of a classroom to share the knowledge that I have gained over the years."

classmates earn top marks from third-grader Caroline Allen. Sharing knowledge is fun, says Allen, who's considering becoming a neurosurgeon or astronaut.

"It's kind of nice being outside and knowing what the thing is. Like pumpkins seeds. And you can teach family members. And the best part is, I can school my sister on it. She's in second grade," says Allen.

Wright Gregg, who has taught at Great Salt Bay for 10 years, has always loved teaching science, but didn't initially have an extensive background in it. She became involved with the RiSE Center six years ago to glean more content knowledge and best practices.

"I have become a much better teacher because of all my experiences with the RiSE Center. I will do anything that the RiSE Center offers. I am a lifer for the RiSE Center," she laughs. "I'm sort of anxiously awaiting the next thing."

Since Great Salt Bay teachers have come together to share ideas and utilize RiSE Center strategies and techniques, Wright Gregg says there's been a powerful culture change at the K-8 school. And the culture change has been recognized. Wright Gregg was named Lincoln County Teacher of the Year in 2015 and two of her colleagues have since won the award.

When teachers statewide share their ideas and expertise, Wright Gregg says the educational ramifications can be transformative for a generation of Maine students.

Through Twitter and other forms of communication, Wright Gregg has gotten to know and learn from brilliant educators.

"It's a wonderful way to approach this career of being a teacher. "It (the RiSE Center) broadens our horizons, which then helps our students." ■

On the RiSE

IN 2001, with a \$1.233 million grant from the U.S. Department of Education, University of Maine physicist Susan McKay and colleagues founded the Maine Center for Research in STEM Education (RiSE). Its mission: to advance the research and practice of teaching and learning in science, technology, engineering and mathematics.

Today, McKay, 18 other UMaine professors, seven professional staff members and 30 graduate students spanning four colleges and 10 STEM departments take a comprehensive approach to accomplish the mission.

In the last eight years, the RiSE Center has secured grants totaling more than \$19 million to work with teachers to infuse classrooms with research-supported practices. In that time, 2,518 elementary, middle and high school teachers have participated in RiSE professional learning opportunities.

The center seeks to reach and inspire all students, giving them "the chance to play in the science space," McKay says.

A goal is workforce development in Maine, including in engineering and health care professions that require a strong background in STEM. Supporting teachers — from preK through graduate school — is a way to accomplish that goal, she says.

STEM fields also are natural places to learn fundamental analytical-reasoning skills that are key to navigating the world and having an informed perspective.

And, McKay says, they're drivers of innovation. "(STEM) gets people thinking creatively," she says. "It's a problem-solving cluster of disciplines."

The numerous academic disciplines represented at the center are a unique strength, McKay says. Faculty pursue education research in their fields — astronomy, biology, chemistry, Earth science, ecology, marine science, mathematics, physics and watershed

biogeochemistry — as well as research across disciplines. RiSE faculty study the teaching and learning of STEM, often with a focus on concepts or practices specific to a discipline, from elementary school through college.

Well-respected researchers with the center have done much to explore and document best practices. In the past year, 19 faculty and 30-plus graduate students have had 20 journal articles and conference proceedings published or accepted for publication. They've taken part in 120 research presentations at national and international conferences and forums.

The center also works at the university level to support research-based improvements to STEM instruction. More than 300 educators, including university faculty, teaching assistants and undergraduate learning assistants, have participated in RiSE professional learning opportunities and STEM education improvement programs.

The center aims to make it easier for teachers in more than 200 Maine classrooms to engage students in science using a variety of strategies, including hands-on materials and active learning.

Thus, the center provides teachers with access to large tubs with abundant materials — from golf balls to maple syrup and from goggles and calculators to potting soil, Matchbox cars and measuring tapes. Schools pay \$15 per student per year for the lot. Particularly important, RiSE provides coordinated professional learning for teachers using these materials, including sessions for those educators who are new to them.

The RiSE Center also provides schools with 3D printers, and assists educators with incorporating the cutting-edge technology into standards-aligned lessons.

Each fall, recent graduates of the center's Master of Science in Teaching (MST) program begin careers in

classrooms around the Pine Tree State, including in high-need rural areas. In addition to being equipped with science content knowledge, they have a thorough understanding of proven teaching techniques.

MST graduate Marina Van der Eb is the Maine STEM Partnership coordinator. The Brooksville, Maine native organizes professional learning opportunities and instructional resources for preK-16+ teachers. She says it's particularly rewarding to bolster educators who don't have extensive backgrounds in science and, for budgetary or other reasons, have been assigned to teach STEM courses.

Educators who have trained with the center pay it forward by mentoring colleagues, which creates ever-expanding positive ripple effects.

For instance, fifth-grade students who have RiSE-affiliated teachers are 27 percent more likely to agree or strongly agree with a statement on the Maine Educational Assessment (MEA) that science is "interesting and fun." And in schools where teachers participate in RiSE programs, the percentage of eighth-graders meeting or exceeding proficiency on the MEA for science improved from 71.4 percent in 2010 to 80.1 percent in 2014, during the first four years of the center's programming.

The center's work to integrate research and practice models is one way that a land grant university can benefit and involve the state.

