

Battle lines

It's a bird! It's a plane!

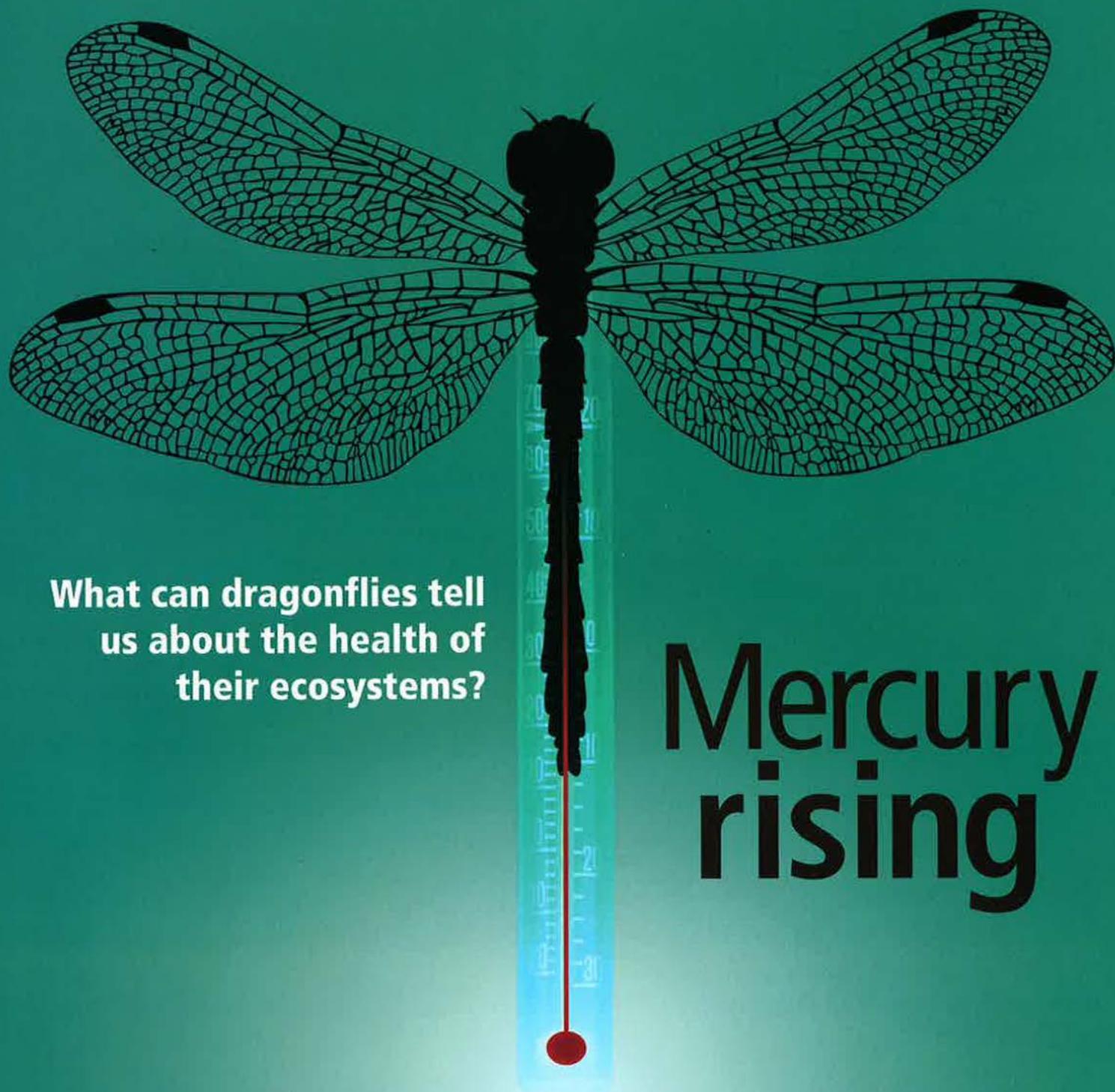
Island life



UMaine Today

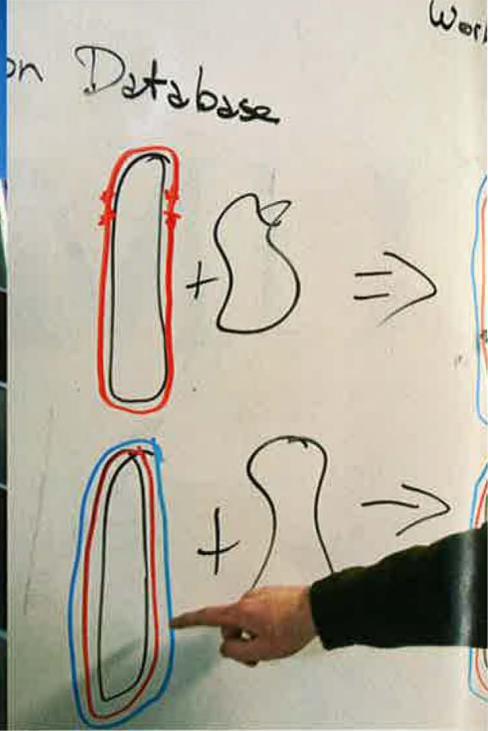
CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

SPRING 2013



What can dragonflies tell us about the health of their ecosystems?

Mercury rising



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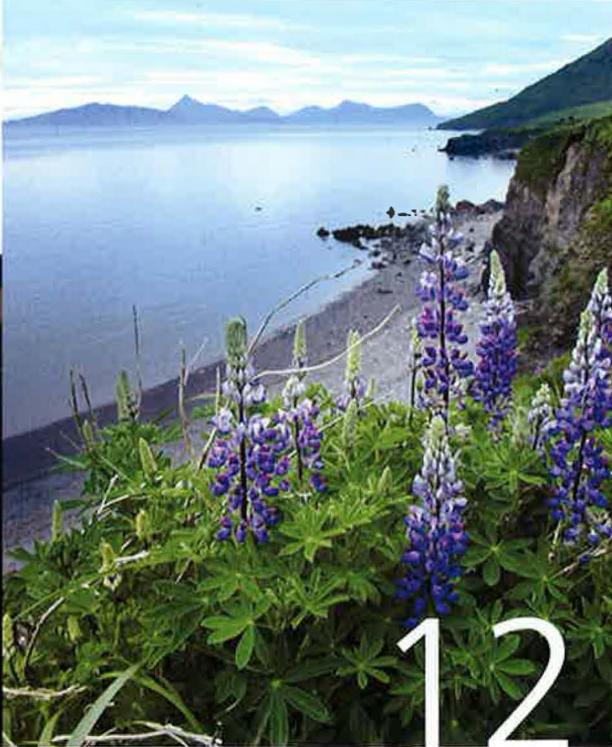


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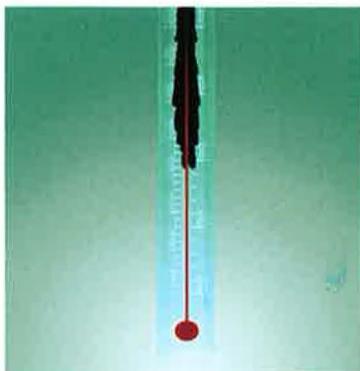
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ON THE COVER: A University of Maine researcher is studying dragonflies as bio-sentinels of mercury in their ecosystems. Aiding the University of Maine research effort are high school students and their teachers in Maine and citizen scientists in national parks across the country. See related story on page 2,

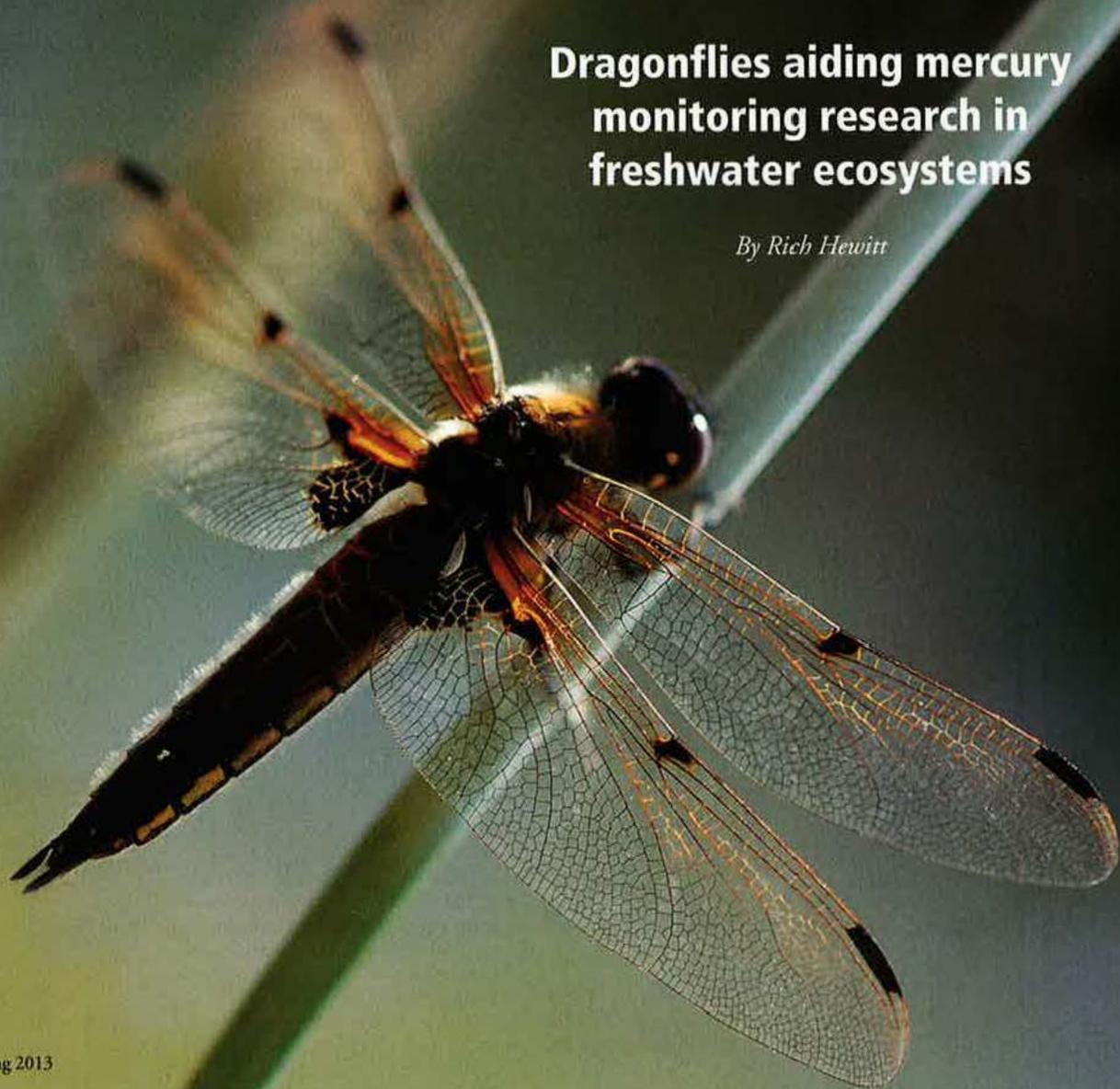
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Sentinel species

**Dragonflies aiding mercury
monitoring research in
freshwater ecosystems**

By Rich Hewitt



IN THE PASTORAL settings of freshwater ecosystems, dragonflies buzz and flit through the grasses and floating plants of ponds and lakes. But an up-close look at the larvae of these wetland predators brings images from *Alien* and other sci-fi horror films to mind.

