

Resistance  
to Red Tide

Double Lives

Connections  
for Newborns  
in Need

Reclaiming  
Castine

# UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

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2006

## Troubled waters

What does the future hold for  
groundfishing in the Gulf of Maine?

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## President's Message

Photo by Bill Drake



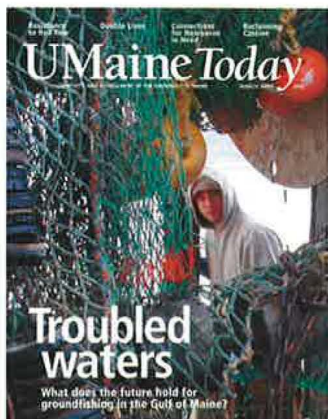
WHILE WE ARE PROUD of the University of Maine's status as a national-level research university, an institution where outstanding scholars work to redefine the borders of new knowledge, it also is important to consider the foundation upon which the research enterprise rests. Without our strong, comprehensive, liberal arts-based undergraduate programs — the heart of any university's academic life — UMaine would not be nearly as strong, nor would it be able to effectively support the research and development activity that also is an important component of a 21st-century land-grant university.

Unlike any other university in Maine, but similar to the great state universities across the United States, UMaine offers a vast array of academic programs that help our students to learn to think clearly, to communicate effectively and to understand the world around them. As people who are truly educated, our students leave UMaine ready to take leadership roles and to contribute to society in meaningful ways. We are fortunate to have a faculty of learned and accomplished scholars — historians, anthropologists, philosophers, economists and experts in so many other disciplines — who provide those critical insights that help our students truly learn.

A great many of those UMaine professors are leaders in their fields. Their research and scholarly contributions are on the leading edge of current thinking in important areas, and our students benefit greatly from the close faculty interaction that is so important to us at UMaine.

We have talked a lot recently about partnerships and collaborations — the “new model” land-grant university. Several fine institutions have joined with us in enterprises related to important research. I believe that the decisionmakers at those institutions recognize the true essence of UMaine, and that they appreciate the fact that our students and our faculty members are part of a real community of scholars, where the quest for knowledge is valued above all else.

Robert A. Kennedy  
President



ON THE COVER: Dustin McLellan, 21, and his 19-year-old brother Brendon (not pictured) work aboard their father's 72-foot steel-sterned trawler *Adventurer*. The brothers are the seventh generation of McLellans to make their living on cod, hake, pollack and flounder taken from the Gulf of Maine. But what the future holds for them and other commercial fishermen is increasingly uncertain. Their father, Cameron, has seen the McLellan family's seven-trawler fleet shrink to three. That's why Cameron McLellan has been involved in collaborative research with scientists at the University of Maine's Darling Marine Center in Walpole, Maine. The trawler captain is committed to the idea that better management can make a difference, and that collaboration between fishermen and scientists is the best way to get there. See the related story starting on page 16.

Photo by David Munson

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Photo by Barth Schorre, courtesy of the Cornell Laboratory of Ornithology



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# Resistance to

**C**OMBED FROM THE coastal muds of New Brunswick, Canada, hundreds of soft-shell clams made their way from basket to boat to pickup, headed south for their last hurrah. The men and women who harvested the mollusks carefully cleaned and sorted their haul, working through their catch with a clamdigger's dexterity and a scientist's eye, prepping the hapless clams for their final demise.

That many clams could have been used to make a big batch of chowder. Instead, they were used to make history.

The clams were the focus of research conducted by an international team of scientists that included University of Maine marine scientist Laurie Connell. The scientists' paper last April, "Sodium Channel Mutation Leading to Saxitoxin Resistance in Clams Increases Risk of PSP," was the culmination of more than eight years of intensive research aimed at achieving a better understanding of a notorious and potentially

deadly compound known as saxitoxin. Saxitoxin is the primary culprit in cases of paralytic shellfish poisoning (PSP), the always dangerous, sometimes deadly consequence of the coastal phenomenon known as red tide.

The paper, published in the highly respected scientific journal *Nature*, spent more than five months at the top of the charts.

"I was shocked to hear that the paper was so popular. It's had more than 60,000 downloads and it's still going," said Connell in January. "It does have a very broad appeal."

SAXITOXIN'S ROLE IN PSP has been the subject of considerable interest in recent decades. However, most of the research focused primarily on the effects the poison has on humans and other mammals that contract PSP by eating clams and other filter-feeding shellfish. Filter feeders accumulate saxitoxin in their tissues as they dine on the algae that carry the poison, passing along a concentrated dose to their mammalian predators. The first researchers to take a



**A newly discovered strain of renegade clams with the ability to ward off paralytic shellfish poisoning could shed light on the nature of the nervous system**

By David Munson

Photos by Bill Drake

# red tide



comprehensive look at the effects of saxitoxin on clams, Connell and her team, including retired UMaine researcher Betty Twarog, found that mollusks suffer many of the same PSP symptoms as humans.

Well, at least some of them do.

Connell, an assistant research professor in the School of Marine Sciences, discovered that not all clams are created equal when it comes to fighting off the effects of PSP. Now she's begun to unravel a microscopic mystery that speaks to the very nature of the nervous system itself.

As it turns out, a renegade strain of red tide-resistant clams has been working its way into both Maine and Canadian clam populations in the last few millennia. Thanks to a mutation in their genetic code, these clams were able to survive and reproduce despite the presence of saxitoxin. This strain eventually became dominant in clam populations that are frequently exposed to red tide.

In fact, Connell and her team of specialists found that the mutant clams were more than 1,000 times more resistant to the effects of red

**“Knowledge of the genetic susceptibility of clams to red tide could help managers make better decisions on what clams to use in seeding programs, how long to close clam beds and other issues.”**

Laurie Connell





tide than their unmutated brethren, a surprising discovery that has significant implications in both clam management and medical research.

**THE SYMPTOMS OF** saxitoxin poisoning — numbness, paralysis and even death — result from the compound's ability to interfere with the nervous system at the subcellular level, blocking sodium channels, and interrupting the crackle and blink of nerve impulses moving from cell to cell. Because of its power over the nerve impulse, saxitoxin has been used extensively by medical researchers to study the function of the nervous system and its associated diseases. Connell's comprehensive approach opens new doors to future research by connecting sodium-channel function to specific control sites in the organism's DNA.