"It is exciting to see that the RiSE Center and its partnerships have had such widespread positive impacts on teaching and learning in Maine during its first 17 years," says McKay. "We have laid the groundwork for continuing improvement to benefit all of our students and prepare them for many career options."



Plugged in

Michael Socolow analyzes the first draft of history

By Beth Staples / Photographs by Adam Küykendall

MICHAEL SOCOLOW arrives mornings at his book-filled corner office in Dunn Hall and promptly checks Twitter to catch up on the previous eight or so hours of news and commentary. “I feel like I’m plugged in after that,” says the University of Maine associate professor of communication and journalism, who likens Twitter to the wire services he monitored in the early 1990s when he was a CNN assignment editor in Los Angeles.

“You could find out stories before anybody else. That’s what I enjoyed about journalism, being at the nerve center,” Socolow says. “If a breaking story occurs today, it happens first on Twitter. If you want to be informed, that’s the place you have to be.”

And that’s where he is.


@MichaelSocolow is one of about 335 million Twitter users worldwide. In 280 or fewer characters, he adds to the conversation about breaking news.

He also writes analyses for news outlets in which he seeks to put journalism’s “first draft of history” into broader context. Sometimes Socolow pitches columns to editors. And because of his presence on Twitter and his expertise about the intersection of media and history, editors reach out to him.

In the last year, his commentary has run in *The Boston Globe*, *Chicago Tribune*, *The New York Times*, *Columbia Journalism Review* and other outlets. His work provides historical perspective on current political, cultural, sports and media topics.

Which makes sense.

The Triumph typewriter in Michael Socolow’s office once belonged to his father, Sandy Socolow, who produced the *CBS Evening News with Walter Cronkite*.



Journalism is the first rough draft of history.

Socolow earned an undergraduate degree in history at Columbia University and a doctorate in the same discipline at Georgetown University.

“I always loved history and I loved the media,” he says. “And I wondered how these two things combined. I wondered where the media universe we live in today came from.”

Socolow searches for repeating patterns in American media history. And he takes away lessons they offer for the media and others in today’s political and cultural climate. He found both in the Thai boys’ soccer team’s rescue from a flooded cave.

In his *Boston Globe* piece titled “The Thai teens and the baby in the well,” Socolow compares the coverage of the soccer squad’s plight with that of the 33 Chilean miners trapped underground for more than two months in 2010, and to the retrieval of Jessica McClure, the baby trapped for 58 hours in an abandoned well in Texas in 1987.

Socolow says “baby-in-the-well” stories show journalists and their employers that “storytelling is not about the technology, it’s about the narrative.”

“Media history teaches how these and other formulaic narratives continually reoccur and prove irresistible to audiences,” he wrote. “Looking to the most foundational aspects of journalism as a cultural practice might help reverse the economic devastation facing the media industries in this era of transformation. You might even say these stories could rescue journalism.”

These thrilling stories resonate because they build community and “demonstrate to readers and viewers that life and death, and heroism and courage, are a part of daily existence,” he wrote.

They also encourage “us to reflect on our own courage and resilience. Like a good myth or parable, these stories reaffirm the most basic elements of humanity.”

This summer, Socolow wrote about another familiar pattern when Alex Jones’ InfoWars material was being banned by Apple, Facebook and others. His piece for *The Conversation* was titled “Audiences love the anger: Alex Jones, or someone like him, will be back.”

“Confrontational characters spouting conspiracy theories and promoting fringe ideas have been with us since the invention of American broadcasting,” he wrote. “First on radio, then on television, the American audience has consistently proven eager to consume the rants of angry and bitter men.”

Jones isn’t unique because when the “American Dream isn’t working out so well, scapegoats must be found” and the Joneses of the broadcasting world “simultaneously soothe and stoke the anxieties and insecurities of Americans living in a world that’s increasingly complex and beyond comprehension.”

And “as long as insecurity and anxiety can be exploited,” Socolow predicted “there will be new versions of InfoWars to pollute our nation.”

FIVE DAYS after Michael Wolff’s best-selling book *Fire and Fury: Inside the Trump White House* was published, Socolow penned “As an industry rots, Michael Wolff laughs his way to the bank” for *Columbia Journalism Review*.

Media critics had written withering reviews, and cited a slew of media ethics violations and editing blunders. Socolow says there’s another reason the press pilloried Wolff: He was making millions “when ethical, professional, nuts-and-bolts political journalism is collapsing.”

And when “the job of the newspaper is to comfort the afflicted and afflict the comfortable” as *Chicago Evening Post* columnist Finley Peter Dunne asserted, “to exploit journalism ambitiously — to plan reporting so as to make millions and facilitate social climbing — would seem a betrayal of classic journalistic values,” wrote Socolow. “It’s precisely that betrayal that bothers so many journalists watching Wolff laugh his way to the bank.”

Socolow gave props to *Mad Magazine* in his analysis “Mad Magazine’s clout may have faded, but its ethos matters more than ever before” in *The Conversation*.

He credited the magazine with performing a key public service when it “preached subversion and unadulterated truth-telling when so-called objective journalism remained



“

Looking at the most fundamental aspects of journalism as a cultural practice might help reverse the economic devastation facing the media industries in this era of transformation.”