Large, bulbous eyes. Six spindly legs on a somewhat short, slightly stubby body. Gills in their abdomens to breathe. A lower jaw-like feature that's more like an extendible weapon, shooting out in an instant to grab something edible as it passes by.

And they eat just about anything that moves — from mosquito larvae and tadpoles to small fish. Even other dragonfly larvae.

Indeed, dragonflies spend most of their lives as larvae — up to five years. The larvae hatch from eggs in the water, grasses or mud, grow up to 2 inches long and molt repeatedly before developing wings and taking flight.

That aquatic existence is what endears dragonflies to biogeochemist Sarah Nelson, who studies the insects as bio-sentinels of mercury in freshwater ecosystems.

Nelson, a scientist at the Senator George J. Mitchell Center and the School of Forest Resources at the University of Maine, has been researching mercury in the environment since she first walked onto the Orono campus as a graduate student. Building on a long history of mercury research at UMaine, she is now the primary investigator for several studies regarding mercury, including research involving dragonfly larvae.

At the same time, she has worked with other agencies and organizations to develop educational programs that put teachers, students and citizen scientists into the field as frontline researchers.

Armed only with hip waders and dip nets, students from schools throughout New England regularly go searching for dragonfly larvae under Nelson's guidance. They are not only discovering science, she says, but also are participating in meaningful research that has bolstered the work being done by professional scientists. Dragonfly larvae are easy to identify and it doesn't take the students long, as one of their teachers put it, to "get their dragonfly eyes on."

"They know what they're looking for,"

Nelson says. "It's hard to get them out of the stream. They go out and bring back what they find on the stream bottom, and they're just amazed at the critters they see. That's a great place-based learning outcome in its own right."

IT WAS DURING a student program, in fact, that Nelson first had an inkling that dragonfly larvae might be a good indicator species for high mercury levels. She had worked with Bill Zoellick at the Schoodic Education and Research Center (SERC) Institute at Acadia National Park, Maine Sea Grant and Dartmouth College to develop a program now called Acadia Learning. It put students through what Nelson characterizes as a "mini-masters" research project in which they develop hypotheses, collect data, interpret results, and present their findings. They were working to identify mercury concentrations in invertebrates when students at one school noticed that mercury levels in their specimens were always higher than in those collected by students at another school.

Nelson says she also noticed that students at all of the schools in the

Sentinel species



Dragonflies spend up to five years as larvae living in water, which makes them ideal for monitoring mercury contamination. Larvae species, left to right: *Aeshnidae*, *Corduliidae*, *Gomphidae* and *Libellulidae*.

program consistently turned up dragonfly larvae in their nets. Not only did they find variability in mercury levels at different sites, but also a common insect.

That, she says, was a “eureka moment” — when they first thought that there could be a correlation between the mercury levels in dragonfly larvae and in the environments in which they live.

“Since then, I have been working with a diverse group of collaborators all over the U.S. to determine how we can use dragonfly larvae as bio-sentinels for mercury,” she says.

The work is significant due to concerns nationwide about environmental mercury contamination. Mercury is a natural element. However, it’s also toxic and can be harmful to animals and humans, especially in the form of methylmercury.

Methylmercury is the more toxic form that develops as mercury is ingested and excreted by bacteria in the environment. Through that process, mercury becomes linked with a carbon group, which allows it to pass through cell walls and get into the food web, where it can be ingested by animals and humans.

Mercury is a global pollutant. Current loads of mercury to the landscape are about three times preindustrial levels. Partly as the result of burning fossil fuels, elevated concentrations of mercury have been deposited throughout the country, especially in the Northeast.

“Science is not something that only happens in a specialized research facility. It happens in your backyard.” Sarah Nelson

According to Nelson, it is difficult to predict which ecosystems or watersheds might be most affected by mercury or methylmercury. Several New England states, including Maine, have issued statewide advisories for fish consumption from all of their lakes and streams.

FOR SOME TIME, researchers have studied how mercury accumulates in the environment. They also have been looking for indicators that would show which environments were likely to develop high

concentrations of mercury in food webs.

It’s possible to test water samples, but the sampling process must meet stringent handling requirements. And those samples are very expensive to analyze, and might not represent the amount of mercury that becomes entrained in the food web. It’s also not feasible to test samples from all of the lakes in each state.

Collecting and analyzing fish has its own set of problems, including their mobility from one environment to another.

As a result, researchers have spent a lot of time and effort trying to find less expensive, less labor-intensive and more representative methods to determine how much mercury is in a specific place.

“It would be nice to have a predictive tool for how much mercury is in certain areas,” Nelson says.

Such a tool would provide a way for researchers to target specific areas for further study.

And that’s where the dragonfly larvae come in.

The basic characteristics of the dragonfly larvae seem to make them the perfect sentinel species for mercury levels in



Photo by Jennifer McKay

Dishing on dragonflies

ONE OF THE foremost experts on dragonflies in Maine is entomologist Alysa Remsburg, an associate professor of ecology at Unity College. Remsburg and University of Maine biogeochemist Sarah Nelson are collaborating on upcoming research related to dragonflies and mercury detection. We asked Remsburg to share her favorite facts about the insects.

diverse environments. They are ubiquitous, living in lakes, streams and wetlands, and are found in all 50 states. They are easy to identify and to collect, and because they spend as much as five years developing in the same aquatic system, they experience the water and sediment chemistry of that system.

As both predators and prey, they provide a key link in the food chain as mercury accumulates and magnifies. They also are easier and less expensive to test for mercury than other types of samples.

It has been these characteristics of the developing dragonflies that have allowed Nelson to expand the citizen science portion of her research. The Acadia Learning project — now in its fifth year — includes 17 teachers in 13 schools across Maine, New Hampshire and Vermont. The program brings scientists, teachers and students together in partnerships that result in useful research and effective science education through a model of inquiry-based education, and also includes a summer institute to help teachers incorporate that model in their classrooms.

“We fully support the teachers so they can do this,” Nelson says. “It can be

perceived as a risky way to teach for some. Teachers don’t know the answers at a certain point; they don’t always know how it’s going to turn out.”

NELSON NOW has partnered with the National Park Service for a pilot program that allows citizen scientists to work with staff at national parks. That grew out of a mercury meeting in Acadia National Park in 2011 where park service officials expressed an interest in expanding Nelson’s research to other parks.

With support from UMaine Faculty Research Funds and High-End Instrumentation Research grants that cover the costs of lab analysis and shipping, they launched a pilot program last spring to gather dragonfly larvae samples from national parks across the country.

“It’s a shoestring budget, but we had a great first year with samples from places like Denali, the Great Smoky Mountains, Channel Islands, Cape Cod, the Rocky Mountains and Acadia,” she says. “We’re currently seeking additional funding to continue with a fully developed program.”

While programs such as Acadia Learning and the National Parks project are

- Maine is home to 158 dragonfly and damselfly species. More than 5,600 dragonfly and damselfly species occur worldwide.
- Biologists classify dragonflies and damselflies in the order *Odonata*, akin to the order *Lepidoptera* that includes butterflies and moths.
- The name *Odonata* refers to the toothed jaws that all dragonflies and damselflies share. Even dragonfly larvae project their jaw forward rapidly to capture prey.
- Dragonflies in Maine spend the first one to five years of their lives as larvae in freshwater and only a few weeks as flying adults.
- The larvae molt nine to 15 times in the water, while trying to avoid getting eaten by other dragonflies or fish.
- Young adult dragonflies walk onto land and unfurl new wings, leaving behind their old exoskeletons.
- Some adult dragonflies do all of their hunting, eating, territory guarding, mating and egg laying while in flight.
- Some dragonflies such as Skimmers guard territories and eat their prey while perching on plants or the ground.
- All *Odonates* are carnivores, consuming smaller insects in the air and water.
- Dragonflies first evolved around 300 million years ago (before dinosaurs) and were among the first insects to fly.

Sentinel species

providing important research data for scientists, Nelson says they also are helping to promote an interest in science beyond the research facility.

“Science is not something that only happens in a specialized research facility,” she says. “It happens in your backyard.”

These types of programs also help to address issues of data literacy, giving students and adults a better understanding of how data are collected and used — and how to talk about them. That is a key skill in the information age, she says.

“It’s important that people think about science and how to use data. There’s a lot of information and data thrown at us every day, and it’s hard to make informed choices if you don’t know how to interpret the data that are being presented.”

Meanwhile, Nelson’s research has reached a critical point. An intensive research effort at long-term U.S. EPA lake study sites in New England and New York during summer 2012 may provide the final pieces of data Nelson needs to show that the developing dragonflies are linked to the ponds, lakes and streams in which they live, and reflect the levels of mercury accumulating in those bodies of water. That study links mercury in water and dragonflies to lake chemistry and the landscapes surrounding the 74 sampled lakes and ponds.

“We’re nearly there,” she says.

Those samples were analyzed late in 2012. The results will be combined with findings of previous research, including work done by students in Maine schools and citizen scientists at national parks nationwide, and may be available as early as this year. ■



Old Town High School students Christine Pollard, left, and Jaime Lemery tending their newly hatched dragonfly larvae.

Hatching dragonfly eggs

OLD TOWN HIGH SCHOOL senior Andrew Brothers says the dragonfly larvae and zooplankton in teacher Ed Lindsey’s science lab are even more fun than the ant farm he had as a kid.

But the project Brothers is working on is far from child’s play.

Brothers, along with senior Samantha Emerson, and sophomores Christine Pollard and Jaime Lemery, are collaborating with University of Maine researcher Sarah Nelson, who is using dragonfly larvae as bio-sentinels for mercury in wetlands, stream watersheds and lakes across the Northeast.

In their classroom laboratory, the students have set up mesocosms — mini-ecosystems in the form of tanks of circulated stream water from Baker Brook in Sunhaze Meadows National Wildlife Refuge in Milford, Maine — where 300 dragonfly eggs have hatched. The eggs were gathered from adult insects the students captured.

Now that the dragonfly larvae are eating, growing and molting, the students are collecting data to find out how — and at what rate — mercury accumulates as the dragonfly grow.

They’re periodically measuring mercury in the water, zooplankton, larvae and exoskeletons the young dragonflies shed. UMaine’s Sawyer Environmental Chemistry Research Lab will analyze the samples with a direct mercury analyzer. The goal is to shed light on the patterns of mercury accumulation as dragonflies grow from egg to adult, informing research on the use of dragonflies as local indicators of how mercury moves up food chains.

This is an independent study project for the high school students, who are pioneers of sorts for building the mini-ecosystems and raising dragonflies. Nelson says one of the only reference materials they could locate about the topic was a book written in the 1920s.

The dragonfly larvae are fed zooplankton that the students are growing in tanks of Baker Brook water. The zooplankton are raised on neon green phytoplankton, grown in an apparatus Brothers built.