Connell's work is likely to affect the clams as well. While the mutant gene makes the carrier clam no less edible, the clam's ability to tolerate high levels of saxitoxin increases its potential danger to humans by allowing it to stockpile higher levels of the toxin in its tissues. Discovery that some clam populations are genetically more resistant to red tide poisoning could lead to management changes in the soft-shell fishery.



In another research initiative, Laurie Connell, left, and research technician Cindy Adams study yeast cultured from Antarctic soil samples. Connell is pursuing a long-term project to identify microorganisms that live in Antarctic earth.

“Genetically resistant clams are able to continue feeding much longer, accumulating more toxins in their tissues, which take longer to purge. Knowledge of the genetic susceptibility of clams to red tide could help managers make better decisions on what clams to use in seeding programs, how long to close clam beds and other issues,” she says.

The project's implications don't stop there. Connell's discoveries are of interest to marine ecologists, public health officials, bioengineers, fishermen — the list goes on and on. The significance of the research in such a broad range of disciplines speaks to its popularity in *Nature*. ■

## Safer Shellfish Through Technology

**FACIAL NUMBNESS**, tingling in the arms and legs, nausea, dizziness — and those are the milder symptoms.

Paralytic shellfish poisoning (PSP) resulting from the consumption of shellfish tainted with toxins found in the algae that cause red tide is a very real danger. PSP has become a growing concern in recent years with dramatic increases in the extent and frequency of red tide blooms in Maine's coastal waters.

While the state has an extensive monitoring program for detecting the presence of the various species of algae responsible for red tide, current testing procedures are costly and time consuming. Utilizing breakthrough techniques in molecular biology and sensor technology, University of Maine marine scientist Laurie Connell and bioengineer Rosemary Smith of UMaine's Laboratory for Surface Science and Technology are teaming up to develop a faster, more efficient device that can detect PSP-causing algae in the field.

Backed by nearly \$400,000 in funding by the National Oceanographic and Atmospheric Administration's Monitoring and Event Response for Harmful Algal Blooms Program, the primary goal is to develop a small testing device that is based on a direct-detection mechanism, rather than enzymes or biological materials that can be short-lived and expensive. The handheld device will use a DNA-like molecule that binds to the genetic material of the organisms present in the sample. Light reflected from the bound molecules would then be measured to reveal the identity and concentration of the organisms present.

The rapid-detection device will have the ability to provide on-site, nearly instantaneous results at low cost. It also could be deployed on buoys to create red tide detection arrays in critical areas.

In serious cases, PSP can lead to muscle paralysis and respiratory failure. Connell and Smith's work has the potential to assist water quality managers working to prevent future poisonings in Maine and around the world.

# Double Lives



By David Munson

**Biological research offers insights into connectivity among songbird migration habitats**

**W**ITH THE ARRIVAL of the first spring robin, the courtship call of the redwing, the orderly departure of the Canada goose, birds help us to define our place in time more deeply than any clock or calendar. The movements of migrating birds have become important milestones in our cultural calendar, marking the passing of the seasons and keeping us connected to the natural world.

**American redstart**

Photo by Isidor Jeklin, courtesy of the Cornell Laboratory of Ornithology

**Kristen Covino, left, a master's student in biology, and Rebecca Holberton, associate professor of biological sciences, inspect the body condition of a dark-eyed junco.**

Photo by Bill Drake



**F**OR DECADES, the arrival and departure of a local bird population often paralleled the beginning and end of our knowledge of the species. Where they went when they departed and what they did there remained a mystery. Filling that information gap between the double lives they lead has become a critical part of understanding the ecology of migratory birds.

A groundbreaking discovery made nearly a decade ago by University of Maine professor Rebecca Holberton and her colleagues has become what is arguably the single most important tool in understanding the connections between what happens to birds on their wintering grounds and their success on their breeding grounds. Using a technique akin to radiocarbon dating, the researchers found a way to not only use stable carbon isotopes to determine where individual birds are feeding, but to also reveal how these patterns can affect population decline. The approach is offering researchers valuable insights into the complex interactions between bird populations and the places they call home.

Different types and abundances of carbon isotopes are found from region to region and habitat to habitat. These “isotopic signatures” are reflected in the tissues of the birds that feed there. Blood from captured birds is analyzed and compared to carbon isotope measurements from potential habitats to determine feeding sites. Holberton and her colleagues found the same blood sample also can provide hints about how well the bird is doing.

**Rebecca Holberton collaborates with Peter Marra, a researcher at the Smithsonian Migratory Bird Center, to study the connectivity and seasonal interaction among the different habitats in which migratory birds live throughout the year, including the Maine woods.**

In the past, an individual bird had to be captured and recaptured to provide any information about where it spent its time or what happened to it while it was in a particular place. Using this new approach, only a single capture is necessary, making data for migration research not only easier to collect, but more accurate. Working in collaboration with researcher Peter Marra of the Smithsonian Migratory Bird Center, Holberton put the new technique to use for the first time in a study of the American redstart, a striking black and orange songbird that winters in Jamaica and returns to Ontario to breed.

The redstart's tropical feeding grounds offer the bird two very different habitats in which to dine, each with its own menu of insects, spiders and other small invertebrates. Jamaica's threatened mangrove swamps provide a wide selection and sizeable portions, while food in the island's dry scrub forests is generally scarce.

“The wet mangrove habitats have different carbon signatures than the dry scrub areas. Different ratios of carbon 13 and nitrogen are incorporated into the plants; the insects eat the plants and the birds eat the insects. When you look at this isotope marker in bird blood, it differs dramatically according to the habitats where the birds have been feeding,” Holberton says. “We can use that as a way of tracking the bird, creating a meaningful link between wintering-ground and breeding-ground events.”



ONCE THEY ESTABLISHED a link between the redstart's two lives, Holberton and Marra took the research a step further, using the new data to examine the effects of habitat loss on the fitness of individual birds.

"There is an active social hierarchy that determines which birds will feed in the rich mangrove habitats and which will feed in the dry scrub," says Holberton. "The loss of the mangroves is a big issue, and we needed a reliable indicator of how well the birds were doing as a consequence of their competition for better habitats, like the mangroves."

Intent on measuring each bird's true fitness, Holberton developed another novel approach by measuring the relative levels of the hormone corticosterone in the birds' blood.

"You can catch and weigh birds to see how they are doing, but two birds of equal weight may have had to do a vastly different amount of work to get to the same place. Fitness is just not something you can tell by holding the bird in your hand," she says. "We needed an indicator of how hard the birds were working to prepare themselves for migration, and corticosterone is that indicator."