The news business is in Michael Socolow’s blood and it shows, says David Folkenflik, an NPR News media correspondent. “He’s a valuable voice and he’s curious about the world around him. He has a very accessible way of writing. He has a nimble, fun mind and journalists and the public benefit from reading his pieces.”

deferential to authority. Long before responsible organs of public opinion like *The New York Times* and the *CBS Evening News* discovered it, *Mad* told its readers all about the credibility gap.”

That credibility gap, though, appears to have widened since 2001. As evidence, Socolow cited the failure of the media before the Iraq War and “the acquiescence to the carnival-like coverage of our first reality TV star president.”

BEFORE HE transitioned to academia, Socolow worked for the host broadcast organizations at the Olympic Games in Sydney, Barcelona and Atlanta. And as assignment editor

at CNN, Socolow helped direct breaking news coverage in Los Angeles and on the West Coast. He worked extensively on the O.J. Simpson trial, and was part of the team awarded the CableACE Award for coverage of the 1994 Northridge earthquake.

Socolow pivoted from broadcasting when he sensed the scale and pace of reporting were rapidly changing. Many top journalists are adrenaline junkies and Socolow says he’s “a bit too contemplative and too slow” for that lifestyle.

For a professor, media historian and author, though, being contemplative is an asset. And an appreciated one.

In spring 2018, the Library of American Broadcasting



In 2018, UMaine's College of Liberal Arts and Sciences recognized Socolow's curiosity and contributions, presenting him with an Outstanding Faculty Award for Research and Creative Achievement.

Foundation presented Socolow with its 2018 Broadcast Historian Award for his book *Six Minutes in Berlin*.

The book — which combines Socolow's passions for writing, history and crew — details the University of Washington men's crew team's improbable and thrilling win at the 1936 Olympics in Berlin.

Socolow puts readers in the boat with the Huskies, in living rooms with Americans riveted to the broadcast of the race, and with the broadcast professionals working to bring the Olympics to 300 million people around the world.

In a release about the award, a portion of Allen Guttman's review in the *Journal of American History* was cited. "The stroke-by-stroke story of the Huskies' come-from-behind victory is a masterpiece of sports journalism. (T)he text reads as if Socolow had discovered that his true vocation is to be a novelist," wrote Guttman, a retired professor of English and American studies at Amherst College.

Former sports writer Ron Bishop, an author and professor

of communication at Drexel University, also is a fan. He wrote in *American Journalism* that *Six Minutes in Berlin* "belongs on all history of sports or sports journalism syllabi" and "is among the best works of sports history."

Socolow, who rowed at Phillips Exeter Academy and at Columbia, says rowing taught him to value process as much as results. In a column for *The Boston Globe*, he describes the "great exultation" known to rowers as "swing."

"Swing is ephemeral and almost indescribable. It's the challenge that keeps oarsmen rowing. It's the moment when the physical propulsion of a shell evolves into a metaphysical feeling of transcendence. This is the essence of crew," he wrote.

"Every oarsman, and coxswain, knows when swing occurs. They sense their effort has become transcendent; the boat is now flying but the effort to maintain — and even grow — speed eases. Everything flows as the boat glides. Everyone feels it but nobody acknowledges it. It is

unity made manifest. It's surrender to process rather than demanding results."

SOCOLOW'S ADOPTED a similar perspective about writing. He surrenders to the process, which is what matters. He isn't fazed when editors reject his pitches.

A good number, though, are accepted.

James Freeman, assistant editor of *The Wall Street Journal's* editorial page, views Socolow as an active participant in the media business because of his interesting commentary.

"His work has a richness not just because he is still a curious reporter who understands trends in our age of digital media abundance, but also because he has studied the early history of electronic media scarcity," says Freeman. "While we don't always agree, he always makes me think."

Freeman says Socolow was already an informal culture journalist when the two were friends at Phillips Exeter.

"He would play music none of us had ever heard and tell us all about the people who made it. And then years later when it became popular, we could confidently report that we'd been listening to it for years," says Freeman.

"Same thing with sports. Some Americans have recently started tuning into English Premier League soccer on weekend mornings, but Mike was a fan when I met him in 1983. So he was a naturally curious reporter, always looking far and wide for whatever was new and different and interesting and then sharing it with others."

For a semester beginning in January, Socolow will be based at the University of Canberra's News and Media Research Centre in Australia, where he'll be a Fulbright Senior Research Scholar. He'll examine how Australian media interacts, and has historically interacted, with media on a global scale.

Socolow says persistence has been key throughout his

careers. In 2003, when he initially applied for a teaching position at UMaine, he didn't get the job. Socolow still has the rejection letter.

He seeks to impart lessons about persistence to students in courses he teaches, including Journalism Across Platforms; Propaganda and Political Communication; and Media

History. He also helps them hone skills so they write clear, precise, engaging prose and think about a story from a multitude of angles, rather than "both sides."

"I got that from dad. He used to say that anybody can get both sides," says Socolow. "But real journalists can find sides five, six and seven."

His dad, Sandy Socolow, would know.

He was a producer on *CBS Evening News with Walter Cronkite* for much of the 1960s and '70s, and produced and coordinated much of the coverage of the Vietnam War, the moon landing and Watergate.