“They’re cool little creatures,” Brothers says of the zooplankton, which are barely visible to the naked eye. “They corral around like dogs to a food bowl when they’re being fed.”

The dragonfly larvae are also interesting. Lemery calls them “tenacious and mobile little soldiers” that sometimes escape from their containers. Each larva is housed in a separate container in the water tanks. Nelson says they would devour each other if they were kept together.

The science students are mentored by Lindsey, one of 18 educators nationwide to receive the 2012 Presidential Innovation Award, due in part to his leadership in this project.



Up-tempo

IN 1912, Meyer Davis was a 19-year-old violinist making a name for himself with a popular style of dance music that he and his orchestra brought to the stage. The Meyer Davis Orchestra went on to perform for eight presidents at the White House — from Woodrow Wilson to Gerald Ford — and for kings, dukes and queens throughout the world. His band played at the inaugural balls of Coolidge, Hoover, Roosevelt, Truman, Eisenhower and Kennedy, as well as society soirees at the best hotels, resorts and clubs from Bar Harbor to Palm Beach. High society weddings, debutante parties and galas were not in vogue without a Meyer Davis Orchestra performance. At the height of his career, there were more than 1,000 musicians in Davis' orchestras, including such artists as Benny Goodman, and Jimmy and Tommy Dorsey. In 1925, 13 years into his career, the *New York Telegraph* described Davis as being “in a class by himself,” both as an artist and a band agent with more capital and real estate than any other orchestra leader in this country. He conducted his last orchestral performance at the Philadelphia Assembly Ball in 1975. The Meyer Davis Collection in the University of Maine’s Fogler Library sheds a bright light not only on a musical era but on American history. ■

A photo of Meyer Davis, seated center, surrounded by band members, circa 1920s. Special Collections in Fogler Library holds the Meyer Davis Collection containing materials dating from the 1880s to 1977, including day books of news clippings and publicity, photo albums, artifacts, programs and letters reflecting the career of an inspirational and influential society orchestra leader.

United

By Beth Staples

LAURA ZEGEL counsels girls and women. She knows well the pain that can accompany adolescence and the pitfalls that can plague mother-daughter relationships. So when Zegel, a licensed clinical social worker in Rockland, Maine, and mother of a 3-year-old daughter, saw a flier promoting the Maine Mother-Daughter Project, she was thrilled.

The Maine Mother-Daughter Project strives to bring together mothers and daughters to form a community that supports them and their relationships.

"I want to do what I can to have the best relationship I can with my daughter and do the best that I can by her," Zegel says. "I'm grateful for this framework to get together. Parenting is hard."

It's a lot easier, she says, with the support of trusted friends and mothers.

Kimberly Huisman, a University of Maine associate professor of sociology, introduced the Maine Mother-Daughter Project last summer after reading about the program SuEllen Hamkins, Renee Schultz and several other mothers launched in western Massachusetts in 1997. Introduction of the Maine project was made possible by a grant from the Maine Humanities Council.

Huisman, who also is the mother of a 7-year-old daughter, is a proponent of public sociology — bringing academic

resources into communities to promote dialogue, enrich understanding of social issues and expose people to more critical, sociological understandings of the world.

The Maine Mother-Daughter Project does just that, says Huisman, providing opportunities for people to connect their individual lives and experiences with larger historical and cultural forces.

"I'm thrilled to live in a community where this type of project is accepted with such open arms. Most exciting to me is that other women will help nurture our girls." Elizabeth Joy

The mothers in Massachusetts developed the project using feminist research, community building and postmodern psychotherapies.

They wanted moms to know that they were not expected to be perfect and that it was OK to put their needs first. They didn't believe that teen girls were inherently rebellious or that growing up had to mean growing apart.

Participants supported each other as women and mothers, and they buoyed and celebrated their daughters as they ap-

proached milestones and navigated their teen years.

"I think there's a growing appreciation that what makes healthy humans is the ability to connect with other people," says Hamkins, a psychiatrist who focuses on women's mental health.

The Massachusetts moms were proactive. Through activities and role-playing, they prepared their daughters for a myriad of life events — from their first menstrual cycle to their first date.

Participants flourished, Hamkins says, and in 2007, she and Schultz, a family and marriage therapist, wrote *The Mother-Daughter Project: How Mothers and Daughters Can Band Together, Beat the Odds, and Thrive Through Adolescence* to share their successes and strategies.

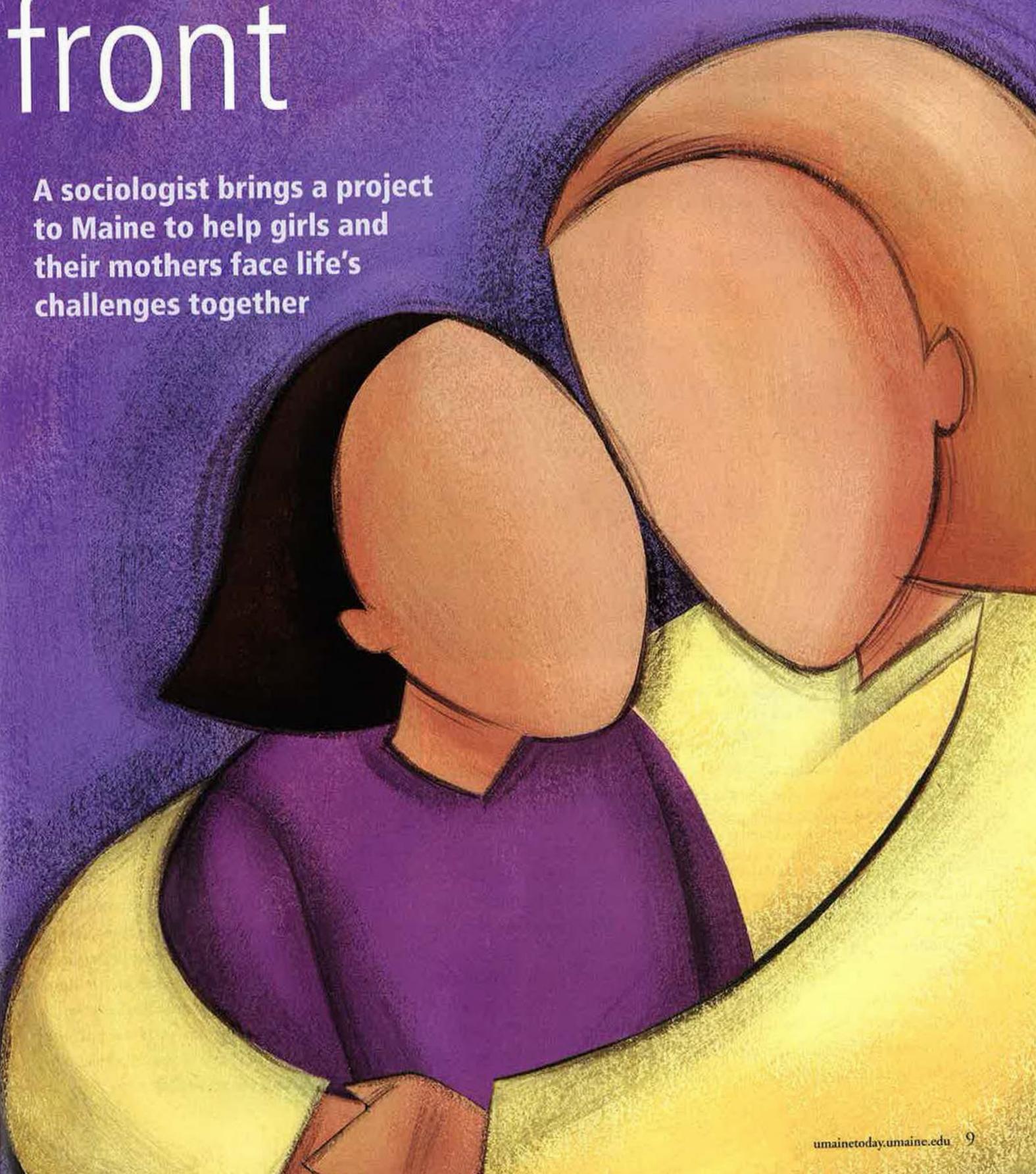
HUISMAN, ZEGEL and 37 other moms and their daughters are employing similar strategies and some of their own in mother-daughter groups that meet regularly in the midcoast Maine area. The general plan is for small groups of mothers with daughters of the same age to gather, bond, talk about child-rearing and build a foundation of trust.

For Huisman, it's crucial the groups are judgment-free. "It's important to me that it feels safe to talk about challenges (of motherhood)," she says.

In addition to the mothers-only meetings, the Maine mothers and daughters participate in an outing, activity or

front

A sociologist brings a project to Maine to help girls and their mothers face life's challenges together



discussion once a month. They might kayak, go to the movies, do community service, role-play or talk about age-appropriate topics.

Hamkins says her mother-daughter group had an annual theme. When their daughters were 8, it was friendship; when they were 9, it was puberty; and when they were 13, romantic relationships.

Her oldest daughter, now 23, is a bio-engineer. Hamkins says they have a very good relationship and enjoy each other. "I'm grateful," she says.

Huisman's Maine Mother-Daughter Project has featured an October event highlighted by panel discussions and a keynote speech by Lyn Mikel Brown, a professor at Colby College, co-author of *Packaging Girlhood: Rescuing Our Daughters from Marketers' Schemes*, and co-founder of Hardy Girls Healthy Women.

As of January, Huisman also had shown three films at UMaine's Hutchinson Center in Belfast, Maine: *Cover Girl Culture: Awakening the Media Generation*, *A Girl's Life* and *The Story of Mothers and Daughters*.

As a result of the project, Huisman has reflected on her relationship with her mother. "I feel like I have a deeper understanding of the challenges she faced," she says.

It's also important, Hamkins says, to understand the current culture in which girls and women live: the Equal Rights Amendment has not been ratified, women make 77 cents for every dollar a man makes and a recent Centers for Disease Control and Prevention survey indicated one in four women reported being attacked by their boyfriends or husbands.

"We provide a real alternative to values on Netflix. It doesn't mean it's easy and it doesn't mean the girls won't ever be sexually harassed or won't develop an eating disorder, but if it does happen, they'll be able to deal with it in a loving context." SuEllen Hamkins

Because of social media and the Internet, Hamkins says opportunities and challenges are greater for girls now than they were 15 years ago.

WHILE THERE are positive achievement-oriented female role models, including Supreme Court justices, college professors, secretaries of state and professional athletes, there are also fairy tales, cartoons, movies, television shows and advertisements that bombard girls with the message that being thin and pretty are what matters.

"It (mass culture) may serve business," Hamkins says, "but it does not serve mothers and daughters."

When girls understand that those messages are intended to sell products, Hamkins says they're more likely to be immune to them.

Girls tend to look outside their immediate families to learn about the world, Hamkins says, and "we (mother-daughter groups) provide a real alternative to values on Netflix. It doesn't mean it's easy and it doesn't mean the girls won't ever be sexually harassed or won't develop an eating disorder, but if it does happen they'll be able to deal with it in a loving context."

Aiding Huisman in coordinating the Maine Mother-Daughter Project are undergraduates Tess Walter and Elizabeth Joy, who work as research assistants.