In birds, corticosterone's primary function is to initiate the urge to feed. When food is scarce or the bird is nutritionally bankrupt, the level of corticosterone will remain high. If it stays high due to increased competition for marginal habitats, it can put a bird into survival mode, ultimately leading to the breakdown of skeletal muscle and a weaker immune system.

The time and effort it takes for an individual redstart to prepare for its long migration north can have serious implications for its breeding success. Holberton found that the lucky few that were able

to fatten up on the bounty of the Jamaican mangroves arrived in Ontario earlier, and were generally in better condition to breed. Setting the stage for future research, Holberton and her colleagues have developed new laboratory techniques that they hope will show how wintering-ground events affect migration and breeding success.

"In general in birds, individuals that are in better condition when they leave their winter feeding areas arrive in their breeding grounds sooner and have better nesting success," says Holberton. "We plan to use hormone levels to determine whether their increased success is due to arrival time alone or if their bodies are preparing for breeding even sooner. It may be that birds stuck in poorer habitats during the winter can't get ready to breed as quickly as those in the mangroves. If so, we can say conclusively that winter habitat affects breeding, which is critical when we try to work with bird populations."

Holberton's new research could provide a valuable link between migration timing, physical condition and preparation for breeding, helping other researchers to establish more effective management plans for threatened and endangered songbirds.

The use of stable isotopes to follow the movements of birds and animals has become common practice. Use of hormone analysis in bird research also has increased. However, for Holberton, combining the new research techniques is simply a means to an end.

"On a single night during migration, more than 5 billion birds will move through the night sky in North America. As they pass overhead, calling to one another, I often wonder what they'll find when they reach their destinations. I hope that, in some small way, our work can make a difference. We owe them that." ■



**Blackpoll Warbler**

Photo by Jim Wedge, courtesy of the Cornell Laboratory of Ornithology

## Alternative energy, warbler style

NOW THAT FUEL PRICES are fixed firmly above the \$2 mark, the sound of sobbing can often be heard at the gas pump. However, the blackpoll warbler is singing a different tune, boasting an incredible 720,000 miles per gallon during its amazing 2,300-mile migratory flight.

Weighing in at less than an ounce, the tiny traveler makes its way from New England to the Caribbean and on to the Amazon in something less than 90 hours, crossing huge expanses of open ocean without refueling or even taking a quick siesta.

"There are other birds that fly longer distances, but they can stop. The blackpoll can't stop. It flies for three to five days straight," says University of Maine ornithologist Rebecca Holberton, who has studied the ambitious bird for several years. "They don't eat any more than other songbirds, but they definitely make the most of what they have."

# Connections for



## COTT HAYDEN

remembers the day the Earth stood still. It happened when he and his wife, Lori, were told the reason that their healthy, vivacious 15-month-old daughter had not yet learned to speak.

Jessica was diagnosed with profound bilateral hearing loss. She is deaf.

"By far, it was the most devastating news that I've ever received," says Hayden. "It hit me with a force that I couldn't imagine; it brought me to my knees. I felt that my family's dreams had been shattered. I cried, and cried and cried."

The diagnosis that resulted from a hearing test came as a complete surprise to the Haydens. All along, Jessica had responded to gestures and vibrations, turning her head, smiling, laughing. But the words never came.

"Even when we went for a hearing test, we still didn't think there would be an issue," Hayden says. "It's amazing how babies adapt."

Jessica was born in Bangor, Maine, in 1999, a year before the state legislature established the Maine Newborn Hearing Program and five years before hospitals began reporting screening results. Her experience was unlike that of newborns today who are screened for hearing loss before leaving Maine hospitals. As a result, Jessica and her parents lost 15 months to silence.

However, once informed, the Haydens made up for that lost time with the help of early intervention services paid for under the federal Individuals with Disabilities Education Act. Initially, the family worked with an audiologist, early child family consultant, speech-language pathologist and developmental therapist. Later, there was auditory-verbal, recreational and music therapy, as well as family training.

Jessica first used hearing aids and learned American Sign Language. Ten months later, she underwent elective surgery to receive a cochlear implant.

"For Jessica, the hearing aids were of little or no benefit," Hayden says. "But we thought that if she had access to sound, maybe she could learn to listen, and maybe then she could learn to speak. We were not trying to fix a broken child, but to provide one more opportunity for her."

Last fall, Jessica started kindergarten. In the classroom, the teacher wears a small microphone as part of an FM auditory trainer system that provides direct, amplified speech to Jessica. The now 6-year-old uses no other educational aids or assistance.

She talks. Sings. Reads aloud.

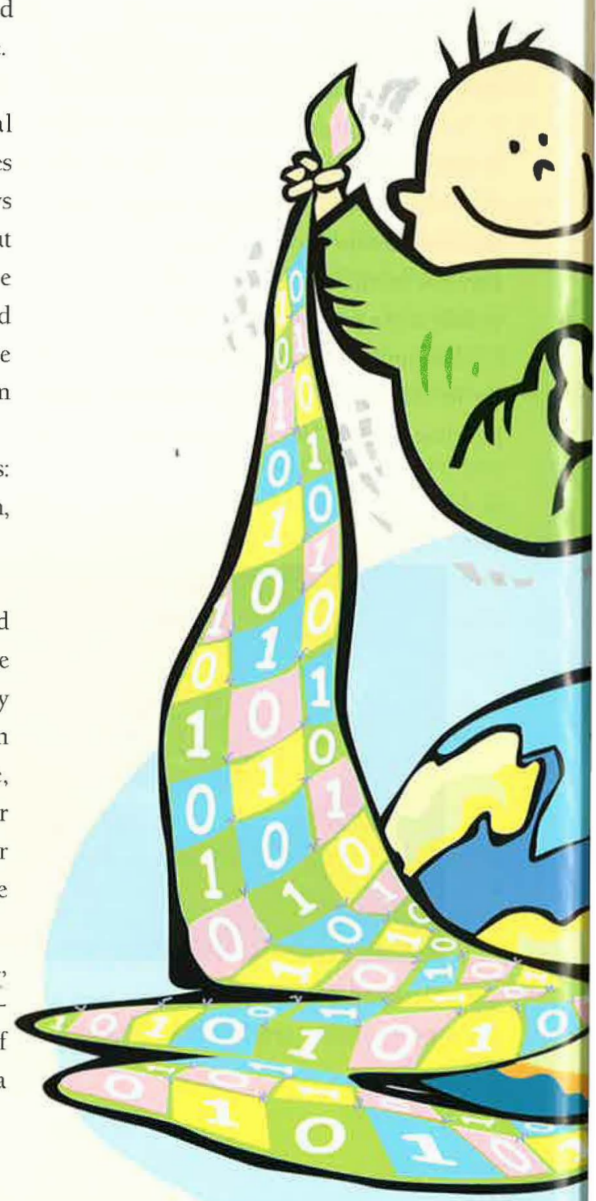
"Early intervention with parental involvement is a powerful healer. It restores some order and sense in your life," says Hayden, who has given a presentation about his family's experiences to healthcare providers at Children's Hospital Boston, and who last year testified in Augusta before the legislature's Appropriations and Education committees.