Prior to his long career in television, Sandy Socolow was an overseas wire service reporter.

Socolow's mother, Nan Socolow, is an accomplished poet. *Rolling Stone* and *The New Republic* have published her poems.

Growing up, Socolow says the television was on in his home much of the time. He recalls that his father frequently joked that TV "paid the rent."

Socolow doesn't watch a lot of television anymore. His preferred mediums are Twitter, the web, radio and newspapers. When he travels, Socolow reads local papers to get a sense of place.

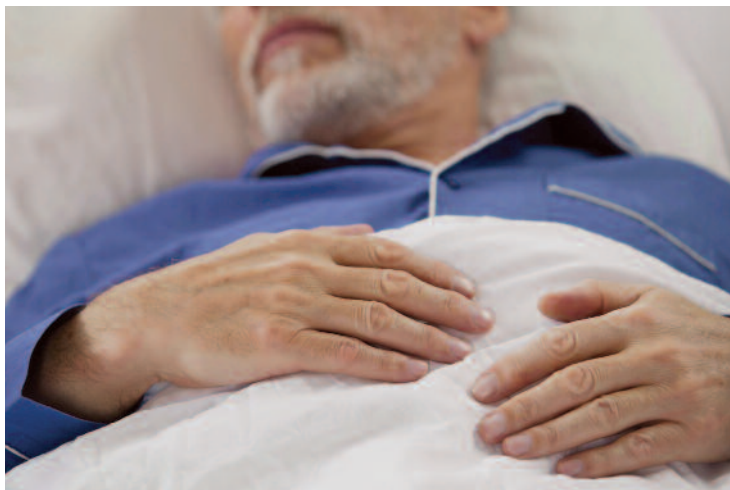
Media, he says, will continue to evolve.

"It's always in an era of transformation. So if you don't like Twitter right now, if you don't like Facebook right now, wait a decade. They won't look the way they look right now."

That's the way it is. ■

“ I always loved history and I loved the media. I wondered how these two things combined. I wondered where the media universe we live in today came from.”

Michael Socolow



AN INVENTION FOR EARLY DETECTION

A HOME-BASED sleep monitoring invention developed by University of Maine researchers that has the potential to help detect early symptoms of mild cognitive impairment and Alzheimer's disease in elders has received a \$1 million Small Business Innovation Research Award from the National Institute of Health's Institute on Aging.

The two-year NIH Phase II award to Activas Diagnostics LLC, founded by professors Marie Hayes and Ali Abedi, focuses on bringing the spin-off company's patented SleepMove product — a fitted mattress undersheet instrumented with 16 hybrid wireless sensors — to market as a new approach to diagnostics and monitoring in early stage neurological disease.

Activas Diagnostics' SleepMove technology allows for home-based, noninvasive recording that integrates wireless sensing technology, signal processing and statistical inference software to identify two novel biomarkers of sleep disorder that complement standard actigraphy, and a new level of accuracy for out-patient sleep recording.

The goal is to move the technology into clinical trials and establish approval from the U.S. Food and Drug Administration.

COMPOSITE CROSSINGS

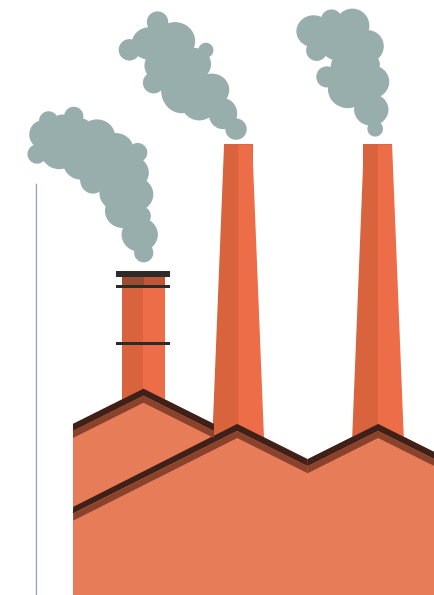
THIS PAST summer, the University of Maine Advanced Structures and Composites Center unveiled an innovative, rapidly deployable bridge system featuring composite material girders and precast concrete deck panels.

The patent-pending system is designed to be constructed in 72 hours, reducing the time and logistics of highway bridge building. The new bridge girders are built to last 100 years, and the precast concrete deck is designed to be easily removed and replaced.

The bridge system can be used for highways, pedestrian byways and military applications. The design is targeted for short- to medium-span bridge applications, up to 80-foot unsupported spans.

An August strength test of the composite girder confirmed the design modeling predictions, and demonstrated the bridge system can withstand the truck load specified in the American Association of State Highway and Transportation Officials (AASHTO) Bridge Design Specifications. The composite bridge withstood forces up to 376,000 pounds and 7.5 times the HL 93 design load specified by AASHTO.

The project, funded by the U.S. Army Corps of Engineers, is led by professors Habib Dagher and William Davids, and James Anderson, Josh Clapp and Cody Shelter, with graduate students Anthony Diba and Dante Guzzi.