Walter is a fourth-year psychology major with a biological-cognitive concentration who joined the project this semester. After one of the films, the Niagara Falls, N.Y., native and her mother served on a panel addressing cyberbullying.

Joy is a senior double majoring in sociology and psychology, with a concentration in developmental psychology. The Waldo resident has assisted Huisman with every aspect of the project since its inception, including research and website development. She's also the mother of a 3-year-old daughter.

"I'm thrilled to live in a community where this type of project is accepted with such open arms," Joy says. "Most exciting to me is that other women will help nurture our girls."

The project seems to be making an impact in the Belfast community. In addition to seven new mother-daughter groups and large audiences at the films, there's a waiting list at the Belfast Free Library for the 10 copies of the book by Hamkins and Schultz that Huisman purchased for the project. ■



Tough love

ARTIST CAROLINE ROBE describes the past year in two words: tough love. Tough, because she began a self-study of one of the most archaic, difficult painting mediums — egg tempera. Love, because the arduous journey resulted in unequivocal success in an art form that she says suits her personality and her voice.

“I’m inclined to be less urban, off the beaten path,” says Robe, a University of Maine student from Waterville, Maine, who completed her studio art degree last December. “Egg tempera is an old painting style that’s not common and not designed for ease.”

In her self-study of the technically difficult egg tempera painting process, Robe consulted her thesis adviser Ed Nadeau and took an independent study with James Linehan, both UMaine artists and professors. She read countless books on the medium and studied the works of the 20th-century master of egg tempera — Andrew Wyeth.

“Egg tempera is a technical process that results in unparalleled beauty. It has a romance to it,” says Robe. “In the 13th to 15th centuries, it was meant to be a literary art. And that’s what I wanted to do through my artwork — tell stories.” ■

In fall 2011, Robe discovered her passion for what is considered one of the oldest painting mediums when she studied abroad at the Aegean Center for the Fine Arts in Greece. For a month, she also traveled through Italy, studying pre-Renaissance and Renaissance art, with particular interest in the egg tempera works. When she returned to UMaine, she established a studio in her Orono apartment and started her honors thesis — an exploration on modern-day egg tempera painting.

Zooarchaeologist studies prehistoric subsistence shifts due to climate change

Island life

By Beth Staples

CATHERINE WEST was a junior history major at Bryn Mawr when she jumped at the chance to be a field school student during a 1998 dig at a prehistoric Aleut site on Unalaska Island. As part of that summer adventure, she met welcoming locals, hiked lush green mountains, saw whales breach in the Bering Sea, attended a Russian Orthodox Church and explored remnants of World War II bunkers.

And that rainy summer, when the fishing village was bathed in light 20 hours a day, she learned about excavation techniques, and cleaned and sorted bone and stone artifacts. And she became hooked on archeology.

“I was starstruck,” says West, now an assistant professor of anthropology and climate change at the University of Maine.

West has participated in a number of digs since that memorable trip 15 years ago. She’s seen breathtaking sights, including frolicking Kodiak bear cubs and rivers turned pink during salmon runs.

The digs are the basis for her research examining the effects of Holocene (the 11,700 years since the last ice age) climate change and subsequent resource availability on prehistoric subsistence in Arctic and subarctic ecosystems.

She applies the resulting data to enlighten modern environmental and conservation issues.

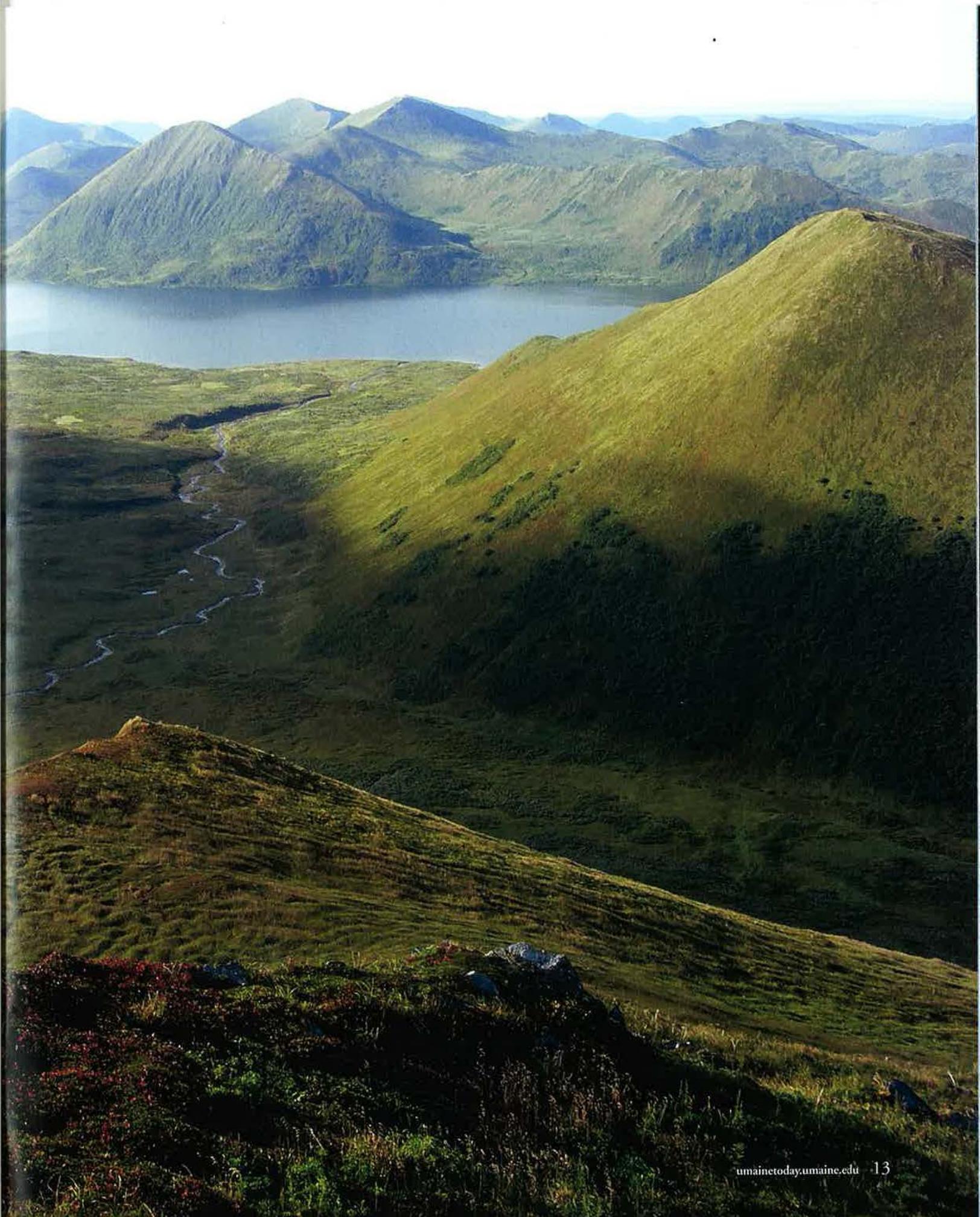
Late this spring and summer, she’ll participate in digs on two islands in the Kodiak Archipelago. For six weeks starting in mid-May, West will be part of a six-person team exploring remnants of 500- to 1,000-year-old structures near Kodiak Island’s Old Harbor, where Alutiiq people settled more than 7,000 years ago.

The island’s first Russian settlement is nearby, as is Port Hobron, which was a whaling station as late as the 1920s. Kodiak Island is the largest island in the

Kodiak Island’s coastline features a productive marine environment that has provided rich biological resources for the island’s human occupants for more than 7,000 years.

Photos courtesy of Patrick Saltonstall





Island life



In her research on prehistoric climate and hunting strategies, Catherine West works with the local community through the Alutiiq Museum and Archaeological Repository in Kodiak, Alaska, which serves to preserve and share the cultural traditions of the Alutiiq people.

Kodiak Archipelago, separated from the southern coast of Alaska by Shelikof Strait.

In these regions, where “the connection between humans and the environment is so immediate,” West examines how abrupt changes in climate affected Arctic hunter-gatherers 600 years ago, during a period of extreme cold known as the Little Ice Age.

Inhabitants, says West, seemed relatively resilient to change, perhaps because they were already so well-adapted to this harsh environment.

During the Little Ice Age in the Gulf of Alaska, West says winters were likely

colder and lasted longer, and glaciers advanced. Storms were more severe. Some animals likely left the region.

The weather affected people’s ability to fish — as well as the fish available — and perhaps impacted how far underground Native people built their shelters.

FOR THOUSANDS of years, Arctic hunter-gatherers threw bones of the fish, sea mammals and seabirds they ate into trash dumps. That trash is treasure for West, a zooarchaeologist; she studies animal remains recovered from archeological sites. The remains include otoliths —

the ear bones of fish — as well as shellfish and other bones. By analyzing their chemical composition, West reconstructs ancient trophic positions — where organisms were in a food chain — as well as ocean water temperatures.

The artifacts also provide information about how people altered their hunting and fishing strategies in response to environmental changes. Chemical analysis of the remains, says West, draws a direct link among prehistoric animal populations, the environment and ancient human behavior.

Developing long-term data sets creates

a “historical ecology perspective,” and improves scientists’ understanding and context of climate change and its influence on humans and ecosystems, she says.

Climate change is a common topic of conversation among commercial fishermen in the area known for salmon, halibut and king crab, West says.

The Alutiiq Museum and Archaeological Repository in Kodiak, which preserves the 7,500-year heritage of the indigenous Alutiiq people, and the Old Harbor Native Corporation are financially supporting the dig.

AFTER THAT six-week project, West will take part in a four-person, 10-day dig on Chirikof Island, about 80 miles southeast

of Kodiak Island, funded by a grant from the National Geographic Society.

Assisting in the project will be two UMaine senior anthropology majors — Kendra Bird, from Bangor, Maine, who has been analyzing preliminary bird samples from Chirikof Island and whose lab work helped determine the excavation plan, and Samantha Dunning, from Bridgton, Maine, who will participate in the excavation.

The digs are back-to-back, says West, to fit “in the window of nice, warmish weather.” While temperatures climb into the 60s during the day, West says it’s not uncommon for water to freeze overnight in her water bottle.

The results of this dig, which includes

sites 4,000 years old, could solve a 250-year-old problem.

The predicament began in the late 1700s, West says, when Russians introduced Arctic fox to the treeless island. The practice continued into the late 1800s, when Americans purchased the grassy 33,000-acre plot, then introduced cattle. Feral livestock still roam on Chirikof Island.

The fox and cattle decimated the island’s native bird populations, West says.

The United States Fish and Wildlife Service, which oversees the island, now wants to restore the native bird populations there. It’s up to West to ascertain, through the dig, which bird species inhabited the island — and when. ■

Pacific cod as paleothermometers

OTOLITHS OF PREHISTORIC Pacific cod function as paleothermometers, revealing how the species endured fluctuating ocean temperatures 500 years ago, according to a research team led by University of Maine zooarchaeologist Catherine West.