"One of the first things I now tell parents: Today is a new day. With early intervention, their dreams are just beginning."

**JESSICA IS ONE** of an estimated five youngsters born every year in Maine with profound deafness. Annually, as many as 50 out of Maine's 13,500 babies are born with hearing loss, most mild to moderate, according to Ellie Mulcahy, program director of the Genetics Program in the Maine Center for Disease Control and Prevention (Maine CDC, previously the Bureau of Health).

To help them keep track of all the data, the Maine CDC partnered with the University of Maine to carry out the mandate of the legislature by instituting ChildLINK, a

Statewide database  
with services for



# newborns in need

links at-risk babies  
early intervention



By Margaret Nagle

Illustrations by Carol Nichols

sophisticated data system that integrates the information from the State of Maine Electronic Birth Certificate with information from the Newborn Hearing Screen, the Newborn Metabolic Screen and the Birth Defects Registry. The goal of the collaboration is to help children and their families receive information and appropriate services.

Prior to ChildLINK, a program that is currently housed in UMaine's Center for Community Inclusion and Disability Studies (CCIDS), and affiliated with the College of Education and Human Development, there was no centralized, statewide collection of information about the occurrence of hearing loss or birth defects to facilitate systematic follow-up with families by the Children with Special Health Needs Program in the Maine CDC. For the parents of newborns with hearing loss or birth defects, a key to helping their children most is improved access to specialty services, as well as resources that can provide emotional and economic support.

"The desire was to set up a system across the state to screen all newborns, so that those at risk for hearing loss could be identified and referred to diagnostic evaluation and early intervention services," says UMaine researcher Craig Mason, who created ChildLINK with colleague and wife Shihfen Tu, and with Quansheng Song, the lead programmer and database administrator for the project.

"A number of studies have found that even if a hearing screen was done in hospitals and infants were identified as at risk, up to two-thirds of them did not go on to see

an audiologist and many did not receive services until they were 3 years old. By that time, a child with hearing disabilities has lost a lot of time in cognitive and language development."

Today, all 32 birthing hospitals in Maine are enrolled in ChildLINK, providing the Maine CDC with data on infant hearing screening tests and birth defects.

**Craig Mason, a CDC informatics consultant, and other CDC officials are working with New England states to create a model for tracking the progress of at-risk babies born in the region.**

"Imagine if you've just had a child and been told he or she has hearing loss. As a parent you wonder, 'what do I do now?'" says Tu, a UMaine assistant professor of education and applied quantitative methods, and a research and evaluation coordina-

tor for CCIDS. "With the system of newborn screening and early identification, opportunities will be provided for parents to seek expertise from multiple agencies for intervention strategies (that can affect their child's quality of life)."

**UNIVERSAL NEWBORN** hearing screening, which is offered in hospitals as part of routine newborn care, is key to preventing speech and language delays, and developmental disabilities that can occur if the hearing loss goes undetected, says Patricia Day, nurse coordinator of the Maine Birth Defects Program in the Maine CDC.

"Sometimes people think we're a surveillance program, that we're just about the numbers," says Day. "But our first priority is getting information to parents and assisting them into services. We also want to provide healthcare providers with national information and incorporate what we're seeing here."

# Hearing loss is one of the most common problems in infancy — and the most treatable.

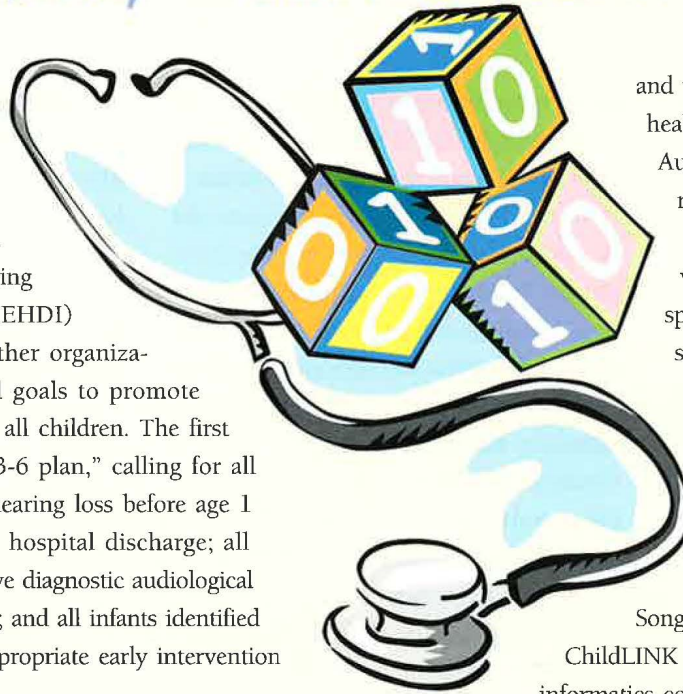
Newborn hearing screening is recommended by the American Academy of Pediatrics. The United States Centers for Disease Control and Prevention's (CDC) Early Hearing Detection and Intervention (EHDI) Program, as well as several other organizations, have endorsed national goals to promote communication from birth for all children. The first three goals constitute the "1-3-6 plan," calling for all newborns to be screened for hearing loss before age 1 month, and preferably before hospital discharge; all infants screening positive to have diagnostic audiological evaluation before age 3 months; and all infants identified with hearing loss to receive appropriate early intervention before age 6 months.

Hearing loss is one of the most common problems in infancy — and one of the most treatable. However, it often can be difficult for parents to grasp the significance of early diagnosis and prevention. Indeed, some parents refute positive screening results with their own tests to see if their infants startle to loud noises, like the banging of a pot or ringing of a telephone. Resorting to such traditional yet primitive hearing tests for infants may only signify that the baby is not completely deaf; the child may still have substantial hearing loss.

"That's why public awareness is so important," says Mason, an associate professor of education and applied quantitative methods. "Parents need to know that even mild hearing loss can lead to delays in language development."