ADVANCED COMBUSTION

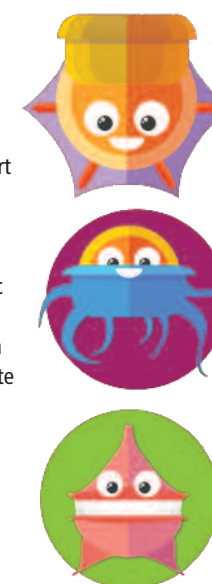
IMPROVING WIRELESS sensor technologies in coal-based power plants is the focus of a \$2.5 million grant from the National Energy Technology Laboratory (NETL) through the Department of Energy's Office of Fossil Energy to the University of Maine.

The UMaine project, led by Mauricio Pereira da Cunha, professor of electrical and computer engineering, and Robert Lad, professor of physics, is one of nine projects funded by NETL as part of the Advanced Combustion Systems Program.

The goal of the program is to develop new advanced sensor instrumentation that can provide improved condition-based maintenance in existing coal power plants, reliably decreasing costs of operation and maintenance, increasing efficiency and safety, and significantly reducing pollutant emissions, according to DOE.

UMaine's research, led by faculty, staff and students in the Laboratory for Surface Science and Technology (LASST), is based on wireless, battery-free surface acoustic wave sensor devices that allow measurements of temperature, as well as stress and strain, on equipment operating under harsh environments, including very high temperatures.

The technology aims to monitor temperature and equipment degradation at both the fire and steam sides of boilers and other critical components. The DOE project will focus on technology transfer and development of new materials, and packaging for wireless harsh-environment sensors applications in coal-fired power plants.



PHYTO HEROES

MARINE PHYTOPLANKTON are the inspiration for a new mobile application and educational game launched by University of Maine assistant professor of new media and intermedia Gene Felice.

The app, called Phyto Heroes, is an outcome of an interactive art exhibit, *Oceanic Scales*, developed by Felice and Jennifer Parker at University of California, Santa Cruz, with a grant from the National Endowment for the Arts.

Phyto Heroes explores phytoplankton as a scientific and artistic research subject through an interactive game system designed for third- through fifth-grade students and beyond, supplemented with 10 downloadable lesson plans for instructors. The goal is to illustrate how environmental factors such as pH, temperature and nitrogen levels affect the ocean.

To create the app, Felice worked with UMaine developers and with Parker. The work was supported by Maine Sea Grant, the National Endowment for the Arts, Epsilon and Alliance Data.

The research directly addresses the nationwide lack of **accessible STEM resources**, with project outcomes having significant potential for improving both **educational opportunities** and **workforce training** for many blind or visually impaired individuals. Nicholas Giudice

Unique STEM graphics access

DEVELOPMENT AND evaluation of a first-of-its-kind remote learning platform providing people who are blind or visually impaired (BVI) nonvisual access to STEM-related graphical information is the focus of a \$748,000 National Science Foundation grant to the University of Maine.

The project is led by Nicholas Giudice, UMaine professor of spatial informatics who directs the Virtual Environment and Multimodal Interaction (VEMI) Laboratory. The research team also includes Justin Dimmel, UMaine assistant professor of mathematics education and instructional technology, and Stacy Doore, visiting assistant professor of computer science at Bowdoin College.

The system uses combinations of nonvisual inputs, such as vibration, speech and auditory information, that allow BVI users to feel and hear the visual content of graphics as they move their hand around the touchscreen of smartphones and tablets. With graphical educational materials at the core of all STEM disciplines, this information access is critical for improving BVI students' classroom outcomes.

The project will conduct one of the largest experiments ever performed on graphical access with BVI participants, with results leading to the development of a robust and economically viable solution for the BVI community.





“All educators **will find a use** for this website.” Bobby Deetjen

TIPS FOR FIRST-YEAR TEACHERS

THE FIRST few years of a teacher’s career are arguably the most important. As with any profession, they lay the foundation for the habits and routines that lead to success down the road.

In Maine, school districts are required to provide mentorship to first-year teachers to help them transition to the job. But what that mentorship looks like varies from district to district.

“Teacher induction programs are probably the most important programs we have when it comes to retaining teachers, and currently schools are all over the map in terms of what they do for induction,” says Bobby Deetjen, assistant director at Mid-Coast School of Technology in Rockland and a master’s student in educational leadership at the University of Maine.

To fill in some of the gaps in what individual schools and districts offer, Deetjen and his classmates in the educational leadership program’s Belfast, Maine-based cohort, taught by assistant professor of educational leadership Ian Mette, created a website offering helpful tips, tricks and resources for first-year teachers.

The site has five sections: What’s on your plate; Making connections; How to handle situations; What’s coming up; and Tools and tech.

The website is the culmination of a monthlong May term class, Leading Effective Task Groups in Schools, taught in three locations around the state. The cohorts in Ellsworth and Bangor created YouTube videos addressing issues of trauma and poverty in schools.

IN THE HOLOCAUST GHETTOS

HISTORICAL GEOGRAPHER Anne Knowles has received a three-year, nearly \$300,000 National Endowment for the Humanities Digital Humanities Advancement Grant to use cutting-edge technologies to analyze Holocaust ghettos and the millions of people caught in their brutal conditions during World War II.