Fish have three pair of otoliths or ear stones — calcium carbonate structures found in the inner ear that are used for acoustic perception and balance. In Pacific cod, the largest and most useful for oxygen isotope analysis is the sagittae, which grows in daily, seasonal and yearly bands, much like tree rings. These growth rings can be counted to estimate the age of the fish and sampled to understand such factors as changes in the environment.

The sagittae’s size also increases the odds of it being preserved in the archaeological record.

West has used oxygen isotopes in Pacific cod otoliths to reconstruct Little Ice Age ocean conditions and to assess the relationship among climate, fish biogeography and human foraging activity in the Gulf of Alaska.

Because oxygen isotope ratios in otolith growth bands are determined primarily by water temperature, West studies the growth rings as paleothermometers to understand conditions during the Little Ice Age.

Pacific cod are found throughout the North Pacific Ocean, from China’s Yellow Sea to Monterey Bay, Calif. The broad temporal and geographic distribution of Pacific cod makes their otoliths ideal for paleoenvironmental reconstruction.

For her most recent study of otoliths as paleothermometers, West and researchers from the Seattle-based International Pacific Halibut Commission and the National Marine Fisheries Service analyzed ear stones found at an archaeological site on Kodiak Island, Alaska. The site was occupied during the Little Ice Age that began in the Gulf of Alaska approximately 600 years ago. The 15 whole otoliths selected from the deposits representing a 500-year period clearly indicated that Pacific cod living around the Kodiak Archipelago experienced fluctuations in ocean temperature during the Little Ice Age.

The archaeological otoliths offer a long-term record of Pacific cod’s environmental interaction, contributing to understanding of the species’ survival in the face of changing climate in the North Pacific, according to the researchers, writing in the *Journal of Archaeological Science*.





It's a

Student ingenuity takes flight to benefit migratory bird research

By Beth Staples

LOOK! UP IN the sky! It's a bird. It's a plane.

High above the University of Maine campus, it's Gannet — a remote-controlled airplane that both resembles a bird and is named after one. Gannet is white with black wing tips and a yellow head. It weighs 8 pounds, has an 83-inch wingspan, and can fly 55 mph.

Gannet gets its moniker from the similarly colored North Atlantic seabird that weighs about 6 pounds, has a 70-inch wingspan and hits 62 mph while diving for fish. The plane is equipped with a push propeller so the maneuverable camera

mounted on its nose has an unobstructed bird's-eye view (with a fisheye lens) of land, sea and sky.

Brian Barainca, a UMaine junior from Milford, Maine, majoring in mechanical engineering, conceived, designed and built Gannet and its test companion, Blue. He is president of the Black Bears, UMaine's remote-controlled aircraft club that formed in 2011.

Barainca constructed the waterproof Gannet, which takes off and lands on land and water, for Rebecca Holberton, a UMaine professor of biological sciences and a migratory bird expert.

Holberton researches how external and internal factors affect

Mechanical engineering major Brian Barainca conceived, designed and built Gannet to aid the research of professor Rebecca Holberton, one of the nation's top bird biologists.

bird! It's a plane!



It's a bird! It's a plane!

avian survival. Her goal is to apply knowledge gleaned from birds to better the environment and the lives of humans and wildlife.

Holberton envisions Gannet snapping photos and streaming video of thousands of songbirds in flight off Metinic Island and along the Gulf of Maine coast during spring and fall migrations — for research and aesthetic purposes.

“I’d like to be flying up there with them,” she says.

Gannet is the next best thing.

HOLBERTON COMES naturally by her interest in flight. Her father was an aerospace engineer who worked on guidance systems of moon-orbiting satellites and military aircraft for the U.S. Department of Defense.

For some time, when Holberton thought of unmanned drones monitoring bird activity, she says she saw prohibitive dollar signs.

Then last summer, she had a chance meeting with Barainca. He was operating a remote-controlled plane and helicopter from the parking lot outside Murray Hall on campus, where Holberton’s office is located. That’s when she inquired whether he could install a camera on the crafts.

“Everything I asked him, he said, ‘I can do that,’” she laughs.

And he has.

Thus far, the entire project, which Holberton is funding, has cost south of \$5,000. That includes the plane, transmitter and receiver, as well as the waterproof and shockproof GoPro camera.

The camera sends real-time video to a computer on the ground; Barainca, in effect, is in the cockpit when he watches the video while flying the plane.

Defly maneuvering the toggles, Barainca controls Gannet’s loops, climbs and drops. Gannet’s altitude, speed, direction and coordinates are also displayed on the screen.

Gannet can be programmed to “return home” in case the signal is lost between the transmitter and receiver. The transmitter, Barainca says, is rated to 15 miles.

To date, the skies have been very friendly to Gannet.

Last April, on its first flight in rain and wind above Lengyel

Field on campus, Holberton says Gannet performed beautifully.

Eight months later on a cold, blustery early December day, Ani Varjabedian, a junior zoology major from Middleborough, Mass., placed objects the size of small shorebirds in the fields of UMaine’s J.F. Witter Teaching and Research Center. GoPro easily spotted the objects as Gannet soared 150 to 500 feet in the air.

Birds of prey have flown alongside Gannet. Holberton says a marsh hawk left a wetland to check out the plane and a kettle of migrating broad-winged hawks flew with Gannet this fall before heading farther south on their own.

“They weren’t deterred, they were intrigued,” she says.

Gannet doesn’t make a lot of noise. When you’re standing next to it, Gannet is no louder than a blender; it is very quiet at a distance, which is where wildlife encounter it.

Disturbance tests are planned to determine how close Gannet can fly to birds before they stop feeding or they fly off. Acoustic recordings of Gannet will also be done under various ocean conditions.

“We need to find out what altitude we will fly at so as to not scare the birds and what altitude we need to be at to see the birds,” Barainca says.

BARAINCA AND Varjabedian are conducting test flights to figure out the limits of the aircraft and equipment. And they’re always looking at newer and better technology to incorporate.

One of those pieces of technology will be an infrared camera to capture images of birds at night. Holberton says it will be interesting to see birds roosting after the sun sets and witness challenges they face after dark.

Gannet could also help fill in the gaps in researchers’ understanding of what happens to migrating birds between points A and B, and to identify habitats that are important stopovers.

“Is it a direct flight? Is their path in response to the weather or to another disturbance?” asks Holberton. “We have very little documentation of free-flying songbirds.

Gannet could help fill in the gaps in researchers’ understanding of what happens to migrating songbirds between points A and B, and identify habitats, such as roost sites, that are important stopovers.

“We could relay it (Gannet) all the way up the coast if we wanted to.”

Currently, Gannet must land about every 30 minutes — the maximum life of the batteries keeping it aloft. While the crew has batteries to keep Gannet soaring for about an hour, Barainca says the aircraft needs to be modified to utilize them and testing would need to be done.

Gannet, Holberton says, could prove valuable with additional avian research, including whether land and offshore wind farms impact migration. In 2009, while banding songbirds on Metinic, Holberton and UMaine graduate assistant Adrienne Leppold discovered the Gulf of Maine is a superhighway for songbirds migrating between Canada and South America.

Holberton has also studied the tiny blackpoll warbler, a songbird that migrates nonstop up to 4,000 kilometers over 90 hours. To have energy to accomplish the flying feat, Holberton says the warbler can double its body weight in 72 hours before takeoff.

She says the goal of studying behavior and physiology of blackpoll warblers and other migrants is to understand how animals interact with the environment, and how human-caused and naturally occurring factors affecting environmental conditions, including climate, weather, food quality and habitat availability, could impact wildlife populations.

Holberton is eager to get started with Gannet and laughs when explaining that the protective Barainca hasn't yet yielded the controls to her own plane.

Others have also expressed interest in taking hold of Gannet's controls. Holberton says she's received inquiries from other researchers, as well as military officials, who have caught wind of the project.

It seems the sky's the limit for Gannet.

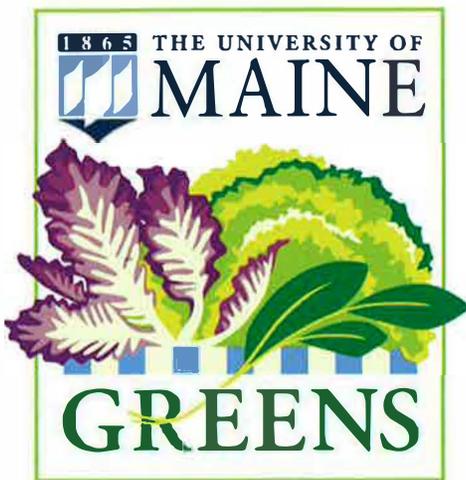
Holberton says Gannet could be used to conduct research on vegetation cover, for instance, and for locating and watching pods of whales in real time.

“It's worth the investment to at least try to effectively and efficiently get information,” Holberton says. “We're not trying to map the Gulf of Maine, we're looking to get information we need — beyond being fun.

“I think the take-home message is to take a chance and be open to opportunities,” she says. “You don't have to have a million dollars to answer million-dollar questions.” ■



Top photo: Brian Barainca also built Blue, Gannet's companion, to test equipment. A waterproof and shockproof GoPro camera perched atop Gannet's nose provides a bird's-eye view of land, sea, sky and birds. The operator controls Gannet's takeoffs, altitude, speed, loops and landings with a hand-held transmitter.



The new greenhouse and campus composting facility are in keeping with UMaine's leadership and commitment to sustainability, which have earned the university a citation in Princeton Review's *Guide to Green Colleges* for four consecutive years.



Rose Presby, a biology major from Farmington, Maine, is one of the 25 students involved in UMaine Greens.

Plate to plant

UMaine's student-run greenhouse and campus compost facility bring sustainability full circle

SNOWFLAKES HUNG in the air outside the greenhouse where University of Maine students snipped lacey red, blue and verdant salad greens. The next day, the 20 pounds of the Elegance Greens Mix — Pac choi, red mustard, mizuna and leaf broccoli — was on the salad bar in the Memorial Union.

The harvest was the first this winter for the UMaine Greens Project, supervised by Eric Gallandt, associate professor of weed ecology and chair of the Department of Plant, Soil, and Environmental Sciences. UMaine's project, which involves growing greens for the UMaine dining commons, builds on the university's Sustainable Agriculture Program.

It also is in keeping with UMaine's national reputation as a green campus. In 2011 and 2012, UMaine was one of 16 colleges nationwide named to Princeton Review's Green Honor Roll.

"I wanted to do something where sustainable agriculture students and students interested in local foods, and food enthusiasts could have a hands-on experience," says Gallandt, noting that the inspiration to start a student greenhouse project came from visiting Michigan State University last year.

UMaine Greens is headquartered in

a 26-foot by 96-foot greenhouse, purchased from a farmer in New Hampshire. It is sited beside UMaine's new automated composting facility that has the potential to convert more than 1 ton of organic waste per day from campus dining facilities — from potato peels and lettuce leaves to meat scraps — into a rich soil

"This has been one of my favorite experiences at UMaine. Hoop houses are the future in Maine for sustainable farmers. Winter production is exciting." Daniel Blanton

amendment that will be used in the greenhouse and campus landscaping, and on university crop fields.

"This has been one of my favorite experiences at UMaine," says Daniel Blanton, a senior majoring in sustainable agriculture from Stow, Mass., one of the 25 students involved in the UMaine Greens Project. "Hoop houses are the future in Maine for sustainable farmers. Winter production is exciting."