A study by the CDC estimated that those lifetime costs are expected to be \$2.1 billion for persons born in 2000 with hearing loss; lifetime costs for an individual with early childhood-onset hearing loss are conservatively estimated to total more than \$275,000.

**BETTER UNDERSTANDING** of the effect of newborn hearing screening and early intervention is the next step in Maine's program. Mason and Tu are part of a multiuniversity research group based at the University of Miami that is linking early childhood health data to educational records in Florida. This has provided valuable information in planning educational services in that state,



and was key to Florida receiving several child health grants, including selection as a CDC Autism Center. Mason and Tu would like to replicate the work in Maine.

"We hope that some of the work we're doing can reduce the amount of special services needed by these children in school," says Tu. "We're hoping that five years from now, Maine has made significant progress in linking newborn screening and education."

The work being done at the University of Maine has been gaining increased national attention. Quansheng Song took the lead in developing a version of ChildLINK for Guam, and Mason now also is a CDC informatics consultant. In that role, he and other CDC

officials are working with New England states to create a collaborative model for tracking the progress of babies born anywhere in the region, including the major metropolitan medical centers where high-risk pregnancies are referred.

"In the past, health officials may have heard about an unnamed baby being born with a rare birth defect," says Mason. "Such anecdotal stories suggest that Maine could have higher rates of some birth defects (than other parts of the country), but whether we do has remained a question without the data. With the numbers, we can begin to look at the basis for such defects, such as heavy metals, mercury and lead."

Of the estimated 200 babies born with a birth defect each year in Maine, many will not live to see their first birthdays. Now a formalized reporting structure allows state health officials to begin to assess the full impact of birth defects on Maine children and their families, including monitoring trends of certain conditions.

A decade from now, the hope is that the data will help delineate any environmental or other causes for the incidence of birth defects in Maine, says Day. In addition, the data sets could help determine future prevention or healthcare strategies. Researchers will be able to look at patterns in an effort to more fully understand, and ultimately prevent or better treat, conditions in newborns that can cause developmental disabilities. ■

With the data, researchers will look at patterns in an effort to more fully understand, and ultimately prevent or treat, conditions in newborns that cause developmental disabilities.

## UNIVERSITY OF MAINE

researchers Craig Mason and Shihfen Tu are methodologists who specialize in informatics to benefit early childhood development. They are helping Maine to develop comprehensive, confidential databases of information on the state's newborns, including new ways of looking at and linking statistical data, in an effort to ultimately improve the quality of life for those with special needs.

Their research in Maine began in 2001 with ChildLINK, a collaboration between UMaine and the Maine Center for Disease Control and Prevention (Maine CDC) to compile a database to ultimately integrate information from the State of Maine Electronic Birth Certificate, the Newborn Hearing Screen, the Newborn Metabolic Screen, and the Birth Defects Registry.

Maine law established the Maine Birth Defects Program and the Maine Newborn Hearing Program, both in what was then the Maine Bureau of Health, in 1999 and 2000, respectively. After a 2002 pilot of ChildLINK, focusing on newborn hearing screening, the birth defects registry went online the following year. The state implemented universal newborn hearing screening in 2004, automating the newborn hearing screening tracking and mandating reporting requirements for hospitals and healthcare providers.

Licensed clinical social worker and programmer Cecilia Cobo-Lewis, and database administrator Quansheng Song provide the primary training and technical support to healthcare professionals reporting statewide.

"We'd like to see Maine have a seamless, streamlined system for children with special needs so families can be immediately connected to the help they need," says Mason.

Mason and Tu have particular interest in developing



Shihfen Tu and Craig Mason

Photo by Bill Drake

# The epidemiology of child development

research. ChildLINK can generate on-demand individualized demographics reports statewide or by hospital for officials with the highest access privileges. Even family-level studies are possible, which are particularly important in research on genetic patterns or environmental risks. With institutional review board and Maine CDC approval, researchers will be able to access anonymous, aggregate information for conducting policy-relevant public health studies.

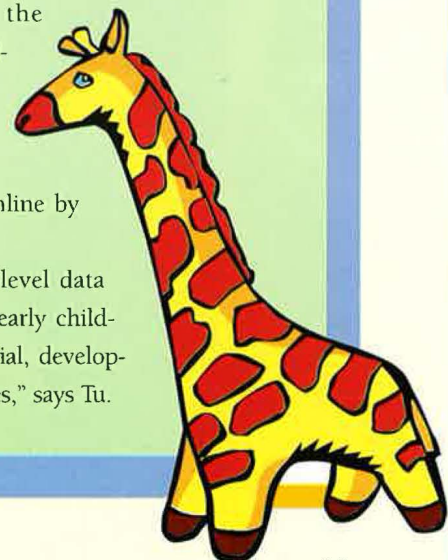
Mason and Tu are members of a national consortium of researchers specializing in child developmental epidemiology using public health databases. The hybridization — bridging public health epidemiology and traditional child development — has led to the creation of the *Journal of Developmental Epidemiology*. Mason is an associate editor; Tu serves on the editorial board of the journal, to be published online by BioMed Central.

"It is work on population-level data using methodology to identify early childhood risk factors to predict social, developmental and educational outcomes," says Tu.

methods for protecting privacy in data collection. The key is in protecting privacy while making the information usable.

"That's part of the role universities play in facilitating this work," says Mason. "It's a collaboration among universities, and state and private agencies that has proved valuable in a number of states."

Using the databases, state health officials can track and plan services, and enhance opportunities for applied state public health surveying and



# Reclaiming Castine

Research by a UMaine archaeologist uncovers clues to the colonial and early American military history of the strategic peninsula that four nations battled to control

*By Dick Broom*

*Photos by Bill Drake*



Undergraduate student David Reid sifts backdirt at the archaeological site in Castine, Maine. Among the artifacts: a fragment of early British bottle glass associated with the 1814 fort.

**I**t's well known that no one traveled by horse in 17th-century Acadia, the vast territory that comprises modern-day Nova Scotia, New Brunswick, the Gaspé Peninsula of Quebec and much of Maine. So why have fragments of spurs been found at the site of Fort Pentagoet in Castine, Maine, on the eastern edge of Penobscot Bay?

Early Acadians are often depicted as rugged, rough-hewn pioneers, yet archaeologists working at Fort Pentagoet discovered bits of silk and satin ribbon, bands of gold braid and elaborate buckles from sword slings.