Knowles, the Colonel James C. McBride Distinguished Professor of History at the University of Maine, is directing the project with co-directors Paul Jaskot of Duke University and Anika Walke of Washington University in St. Louis. They will combine three approaches from digital and spatial humanities to construct a place-based model.

The researchers will create a historical geographic information system (GIS) of 1,400 ghettos by extracting key information from the United States Holocaust Memorial Museum’s (USHMM) Encyclopedia of Camps and Ghettos. This will enable the first systematic, comparative analysis of Jewish ghettos, forced labor and mass murder in Eastern Europe from 1939–45, says Knowles.

From 1,800 transcripts of video interviews from USHMM and the Visual History Archive of the University of Southern California Shoah Foundation, the team will analyze the many ways that Holocaust victims described the ghettos and their experiences.

Researchers then will use geovisualization — the display of information that has a geospatial component — to explore spatial patterns and physical characteristics of ghettos. They’ll reconstruct victims’ movements and connect individual trajectories to the larger events that forced millions from their homes.

FIGHTING INFECTION

ROB WHEELER is engrossed with a generally harmless fungus that naturally lives in and on people, but also can cause disease and death. For 16 years, the University of Maine associate professor of microbiology has been unraveling the mysteries of the fungus *Candida albicans*.

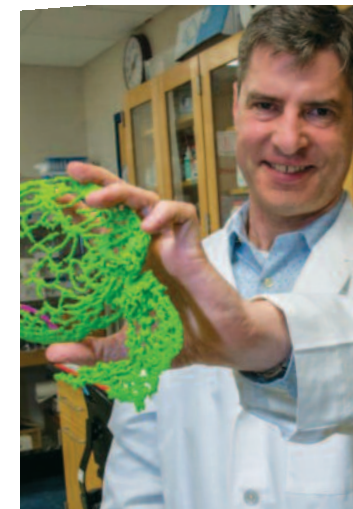
Now with a three-year, more than \$400,000 award from the National Institutes of Health, he and his team of graduate and undergraduate students hope to illuminate interactions between *C. albicans* and the immune system.

Greater understanding of the pathogen can advance treatment and prevention of infectious diseases.

For the most part, this natural gut flora peacefully co-exists in people with healthy immune systems.

But in those whose immune systems are compromised, this opportunistic fungus gets into the bloodstream and transforms into a potentially fatal, organ-attacking pathogen.

Wheeler explores how neutrophils (white blood cells that lead the immune system’s response to fight infection), the epithelial barrier (the safety shields between internal cells and microbes in the environment), and other innate immune components interact with *C. albicans* throughout an infection.



MARINE PROTECTION HELPS CORAL REEFS

REPORTS IN recent years that marine protected areas (MPAs) aren’t effective in saving coral reefs from the damaging effects of global climate change have led some to argue that such expensive interventions are futile. But a study that spanned 700 kilometers of the eastern Caribbean reveals that MPAs can help coral reefs.

Robert Steneck, a professor of marine biology at the University of Maine, has spent much of his 40-year career studying coral reefs. He led the team, partially funded by the National Geographic Society, that conducted research on the leeward islands of the Caribbean and discovered that local reef protection efforts can work — contradicting several previous studies.

Local fisheries management resulted in a 62 percent increase in the density of young corals, which improves the ecosystem’s ability to recover from major impacts like hurricanes and coral bleaching, according to the team’s findings, published in *Science Advances*.

The team also concluded the best way to measure the effectiveness of reef conservation is by using a suite of metrics, including the number, species and size of fish; amount of seaweed; and number of baby corals, rather than one indicator of reef health.

The research team included Peter Mumby of the University of Queensland; Doug Rasher of Bigelow Laboratory for Ocean Sciences in Maine; Chancey MacDonald of James Cook University; and George Stoyale of RARE, Arlington, Virginia.

NEW TATER IN TOWN

PINTO GOLD is the newest gourmet potato variety released by the University of Maine in partnership with the Maine Potato Board. It is the fourth variety released by UMaine since 2014, behind Easton, Sebec and Caribou Russet. The potato is a yellow-fleshed specialty variety with excellent roasting and eating quality, according to Gregory Porter, who leads UMaine’s potato breeding program. The variety is adapted to cool, northern growing areas and produces a high yield of small tubers under those conditions.



“We suggest that **local management measures can bolster the recovery of corals after damaging events** and, eventually, improve their overall condition.”
Robert Steneck



FROM MOLECULES TO MANAGEMENT

TWO UNIVERSITY of Maine professors aim to provide a greater understanding of the mechanisms by which soils adsorb phosphate and maintain it in plant-available forms to increase the sustainability of agriculture in the United States.

Tsutomu Ohno, a professor of soil chemistry, and M. Susan Erich, a professor of plant and soil chemistry, were awarded \$498,000 from the U.S. Department of Agriculture's National Institute of Food and Agriculture for the three-year study.

The goal is to provide the foundational knowledge to design management practices that significantly increase phosphorus use efficiency in agroecosystems and to understand soil carbon stabilization. That would allow a reduction in synthetic fertilizer inputs, reducing adverse impacts to off-farm surface and groundwater resources.

The study will focus on chemical and biological processes that are the foundation for a sustainable agroecosystem, providing molecular-scale chemical data to inform landscape-scale ecological models necessary for decision-making in a changing global environment, according to the researchers.