THE IDEA OF growing and eating healthy, local food is logical and appealing to many in the UMaine community, Gallandt says. Frequent themes in agriculture classes include reducing the number of food miles — the distance food travels to reach the table — and the ability to control and extend the growing environment. This project addresses both topics in a hands-on, positive manner, he says. And there is room, literally, to grow.

Glenn Taylor, director of Culinary Services and a champion of the UMaine Greens Project, says 15 percent of all food served in campus dining halls is harvested at Maine farms — from meat to beets. That equates to UMaine spending \$700,000 annually with area businesses.

Taylor says in two years, the goal is to increase the proportion of locally grown food served at UMaine to 25 percent.

Purchasing vegetables from the UMaine Greens Project won't displace any other local grower, Taylor says, and will help the project become financially self-sustaining.

"We focus on local foods and this is about as local as you can possibly get," says Taylor, carrying a tote of just-clipped salad greens to his vehicle.

Gallandt says it's also fitting the greenhouse is adjacent to the university's new

composting facility. Compost from the vegetables that feed the students will subsequently nourish the greenhouse soil where the greens are grown.

THE 10-FOOT by 40-foot enclosed, automated composting facility — the first for advanced composting of food waste in Maine — is a collaboration between UMaine Dining Services and University of Maine Cooperative Extension.

UMaine Auxiliary Services, which oversees on-campus dining and other student services-related departments, has been composting organic waste at off-campus facilities for nearly 14 years in an effort to be as environmentally responsible and cost-effective as possible by keeping the weighty discards out of the waste stream.

During the academic year, nearly 1 ton of organic waste is generated daily

in UMaine's three dining commons and the Marketplace, the largest retail dining facility on campus.

UMaine Extension Professor Mark Hutchinson, who has 10 years of research in composting, developed the "recipe" for the UMaine composting facility. Ingredients will include the pre- and postconsumer waste from the dining commons and the Marketplace, as well as used horse bedding — primarily wood shavings and sawdust — from UMaine's J.F. Witter Teaching and Research Center.

The resulting compost will be used campuswide as a soil amendment that benefits soil structure.

Now, the greenhouse and compost facility are expected to be an educational resource, not just for UMaine students, but also school and community groups.

"This will allow us to close the loop, not only composting on campus, but pro-

ducing a product that is used on campus," says Dan Sturup, executive director of Auxiliary Services. "At UMaine, we'll go from plate to plant. And, with the help of the greenhouse, back to the plate again."

According to Misa Saros, UMaine's conservation and energy compliance specialist, the composting system is in keeping with UMaine's leadership and commitment to sustainability — from its sustainable agriculture major and sustainable food systems minor, to its campuswide green initiatives, all of which have earned the university a citation in Princeton Review's *Guide to Green Colleges* for four consecutive years.

"We are very excited to be implementing a system that makes productive use of a valuable resource that is too often discarded in landfills or incinerators," says Saros. ■



UMaine's new automated composting facility on campus has the potential to convert more than 1 ton of organic waste per day from campus dining facilities into a rich soil amendment for use in the student-run greenhouse and campus landscaping.

All business



Honors College students are encouraged to study abroad or take part in an alternate learning experience. Because Shelbe Lane was carrying a 21-credit course load as part of her plan to graduate from UMaine in three years, studying abroad wasn't feasible. That's when she pursued the opportunity to intern with the chief legal counsel in the Governor's Office.

IN MAY WHEN Shelbe Lane graduates with honors from the University of Maine, she'll be equipped with a bachelor's degree in business management, a minor in legal studies and experience as the intern to Michael Cianchette, Gov. Paul LePage's chief legal counsel.

All of which should serve her well this fall when she enters the University of Maine School of Law in Portland.

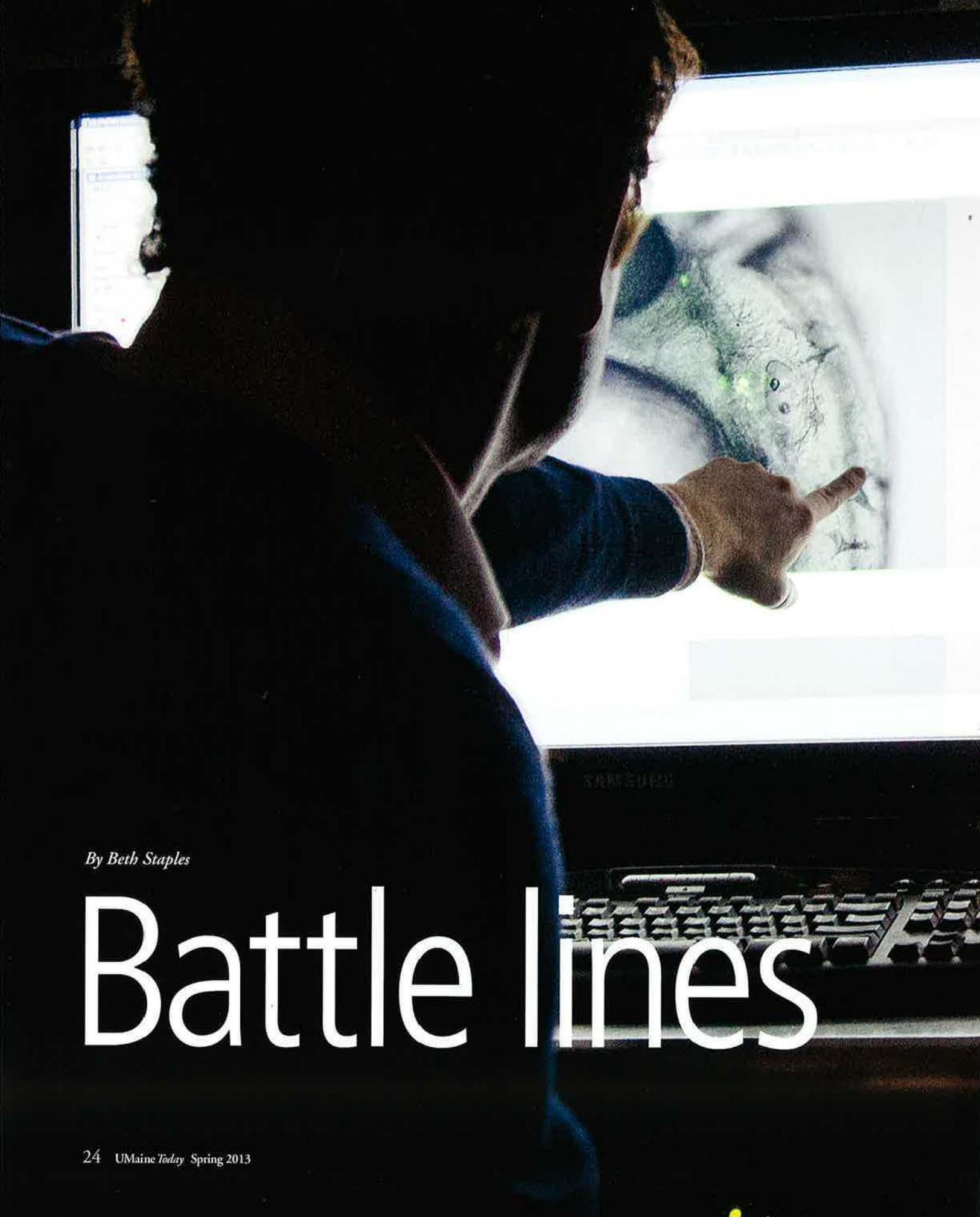
Lane's philosophy helps explain how she accomplished so much in her three years at UMaine: "If you see something you want to accomplish, you should go after it," she says.

The Patten, Maine, native credits UMaine's Honors College with providing her with unique cultural opportunities, interesting, varied courses, and encouragement to be analytical and to search for solutions.

She's also a proud alumna of Maine NEW Leadership, a university program that seeks to educate and engage college-age women and to empower them to be leaders. Lane says the program and its presenters inspired her. She says she wants to enact positive change in ways other than running for elected office.

Throughout her college career, Lane has also worked up to 10 hours a week at her father's logging business in Patten, where she has helped out since she was 13.

Lane is considering specializing in employment law or mediation. ■

A person is shown in profile from the back, pointing their right index finger at a computer monitor. The monitor displays a map with several green circular markers. The person is wearing a dark blue long-sleeved shirt. The background is dark, and the lighting is primarily from the monitor and a secondary screen to the left.

By Beth Staples

Battle lines



A UMaine biomedical lab looks for answers in the transformation of a peaceful yeast to fatal fungus

LIFE-AND-DEATH battles rage in Robert Wheeler's lab at the University of Maine.

The combatants — zebrafish and *Candida albicans* — fight to the bitter end in glass-bottom microplates.

Similar perilous battles are being fought inside humans. The *C. albicans* fungus is a leading cause of hospital-acquired infection that annually kills several thousand patients nationwide.

During the staged scuffles in Wheeler's lab in Hitchner Hall, anesthetized zebrafish are injected with *Candida* and placed in a gelatinous material called agarose.

A laser microscope captures and magnifies the struggles inside the zebrafish blood vessels in real time in high-definition color detail.

The microplate clashes provide the assistant professor of microbiology with the ability to view how immune cells fight the microbe, identify genes involved in virulence, test new drugs and learn how gene perturbations affect host-pathogen interaction.

"We're using zebrafish to ask really specific questions that cannot be answered another way," Wheeler says. "These questions have been inaccessible for a long time. We hope to be able to better utilize existing therapies and be able to develop better therapies."

In March 2012, Wheeler received a three-year, more than \$421,600 grant from the National Institutes of Health to ask and answer these questions in the project: "Genetics & Visualization of Innate Host Response to *Candida albicans* Infection In Vivo."

The goal is that the resulting answers will save human lives.

The grant is the most-recent funding Wheeler has received during his 13-year quest to unravel the mysteries of *Candida*.

MILLIONS OF *C. albicans* live peacefully in digestive tracts of people with healthy immune systems. Despite being the culprit of pesky vaginal infections in adults and oral infections in babies, for the most part, "the organism has evolved to coexist rather than constantly attack," Wheeler says. "It's part of our natural microflora."

Battle lines

But when a person's immune system is compromised — as occurs with organ transplant patients and people with cancer and human immunodeficiency virus — *Candida albicans* transforms from peaceful yeast to an invasive, potentially fatal fungus that infects vital organs.

Candida's Jekyll-to-Hyde conversion proves deadly for about one-third of people afflicted with bloodstream infections of the pathogen. It's clear, says Wheeler, that better diagnostics and therapies are needed.

Wheeler also uses mice to study immunity to *C. albicans*. The research is beneficial, he says, but limited because the live mammals aren't see-through and don't fit under a microscope.

But transparent tropical fish larvae

measuring a few millimeters fit the bill. And the ability to conduct experiments in vivo — “within the living” zebrafish — has been and continues to be elucidating.

Zebrafish also have backbones, share many of the same genes as people, and have the ability to respond to infections and vaccinations in ways similar to humans, Wheeler says.