"What we have found gives us an entirely different picture of gentility as it existed on the frontiers of Acadia, very different from the kind of picture you would expect Disney to create," says Alaric Faulkner, a historical archaeologist in the Department of Anthropology at the Univer-

sity of Maine, who began excavating at Fort Pentagoet in 1981.

"We often have images of the French in Acadia as going around dressed in buckskins and rags," he says. "But, in fact, the traders brought with them the finest fashions and fanciest sewing notions from Europe."

In the 17th century, the French decorated their clothes with ribbons, and wore spurs and gold galloons. Rapiers, which by then had become obsolete as weapons, were important items of dress. All were symbols of wealth and status, and they were adopted by every single trader in French Acadia.

Fort Pentagoet was occupied from 1634 until 1674, when a Dutch privateer sacked it. Like most frontier "forts" of that time, Pentagoet was more of a trading outpost than a military installation. It likely was built primarily for trade with the native people in the area, Faulkner says. Early

written accounts refer to a number of Indian settlements "at Pentagoet." But archaeological research has shown that those settlements were actually scattered over the entire Penobscot River drainage area, so trading with the native population was much more widespread.

"More nonsense has inadvertently been written about Maine history because the geographical extent signified by place names was often far greater in the past than it is today," Faulkner says.

His work at Pentagoet revealed that commerce between coastal Acadia and Quebec also was more extensive and complex than had been thought, involving more than fish, fur and timber. Coal was a valuable commodity in those days; Faulkner's team found coal from a mine in Nova Scotia in the middle of what had been the armorer's forge in Castine.

From such small discoveries can come answers to large questions, Faulkner says.

**Last summer, 12 undergraduate students joined UMaine historical archaeologist Alaric Faulkner in Castine for excavations. Among them were Jane Clifton and Carly Bunyan, below, left to right. Faulkner's research focuses on the physical evidence of cultures and events in the New World since the arrival of the first Europeans. Knowing about the precise location, size and shape of military works, and the geographic features around them, can illuminate, clarify and, sometimes, bring into question the written accounts of events that occurred there.**



“What was so important about Castine in the 17th century that the English and French fought back and forth for decades for this little piece of real estate? Was it control of access to natural resources, such as fur, fish, timber and coal? From what we have found, such as evidence that Castine had access to Nova Scotia’s coal, the answer is partially yes. But we have also learned that access to Quebec via the Penobscot River, improbable as it seems today, was thought to be just as important at the time.”

Located on a neck of land at the mouth of the Penobscot, Castine also was of great military importance.

*The French at Pentagoet*, Faulkner’s archaeological portrait of the Acadian frontier, published in 1987, has been cited as one of the most important books on Maine history. His ability to read and speak French gives him a great advantage, if not a monopoly, in researching Acadian sites because of the historical documentation associated with them. That advantage brings with it a special responsibility to give the Acadians their due, he believes.

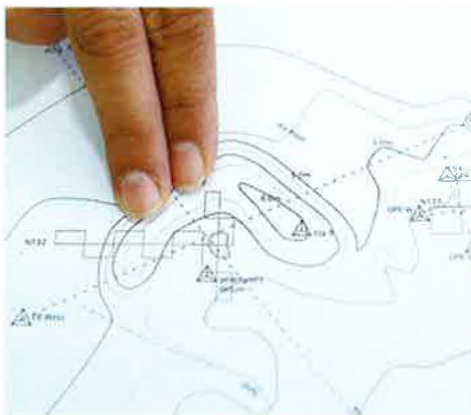
“History is always written by the so-called winners. But there need to be people who can provide some measure of constraint by putting the record straight. We very seldom hear about the Acadians, much less the native people who lived here with them.

“This is something I tried to remedy in my contribution to the history book *Maine: The Pine Tree State* that is currently used in the schools,” says Faulkner, who, with his wife, Gretchen, director of the Hudson Museum at the University of Maine, wrote the textbook’s chapter on the Acadians.

**ALARIC FAULKNER STUDIES** physical evidence of cultures and events in the New World since the arrival of the first Europeans. His work has by no means focused entirely on Castine, although he has returned there several times.

He and his students have added detail

and context to the rich history of the area by mapping and excavating a number of significant sites. One of these was the home of Jean-Vincent de Saint-Castin, an early Acadian leader who married a native woman. Saint-Castin, for whom the town is named, was considered a hero by Acadians and Native Americans for defending their rights against the British.



**“A lot of my work involves resolving what we can see of archaeological features on old maps and transposing them onto new, modern cartography. We use this not only for research purposes, but also to give students an opportunity to learn the process of making good, accurate contour maps.”**

Alaric Faulkner

Faulkner also has studied Castine archaeological sites from later times, primarily military fortifications built during the Revolutionary War and the War of 1812.

“There is in Castine a greater density of military installations than I know of just about anywhere else,” Faulkner says. “A few of them are in more or less pristine condition from an archaeological standpoint.”

Knowing the precise location, size and shape of military works, and the geographic features around them, can illuminate and clarify, and, sometimes, bring into question the written accounts of events that occurred there. Such is the case with the Penobscot Expedition of July 1779, which was the

worst American naval disaster prior to Pearl Harbor. The entire Massachusetts fleet of about 42 ships was trapped in the harbor by British warships while trying to drive the British out of Fort George. All but one of the American ships were scuttled. The commanders on both sides described the events in their diaries.

“But those are only word pictures,” Faulkner says. “Now that we have found the actual places and put them on the landscape, all previous accounts of the Penobscot Expedition are reinforced by the geography of the events, and they give us quite a different picture of what went on.”

Paul Revere commanded the artillery during the Penobscot Expedition. After the smoke had cleared — and the last ship had sunk — he was court-martialed at his own request to clear himself of culpability in the debacle. When he returned home, reminders of where he had been were all around him. The cobblestones that paved Boston’s streets were evidence of trade between that city and the coast of Maine. An excavation of Revere’s own house lot revealed cobbles similar to those Faulkner discovered at the Fort Pentagoet site.

**APART FROM HIS** archaeological fieldwork and scholarship, Faulkner has advanced both the science of archaeology and its practical application through the Maine Historic Archaeological Sites Inventory. The computerized database of about 3,600 sites is administered jointly by UMaine’s Department of Anthropology and the Maine Historic Preservation Commission.

Twenty-seven years ago, Faulkner and the late Robert Bradley of the Historic Preservation Commission created the inventory on index cards. Faulkner converted it into an online resource in 1994. It remains one of the only databases in the nation that allows archaeologists to register sites online and to update the record from the field as they make new discoveries.