The scientists are collaborating with environmental chemist Patrick Hatcher of Old Dominion University and geochemist James Kubicki of University of Texas at El Paso.

ADVANCING REGENERATIVE BIOLOGY

COMPARING REGENERATIVE tissue capabilities among animals is the focus of a new database created by a team of researchers at the University of Maine and MDI Biological Laboratory.

Benjamin King, an assistant professor of bioinformatics at UMaine, and Viravuth Yin from the MDI Biological Laboratory in Bar Harbor, led a team to create RegenDbase, the Comparative Models of Regeneration Database.

While regenerative capacity in mammals is limited to select tissues, lower vertebrates such as zebrafish and salamanders have the ability to regenerate entire limbs and most adult tissues, including heart muscle, according to the researchers.

The online resource allows researchers to compare gene expression patterns across animals with different regenerative capacities to look for shared and unique patterns of gene expression. It incorporates gene expression data sets for protein-coding genes and regulatory RNA molecules from zebrafish, axolotl salamanders and mice.

The researchers used the new database to conduct a comprehensive gene expression study to find RNAs common to heart regeneration in both neonatal mice and zebrafish using an extensive new zebrafish data set. Twenty-eight new zebrafish regulatory RNA molecules were identified using those data, according to King.

Future incorporation of data sets from other organisms and human tissues will enable broader cross-species comparisons of regenerative biology, the researchers hypothesize.

King is the lead author of "RegenDbase: a comparative database of noncoding RNA regulation of tissue regeneration circuits across multiple taxa," published in the journal *Regenerative Medicine*.

Among the co-authors of the study is UMaine student Grace Smith, a molecular and cellular biology major in the Honors College.

This past summer, Smith participated in the Novartis Scientific Summer Scholars Program, where she conducted work at the Novartis Institutes for BioMedical Research in Cambridge, Massachusetts.



Tomorrow's conservation leaders

HELPING TRAIN the next generation of interdisciplinary environmental conservation leaders is the goal of a five-year, \$2.9 million National Science Foundation (NSF) award to the University of Maine.

The interdisciplinary project led by Sandra De Urioste-Stone, a UMaine assistant professor of nature-based tourism, and involving multiple community partners statewide was one of 17 new projects funded by NSF's Research Traineeship (NRT) program to support preparation of future leaders in the STEM (science, technology, engineering and mathematics) workforce.

Eight other UMaine researchers — Aram Calhoun, Adam Daigneault, Daniel Hayes, Bridie McGreavy, Sarah Nelson, Laura Rickard, Linda Silka and Aaron Weiskittel — are involved in the project, which is the result of strong collaboration across a variety of research and academic units.

In Maine, workforce development will focus on the creation of a new graduate education model to enhance conservation science and practice. The coursework, research and community engagement will equip the next generation of leaders with skills to address the challenges presented by global and local changes in environmental, social, economic and climatic conditions.

De Urioste-Stone and the other UMaine faculty members will collaborate with state and local agencies, the National Park Service, nongovernmental organizations and other community partners. They include Acadia National Park, Maine Department of Inland Fisheries and Wildlife, the Penobscot Nation, Schoodic Institute and The Nature Conservancy.

In its first five years, the project expects to train 25 master's and doctoral scholars, including 20 NRT-funded trainees from forest resources, wildlife conservation, communication and environmental sciences to develop interdisciplinary communication, collaboration and professional skills to address emergent conservation issues in Maine and beyond.

LIFE AND DEATH IN THE TWILIGHT ZONE

UNIVERSITY OF Maine scientists were part of an interdisciplinary research team equipped with advanced underwater robotics and analytical instrumentation that set sail in August from Seattle to the northeastern Pacific Ocean.

The researchers examined the life and death of plankton — microscopic organisms that are the base of the ocean food web and play a key role in removing carbon dioxide from the atmosphere and oceans.

They will apply the data to improve NASA's satellite measurements of carbon export. The goal is to better understand how the planet is changing in response to the increasing amount of greenhouse gases.

UMaine professor emerita Mary Jane Perry, professor Emmanuel Boss, associate professor Lee Karp-Boss and oceanography doctoral candidate Nils Haentjens are part of the NASA- and National Science Foundation-supported Export Processes in the Ocean from Remote Sensing (EXPORTS) oceanographic campaign.

Boss and Haentjens were aboard the *Roger Revelle* and Perry was on the research vessel *Sally Ride*. They examined plankton, as well as the chemical and physical properties of the ocean from the surface to 3,200 feet in depth. In that region called the twilight zone, where there is little to no sunlight, carbon from plankton can be kept out of the atmosphere for decades to thousands of years.

Boss and Karp-Boss, who are co-principal investigators of an Oregon State University-led portion of the project, and Haentjens, seek to learn more about how phytoplankton community properties determine the movement of organic carbon from the ocean surface to the twilight zone.