For the life-and-death battles in microplates, Wheeler uses engineered zebrafish with green fluorescent immune system cells and fluorescent red *C. albicans* fungus. A laser scanning confocal microscope captures layered, 3D images of the skirmishes blow-by-blow, in real time.

On Wheeler's iPad, a battle that lasts for hours is condensed into a time-lapsed movie that can be viewed in minutes. The

movie of green zebrafish immune cells gobbling up red *C. albicans* resembles a Pac-Man arcade game.

The Pac-Man reference is one example of how Wheeler explains the fungal host-microbial pathogen interaction in ways that make sense to nonscientists.

He also compares sugar layers of the fungus cell wall using everyday objects and terminology, including M&M candies and GORE-TEX.

ZEBRAFISH AND fungi are familiar foes with apparent elaborate knowledge of each other's respective arsenals.

“For each mode of host immunity, the challenger has designed a defense, which, in turn, leads the host to devise a new avenue of attack,” according to Wheeler.

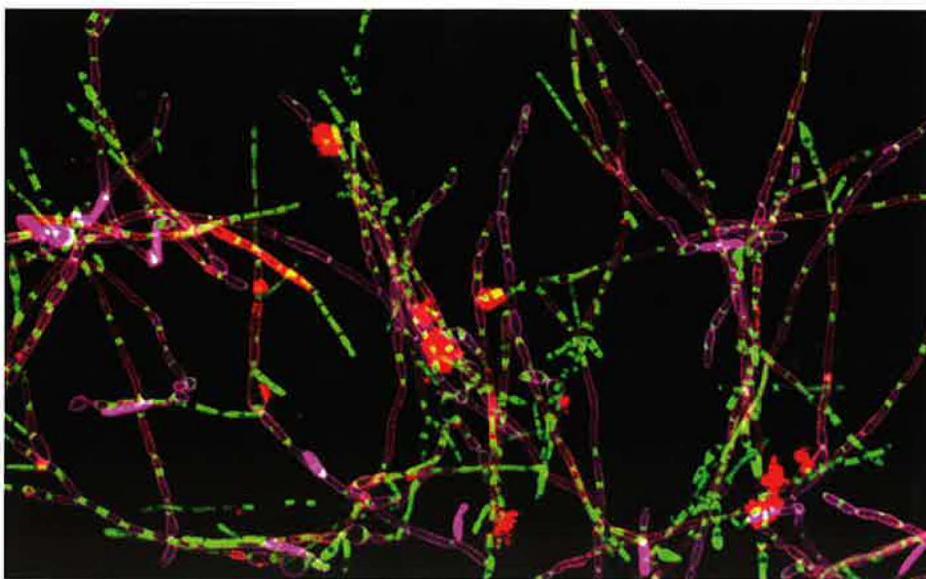
For instance, innate immune cells recognize surface molecules of the deadly fungus, including sugar β -glucan. When the immune cells recognize the *Candida* cell wall, the immune system goes on high alert and responds to eliminate the threat.

In some instances, the *Candida* fungus covers up the β -glucan with a thick protective cell layer, thereby blocking the immune system's response. Wheeler compares this dense sugar coating to GORE-TEX clothing. Just as GORE-TEX doesn't let water penetrate, this outer layer prevents immune molecules from touching the β -glucan.

The switch to drug-containing media causes *Candida* filaments (green fluorescence) to lose their GORE-TEX outer coat and expose the immune-stimulating sugar β -glucan (red reactivity). The surface-label (purple) marks old growth without drugs, where β -glucan is masked.

“These questions have been inaccessible for a long time. We hope to be able to better utilize existing therapies and be able to develop better therapies.”

Robert Wheeler





Researchers in the Wheeler lab include, left to right, Sarah Barker, a postdoctoral research fellow from Yorkshire, England; Xiaojie Ji, a first-year biomedical science doctoral student from Rizhao City, Shandong Province, China; and Remi Gratacap, a postdoctoral research fellow from Grenoble, France.

Some pharmaceutical drugs make *Candida* more recognizable. In addition to killing fungi, one antifungal drug has a side effect of uncovering the β -glucan, Wheeler says.

“If we’re able to expose the β -glucan, the immune system goes crazy,” says Remi Gratacap, a postdoctoral research fellow from Grenoble, France. “You see almost a threshold where the immune system is able to cope and if you go just past that, suddenly (β -glucan) can’t cope anymore.”

The UMaine group, says Wheeler, is also trying to better understand how *Candida* gets from one place to another in the body. Since *Candida* cannot move independently, Wheeler seeks to discover if the pathogen is carried in immune cells.

Candida, Wheeler says, can change shapes, from bunches of yeast to long filaments. Both shapes serve it well: *Candida* travels easily in the blood in yeast form and penetrates tissues best as a filament.

Gratacap says that Wheeler, a proponent of re-examining long-standing scientific concepts accepted as true, is “ridiculously clever.”

WHEELER COMES naturally by it. His paternal grandfather is John Archibald Wheeler, a theoretical physicist who collaborated with Albert Einstein and is heralded for his contributions to gravitation and quantum mechanics. The former Princeton professor, who coined the terms black hole and wormhole, died in 2008.

Robert Wheeler earned degrees from Harvard and Stanford universities, and did his postdoctoral work at Whitehead Institute, a nonprofit research institution in Cambridge, Mass., where biomedical researchers seek to improve human health.

Wheeler, a sought-after expert in the field, is slated to lecture this semester in Germany and France.

Wheeler lauds UMaine colleagues Carol Kim, professor of microbiology and director of the Graduate School of Biomedical Sciences and Engineering, and Clarissa Henry, associate professor of biological sciences, for their help, collegiality and excellent research with zebrafish. The Zebrafish Research Facility, run by Mark Nilan, is only a few steps from Wheeler’s lab.

“It’s hard to overstate how instrumental the well-run facility has been,” Wheeler says. “I really don’t know if I could have done this work anywhere else.”

His research group has already made a significant breakthrough discovery regarding *C. albicans*.

After receiving grants in 2008 and 2009 from the Maine Agricultural and Forest Experiment Station and the National Institutes of Health, he and students Kimberly Brothers and Zachary Newman started viewing interactions between fungi and immune cells. They showed for the first time that NADPH oxidase is required for regulation of *C. albicans* filamentation in vivo.

These observations, first made by Brothers, implied the deadly fungus might spend more time inside zebrafish phagocytes — immune cells that ingest microorganisms, other cells and foreign particles — than researchers had believed.

This, Gratacap says, demonstrates that examining these microscale battles in different hosts can lead to striking insights. ■



**Celebrating
100 Years**

18 62 1917



Photos by Edwin Remsberg
Historical photos courtesy of 4-H Centennial website

Young at heart

UMaine Extension marks a century of youth development

MAINE 4-H has a lot to celebrate on its 100th birthday — deep roots, a large, supportive family and a lot of successes.

Today, 4-H youth programs enrich children's lives through technology and hands-on programming. 4-H — which stands for head, hands, heart and health — is the youth development branch of University of Maine Cooperative Extension. UMaine Extension leaders and volunteers utilize university resources to develop the life skills and broaden horizons of 30,000 Maine children each year.

If youth ages 5–18 are interested in raising steers, making cheese, shearing goats, learning about tractor safety, sewing, growing vegetables and being a member of a Dairy Quiz Bowl Team, UMaine Extension has opportunities for them.

And if they're fascinated with rocketry, adventure camps, new media photography, Junior Maine Guiding, public speaking, climate change, website development and LEGO robotics, 4-H has programs for them as well.

While 4-H has grown in size and scope since its inception in Maine in 1913, its core belief is the same — children are the promise for the future.

As 4-H history goes, in the late 1800s and early 1900s, farmers were reluctant to use new agricultural techniques developed

by public university researchers, so universities established rural youth programs to introduce the concepts to children, which they eagerly shared with their parents.

Alumni praise 4-H for the positive and lasting impact it's had in their lives.

Maine Assistant Attorney General Patrick Larson, a 1985 UMaine graduate, enjoyed hunter safety, outdoor programming, photography, cooking and electricity demonstrations as a member of Union River Valley 4-H in Aurora, Maine.

"The strong sense of public service and volunteerism I learned through 4-H helped me give back to the community later in life," he says. "You learned that that was what you do; you offer your time to help others."

Jodi Harnden of Wilton, Maine, says community service was also a vital component of the Dandy Crafter 4-H Club. Harnden, a third-year secondary education and mathematics double major at UMaine, says her group gave homemade quilts and crafts to residents and hospital patients, and raffled other crafts to support community service projects, including buying animal oxygen masks for area fire departments.

She says participating in 4-H trips and activities helped her develop skills and confidence. The peer tutor and snare drummer in the UMaine Pep Band wants to be a high school teacher.

Lisa Phelps, UMaine Extension's 4-H

program administrator, says the key is to empower children and raise aspirations.

"I have had parents tell me that because of their child's involvement in 4-H, he or she will graduate from high school and go on to college," Phelps says. "And if they were not in 4-H, they would have most likely dropped out of school."

John Rebar, executive director of UMaine Extension, says the self-directed, hands-on 4-H programs encourage children to learn about the world and all that they can achieve in it.

"4-H provides the kinds of experiences that build skills and excitement that are remembered for a lifetime," he says.

The glowing testimonials are backed by research. In 2008, initial results of Tufts University professor Richard Lerner's longitudinal study indicated fifth-grade 4-H members across the country earned better grades, were more engaged in school and were more likely to envision themselves attending college than nonmembers.

That research supports UMaine Extension's most recent efforts to increase UMaine recruitment, enrollment and retention through 4-H Science. The new statewide initiative was awarded a three-year Presidential Request for Visions of University Excellence (PRE-VUE) Program grant last summer as part of the university's five-year strategic plan, the Blue Sky Project. ■

A NEW SPEECH THERAPY training program is giving University of Maine graduate students the skills to provide secure, cost-effective therapy via the Internet to underserved children and adults in Maine and elsewhere.

UMaine's pilot speech therapy telepractice program is among the first in the nation to offer such expertise at the college level. It is modeled after the speech therapy telepractice program established at Waldo County General Hospital in Belfast, Maine, five years ago under the direction of UMaine alumnus and speech-language pathologist Michael Towey.

By virtually eliminating the need for therapists or their clients to travel sometimes long distances to meet for face-to-face therapy in a clinic, telepractice is expected to reduce costs by making services available to people — often in their own homes or schools — who otherwise might never receive help, according to Judy Walker, an associate professor of communication sciences and disorders who developed the program with colleague Casey Monnier. Because of the audiovisual and digital materials-sharing capability of the system, interactive online therapy can be as effective as face-to-face therapy, she says.

Speech therapy telepractice could be particularly beneficial in Maine where an overabundance of people needing speech therapy is compounded by a shortage of speech therapists.

Telepractice therapy



“This R&D program could be transformational for our state and will help us demonstrate a unique, patent-pending floating wind turbine technology called VoltturnUS.” Habib Dagher

\$4M awarded to UMaine's deepwater offshore wind project

THE UNIVERSITY OF MAINE'S Advanced Structures and Composites Center has been awarded the first phase of a potential \$93.2 million deepwater offshore wind demonstration project by the U.S. Department of Energy (DOE). The UMaine Composites Center-led team of industry leaders and national laboratories is one of five awardees selected from more than 70 competing proposals.