Alaric Faulkner's work in Castine was at the site of a fortification built by the British during the War of 1812, near the canal that crosses the neck of the peninsula. Called the Musquetry Redoubt, it is a boomerang-shaped earthworks about 60 feet long from which guards could fire on an enemy attempting to cross a bridge over the canal. The redoubt appears on a map from 1814, but it had never been examined or even included on the state's inventory of archaeological sites. Faulkner and a group of his students found and mapped the site, and completed test excavations. In this photo, Faulkner points out details of the redoubt excavation.

In addition to new information about an archaeological site, the inventory includes all previous research reports on the site and all relevant references, bibliographies and maps. About 40 archaeologists, many of them Faulkner's former students, routinely register sites and contribute to the database. They, along with historians, use it to plan and inform additional research.

Access to the online inventory is restricted to prevent public disclosure of the location of sites.

The database is frequently used for mapping and modeling. For example, it can instantly show differences in the settlement patterns of the French and British in the 17th century.

"We find that most of the British sites were below the 4-meter contour line above high tide, which tells us their allegiance, at least in the early years, was entirely to their ships," Faulkner says. "From the distribution of French sites, we see that they were much more successful in adopting the canoe and bateau, and going farther up the interior drainages."

The historic sites inventory has very practical as well as scholarly applications. The Maine Historic Preservation Commission uses it to help prevent highways, sewer plants and subdivisions from being built on top of archaeological sites — or at least to aid in salvaging as much information as possible when construction projects cannot be redesigned.

"We review about 3,500 federally funded and federally licensed projects a year, in addition to state projects and local projects, when asked by the municipalities," says Earle Shettleworth Jr., director of the Maine Historic Preservation Commission.

"One of the things we look at for each project is the potential impact on cultural resources, including historic archaeological sites. So, it is imperative that we have the most up-to-date information about those sites at our fingertips." ■



**“Scientists need to listen to local expertise, fishermen who spend their lives at sea and know areas and environments in a way that many marine scientists do not have the opportunity to know.”**

Emily Knight

Photo courtesy of Emily Knight

# THE scientist AND THE fisherman

**Traditional opponents combine expertise to fathom the effects of trawling in the Gulf of Maine**

*By David Munson*

**University of Maine graduate student Emily Knight was uniquely qualified for the collaborative research studying the effects of trawling on benthic habitats. Her passion for marine research was rivaled only by her desire to open new doors for communication. Knight saw the project as both an opportunity to collect important new data and a chance to bridge the gap between local knowledge and laboratory expertise.**

**THE FORM OF COMMUNICATION IS QUIET BUT EFFECTIVE**, familiar to anyone who has spoken to a New England crowd about taxes, politics or change. As subtle as a raised eyebrow or an unconscious crossing of the arms, it speaks volumes through its uncomfortable silence.

It's the unspoken language of skepticism, and Maine fishermen speak it fluently.

Maine's fishing community has a reputation for doubting science and questioning change, traits that have only been reinforced by the recent flood of rules and regulations aimed at protecting the Gulf of Maine's dwindling groundfish stocks. And while even the most stubborn of sternsmen will admit that something has to change in order to turn things around, when you're dragging 20 tons of groundfish gear beneath 15-foot swells, skepticism and experience beat theories and projections hands down.

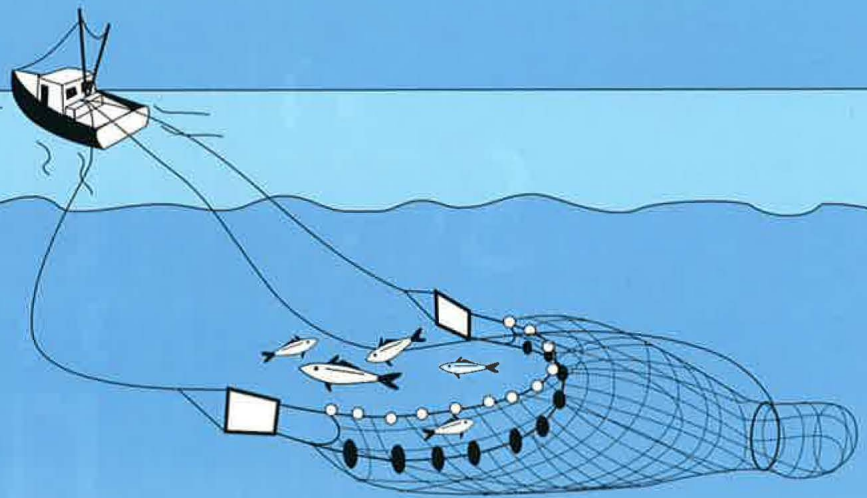
Fishermen assume their skeptical point of view because their livelihood and their lives depend on it, and sixth-generation draggerman Cameron McLellan is no exception.

Nearly four years ago, after reading a research paper by University of Maine Marine Science Professor Les Watling, McLellan's natural skepticism kicked into overdrive. McLellan took issue with a statement in which Watling compared dragging the ocean floor for groundfish to clear-cutting a forest. The lifelong fisherman simply didn't agree with Watling's claim. He needed to find out for himself.

McLellan, who sails out of Portland, worked with Laura Taylor Singer of the nonprofit Gulf of Maine Research Institute, located in the heart of that city's working waterfront, to develop a research proposal comparing the relative health of the ocean floor in protected areas to frequently fished regions in the gulf. The result was a \$195,000 grant from Northeast Consortium that brought together McLellan, Watling and UMaine graduate student Emily Knight for a three-year, groundbreaking study in seafloor ecology and scientist-fisherman relations.

Data gathered and analyzed from 2002–05 as part of Knight's master's thesis research resulted in a paper coauthored by the trio that was presented at national and international conferences. The research informs an ongoing debate about the impact of commercial trawlers on the biodiversity of the seafloor. With any luck, the findings will help steer fisheries management toward a more sustainable future.

**BEGINNING IN SPRING 2002**, Knight conducted research aboard McLellan's 72-foot steel-sterned trawler *Adventurer*. Using a robotic diver, she collected samples of the ocean floor and underwater video in the Western Gulf of Maine Closure, a federally mandated marine protected area closed to dragging, and in



**Ocean trawling involves the use of a cone-shaped net held open by otter boards.**

Illustration by Tamara Jones

traditional groundfish dragging areas in a portion of the Gulf of Maine known as the Kettle. McLellan's guidance in finding appropriate sampling sites, based on his family's decades of fishing history, was critical to achieving a meaningful outcome for the research.