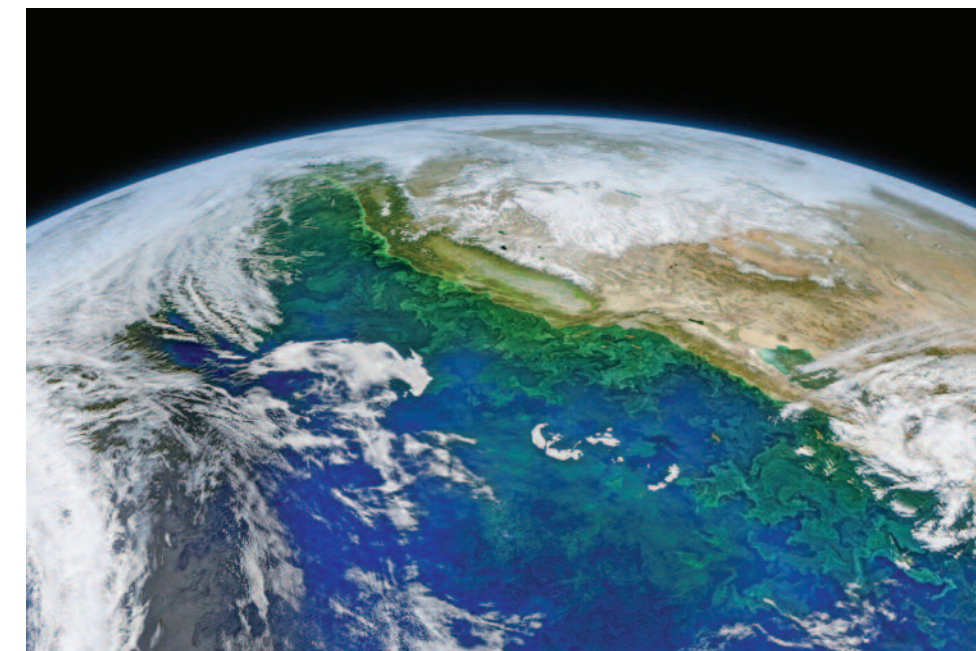


Photo courtesy of NASA



SOCIAL VIOLENCE

IN THE modern era of social media, more than 300 million people use Twitter to share news and engage in online conversations. This provides a glimpse into the minds of a diverse public, making Twitter a useful tool for researchers to study people who sympathize with and promote extreme violence.

Karyn Sporer, University of Maine assistant professor of sociology, is analyzing a subsample of more than 4,300 tweets looking for emerging themes that justify violence. One of her goals is to help agencies find strategies to counter violent extremism and radicalization.

The project, "Justifications for violence: How jihadist sympathizers rationalize terrorism and mass murder," focuses on related tweets occurring within 24 hours surrounding three mass-casualty events: the Paris coordinated event in November 2015, and the Orlando Pulse nightclub event and Nice cargo truck event in June and July 2016, respectively. The three were chosen because of their similarly high number of casualties, intense media focus and social response.

The UMaine project is one of six awarded Summer Faculty Research Funds by the UMaine Office of the Vice President for Research and Dean of the Graduate School.

RURAL YOUTH

HELPING RURAL communities retain and attract young residents is the goal of a three-year study led by the University of Maine.

The project seeks to understand the goals and aspirations of middle- and high-school students in traditionally forest-dependent communities in Maine and Oregon. Researchers will look at economic restructuring, community characteristics, and young people's perceptions of local labor markets in these regions.

"We're trying to untangle how the community in which kids live affects their aspirations and hope for the future, and also hopefully provide some information on what communities can do to better support youth in these places," says Mindy Crandall, an assistant professor of forest landscape management and economics, who is leading the study.

The project consists of three main components: an anonymous survey, community listening sessions, and the distribution of a program evaluation tool that can be used by organizations involved in delivering youth training and education programs.

Through the surveys and listening sessions, the researchers seek to learn about the connections among local communities, youth aspirations for the future and the local economy.

The researchers say they hope the information will help communities better engage the next generation of workers and entrepreneurs as residents and leaders, develop more targeted education and training opportunities, and attract more early-career people to relocate or return.

"Youth aspirations and labor market transitions in rural communities" was funded by the U.S. Department of Agriculture's National Institute of Food and Agriculture. Other UMaine researchers involved in the project are Jessica Leahy, a professor of human dimensions of natural resources; and Nicole Bernsen, a doctoral student. Community partners in Maine include UMaine Extension, the Appalachian Mountain Club, Helping Hands with Hearts and Piscataquis Chamber of Commerce.



A dwindling workforce, places where the school population is kind of right on the edge of viability — **those are pretty critical issues to keep young, working families in those places.**"

Mindy Crandall



This scholarship is allowing me to complete my undergraduate degree and attend grad school, **with the goal of becoming a registered dietitian.**"

Elizabeth Lemin '19, food science and human nutrition major
Recipient of the Elsie S. and A.R. Roderick II '48 Nutrition Scholarship



Vision for Tomorrow

AT THE core of the University of Maine's Vision for Tomorrow comprehensive campaign is expansion of scholarship support to ensure that qualified students have access to UMaine, along with the resources they need to achieve their goals. Contact the University of Maine Foundation to learn more about creating a scholarship in your name to benefit future generations of students. Read more about senior Elizabeth Lemin and our other grateful scholarship recipients online (umainefoundation.org/gratitude).



umainefoundation.org
umaine.edu/visionfortomorrow

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