In this initial phase, each project will receive up to \$4 million to complete the engineering, design and permitting. In a year, DOE will select up to three of these projects for follow-on phases that focus on siting, construction and installation, and aim to achieve commercial operation by 2017. These projects will receive up to \$47 million each over four years, subject to Congressional appropriations. The UMaine Composites Center's industry partners have pledged the remaining funds.

“We are pleased that the DOE has selected our team's program after a rigorous technical review,” says Habib Dagher, director of UMaine's Advanced Structures and Composites Center and principal investigator for the project. “This R&D program could be transformational for our state and will help us demonstrate a unique, patent-pending floating wind turbine technology called VoltturnUS.”

The program, known as Aqua Ventus I and announced by DOE and Sen. Susan Collins, will be a 12 MW demonstration wind park using the VoltturnUS floating platform technology developed at the UMaine Composites Center in the last four years. This project builds on the success of the DeepCwind Consortium Research Program, spearheaded by UMaine Composites Center and its industry partners, and funded by DOE, National Science Foundation-Partnerships for Innovation, and the Maine Technology Institute, among others.

A 1:8-scale VoltturnUS floating platform will be deployed by UMaine researchers this spring at the UMaine Deepwater Offshore Wind Test Site near Monhegan Island, Maine.

UMaine's Composites Center is partnered with industry leaders who collectively will invest more than \$40 million in the demonstration project. The demonstration project will de-risk UMaine's VoltturnUS floating platform so that more private capital can flow into Maine to build larger commercial farms.

Deepwater offshore wind farms could harness stronger and more consistent winds located beyond the reach of traditional fixed-foundation offshore turbines, while being out of the line of sight from shore. The Gulf of Maine has 156.6 GW of offshore wind potential, the majority of which is in deepwater. Maine has a plan to build a 5,000 MW network of floating farms by 2030, which would attract \$20 billion of private capital to the state and create jobs.

Hitting bedrock

A TEAM OF scientists from nine nations, which included two University of Maine graduate students, has made a breakthrough in Antarctica — successfully drilling more than 760 meters through the ice to bedrock on an island in the Ross Sea.

The international team, led by Nancy Bertler of Victoria University's Antarctic Research Centre and GNS Science in New Zealand, completed the drilling on Roosevelt Island in late December when the drill bit brought up sediment from the base of the ice sheet.

The drill cores from the Roosevelt Island Climate Evolution project will provide the most detailed record of the climate history of the Ross Sea region for the last 30,000 years — the time during which the coastal margin of the Antarctic ice sheet retreated following the last great ice age, says Bertler, an adjunct faculty member in UMaine's Climate Change Institute.

Graduate students Skylar Haines and Tom Beers of the Climate Change Institute and the School of Earth and Climate Sciences spent several months working in Antarctica on the ice core drilling project.



Sustaining tomorrow

ENCOURAGING PEOPLE to be engaged in sustainability efforts today that will make a difference tomorrow begins with a look back, says a team of University of Maine resource economists. Reflecting on societal decisions that have come to bear and learning from those aspects that we regret, or for which we are grateful or indifferent could lead to the ultimate motivating question: What actions will the future regret and what will it be thankful for?

Retrospective thinking — learning to evaluate reactions to the legacy we leave — is a means of raising awareness of the potential implications of current actions on the future, according to UMaine School of Economics researchers Mark Anderson, Mario Teisl and Caroline Noblet, writing in the journal *Ecological Economics*.

It is broadly understood that successful sustainability awareness and action require intergenerational equity and stakeholder engagement. It also is generally argued that we cannot presume to know future preferences — both individual and collective — that change over time.

"Reflecting on what about previous decisions contributed to or detracted from sustainability is a concrete exercise in intergenerational thinking," according to the economists, whose research is supported by Maine's Sustainability Solutions Initiative, a program of UMaine's Senator George J. Mitchell Center and Maine EPSCoR.

Bluefin biology

ANALYZING BIOLOGICAL data from Atlantic bluefin tuna could lead to refined population estimates and impact restrictions on the historically overfished species.

Commercial fishermen have been pursuing the prized, warm-bodied species for decades. In January, a 489-pound bluefin sold for \$1.76 million, says Walter Golet, a postdoctoral research associate with the University of Maine's School of Marine Sciences and the Gulf of Maine Research Institute.

Beginning in the late 1970s, worldwide demand and prices for large bluefins increased substantially, Golet says, and stock assessments indicated a rapid decline in the number of adult fish.

Since a rebuilding plan enacted in 1998, assessments suggest some stock rebuilding for both the eastern and western Atlantic stocks of bluefin tuna, says Golet. In 2011, the National Marine Fisheries Service was forced to conduct a status review on Atlantic bluefin tuna and listed it as a Species of Concern.

Golet's research seeks to provide up-to-date, life history data of the bluefin stock that, in turn, would serve as a basis for effective, appropriately placed fishing regulations.

The data will be derived from biological sampling of the tuna's dorsal spines, reproductive organs and sagittal otoliths — small, calcified structures inside the head that are sensitive to orientation and acceleration.

The study is part of a program for the International Commission for the Conservation of Atlantic Tunas and the National Marine Fisheries Service. The research is funded by the National Oceanic and Atmospheric Administration.

A TWO-YEAR study of roundabout design and navigability by drivers found the circular intersections to be viable solutions for problem crossroads. The study by University of Maine civil engineer Per Garder and civil engineering graduate student Olaf Johnson focused on the increasing use of roundabouts in the United States and aging driver demographics. Among their findings:

- The average gap, or headway, needed for the average driver to enter the roundabout was 3.26 seconds. Drivers younger than 20 needed the longest gap — 4.85 seconds, while drivers 70 and older, on average, needed 3.95 seconds.
- On average, drivers in their 30s waited for a 2.90-second gap before entering the roundabout. Drivers in their 40s waited for a 3.17-second gap; drivers in their 50s waited for a gap of 3.19 seconds.
- There are fewer crashes and traffic delays in roundabouts than at intersections with signals.
- A driver traveling straight through 10 roundabouts daily versus 10 signalized

intersections annually saves 14 gallons of gas. If every licensed driver in the country did the same, 2.7 billion gallons of gas would be saved annually.



In a roundabout way



Early intervention for crime prevention

MODERN CRIME prevention would benefit from a greater biosocial approach to delinquency and offending that is rooted in family, school and community intervention strategies, according to a research team led by University of Maine sociologist Michael Rocque.

Today, there is a growing body of literature on the importance of biological risk factors in crime prevention — cognitive deficits; impulsivity and negative temperament; conduct disorder and aggression; and mental and physical health. But unlike criminological theories in the 1900s that contended that deviant behavior was biologically or mentally predisposed, crime prevention research now focuses on the importance of social context and the need to address biological/psychological risk factors early in life.

In a paper published in the *Journal of Criminal Justice*, Rocque, a UMaine alumnus and a sociology instructor, and two colleagues — Brandon Welsh of Northeastern University and Adrian Raine of the University of Pennsylvania — examine the relevance of biology in modern crime prevention.

In particular, the research team looked at the newest form of crime prevention — developmental prevention — that focuses largely on early biological risk factors for delinquency and criminal offending that result from the interaction between the person and the environment.

Developmental crime prevention recommendations are in keeping with traditional sociological approaches — from improving the family environment to address risks of antisocial behavior, to stepping up prenatal care to ensure healthy child development. This biosocial approach looks at crime prevention strategies rooted in programs focused on families and parenting, preschool, mental and physical health, and nutrition.



Farming in your future?

UNIVERSITY OF MAINE Cooperative Extension has introduced a new online Beginning Farmer Resource Network (umaine.edu/new-farmers). Developed by a group of agricultural service providers, the Beginning Farmer Resource Network is a collaborative effort to address concerns among new farmers about available services and provide answers to commonly asked questions. Initial topics range from taxes, financing and U.S. Department of Agriculture programs to finding land or local large animal veterinarians, and how to balance farm and family life. No real one-stop shop is available for new farmers in need of assistance with the huge variety of issues they face in the first few years, says coordinator Tori Jackson, UMaine Extension professor of agriculture and natural resources in the Androscoggin-Sagadahoc office. Beginning Farmer Resource Network is hoping to help make it a little easier.



Photo by Rich Obrey

THE GREAT American humorist Mark Twain suggested that “dialogue is the yeast that lightens the bread.” On Jan. 9, I had the great pleasure of participating in such a dialogue with approximately 250 members of the Portland Regional Chamber of Commerce at its monthly Eggs & Issues Breakfast. Opportunities such as these are critical to bringing our collective voice and action for Maine’s renewal into focus and further action.

Whether I am fortunate to connect with our citizens in Maine’s urban core or in Maine’s beautiful rural communities, there is a common theme among such diverse populations, landscapes and cultures: pride in the uniqueness of Maine’s people and place, a vested interest in Maine’s sons and daughters, perseverance during these difficult economic times, and hope and devotion to a prosperous future for Maine. It is in this openness for dialogue that my presentations about UMaine’s Blue Sky Project further our engagement throughout Maine.

UMaine, through its Blue Sky leadership, is like no other entity in the state, bringing Mainers together from all geographical locations, all fields of study and industry, and all demographics to one common purpose of harnessing our collective knowledge, skill and passion to propel Maine forward.

The types of research highlighted in this edition of *UMaine Today* represent the depth and breadth of that unparalleled UMaine capacity for impact in Maine. Scientist Sarah Nelson, through her research on watershed geochemistry and atmospheric deposition, is using dragonfly larvae to monitor mercury contamination. In the fight to prevent and treat potentially lethal pathogens, particularly in hospital settings, Robert Wheeler is focused on the fungus *Candida*. Songbird migration across Maine skies may be better understood from use of a student-built, remote-controlled plane. Zooarchaeologist Catherine West is examining prehistoric fish and animal bones to understand organisms’ roles in a food chain altered by climate change. Lastly, sociologist Kim Huisman brings an initiative to Maine aimed at strengthening mother-daughter relationships and girls’ success.

As I share the UMaine story in dialogues throughout Maine and the nation, the quality of research, teaching and public outreach exemplified in this edition of *UMaine Today* deeply supports my proposition that UMaine can lead, inspire and lift (as yeast lightens bread) Maine’s renewal in many ways.

Thanks for your commitment to furthering our UMaine Blue Sky dialogue and to lifting Maine.

Paul W. Ferguson
President



Today and tomorrow

SCHOLARSHIPS REMAIN the most effective way to help many of today's students overcome one of the most significant challenges to a college education: affordability. Fortunately, there are a number of ways you can choose to support our students through scholarships. There are three levels of giving at the University of Maine Foundation: Annual (\$1,000), Endowed (\$10,000, payable over five years) and Distinguished Endowed (\$25,000, payable over five years).

An affordable way of endowing a scholarship over a longer period of time is through the new **Today and Tomorrow Student Scholarship Program** at the University of Maine Foundation, which helps students with the costs of today while building endowments for UMaine's next generation of students. With your \$1,000 annual gift, \$500 will be awarded to a current UMaine student and \$500 will go into an endowment fund for future scholarships.

If you would like more information about these scholarship opportunities or would like to discuss other planned giving options, please contact the planned giving staff.

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