"Cameron's direct involvement was of tremendous value to the project," says Singer. "He knows the places where people fish, how often they fish there, what kind of gear they use. You just can't get that kind of expertise anywhere but in the fishing industry."

Knight also was uniquely qualified for the project. The oceanography graduate student's passion for marine research was rivaled only by her desire to open new doors for communication. Knight saw the project as an opportunity to collect important new data and a chance to bridge the gap between local knowledge and laboratory expertise.

"Scientists need to listen to local expertise, fishermen who spend their lives at sea and know areas and environments in a way that many marine scientists do not have the opportunity to know," says Knight. "If more fishermen were part of the process, there would be less of an argument (about the findings); they could trust more."

With the help of Watling's extensive expertise in marine invertebrate research, Knight identified scores of organisms known to inhabit the heterogeneous goo that makes up the seafloor. A remote-operated vehicle was used to establish video transects of the study areas, and samples of

sediment were taken from locations closed to bottom trawling for two-, four- and six-year periods, as well as from the Kettle. The organisms found in each sample were identified and compared, establishing a list of major players for each bottom type. When the menu of species found in closed areas was compared to those groups found in the places that were frequently fished, a pattern quickly emerged.

"We're looking at all the components of the benthic community, including both animals that live in the sediment and living

ing that sessile animals, such as sponges and corals, were some of the hardest hit by trawling efforts. Groundfish spawn in habitat with structure. Juveniles hide in the sponges and corals.

The success of the first season of research led to additional funding from the National Marine Fisheries Service in 2004, allowing Knight to collect additional data that strengthened the significance of her initial findings. While the results of the study may not have been exactly what McLellan and his fellow fishermen wanted

**"I just wanted to make sure that regulations were being based on facts rather than opinion. Ignorance of what's happening out there is just going to work against us in the long term."**

Cameron McLellan



on top. The effects of trawling are different for each. Animals in the sediment reproduce faster and have shorter life spans. Those animals are able to recover quicker than those living on the surface of the sediments.

"In both regions of the closure, one closed for four years and the other for six, we found a huge amount of structure-makers, like worms in the sediment. It's the surface animals that find it harder to recover between disturbances," Knight says, explain-

ing that sessile animals, such as sponges and corals, were some of the hardest hit by trawling efforts. Groundfish spawn in habitat with structure. Juveniles hide in the sponges and corals.

Based on gradual increases in complexity and diversity of seafloor communities that have been protected from bottom trawl-

Cameron McLellan makes net repairs with help from his sons, Dustin and Brendon, who make up his crew.



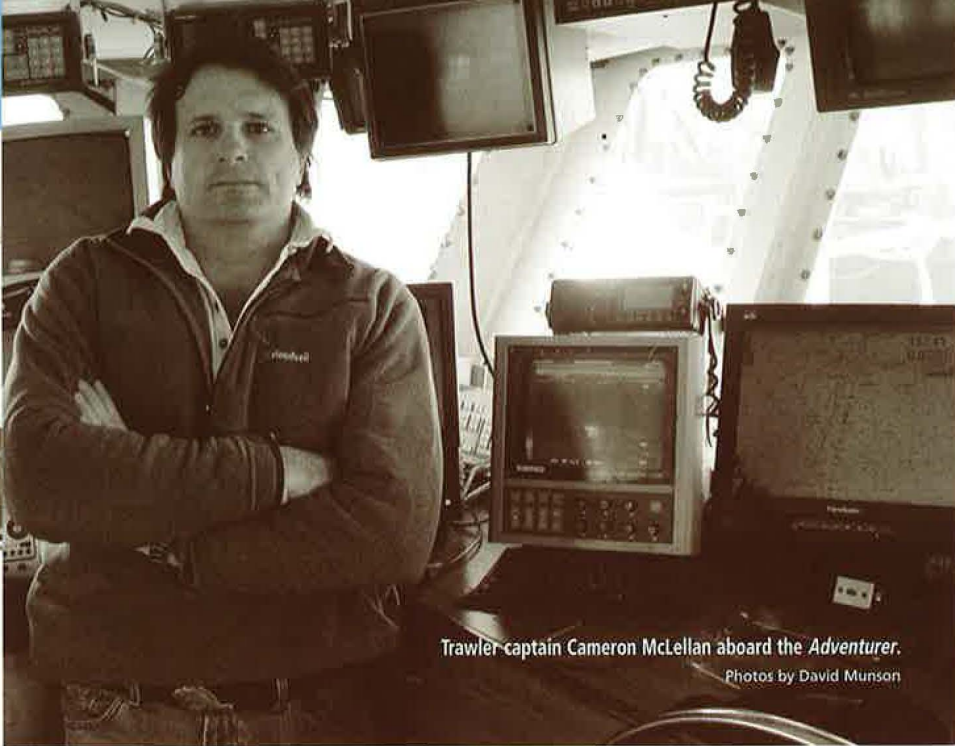
ing for two, four and six years, Watling estimates that it would take roughly a decade for the surface-dwelling organisms to reestablish themselves, but cautioned that a full recovery of the habitat would take much longer.

"I am pretty firmly convinced that if the groundfishing industry doesn't soon begin to undertake measures to conserve complex bottom habitat, there will be little chance that fishery will ever recover to levels seen 50 or 100 years ago. Small bottom fish need complex habitat and it is clear that rock hopper gear reduces habitat complexity," says Watling, an internationally recognized expert on ocean trawling who has written extensively on the subject.

**THE GOOD NEWS IS THAT** recently protected habitats are recovering. While anything resembling a "natural" condition would certainly be far in the future, Knight found that significant gains had been made in the short term.

"Scientists were predicting it would take decades for recovery, but didn't have an opportunity to look at it," says Knight. "We're already seeing signs of recovery after a significant amount of time. We're not seeing a huge trajectory change, but we can say it is recovering toward stability."

While McLellan and Watling still don't see eye to eye, their collaborative efforts in Knight's sampling project strengthened their respect for one another. Through involvement in this and other projects, McLellan has developed a greater appreciation for the



Trawler captain Cameron McLellan aboard the *Adventurer*.  
Photos by David Munson

## A fisherman committed to better management

**W**hether they drag for cod, trawl for shrimp or haul traps for lobster, the men and women who make their living off the coast of Maine are an uncompromising lot: deliberate, honest and stubborn. They won't be driven, they're not easily led and, as with scientists, the truth is something they like to discover themselves.

For 45-year-old trawler captain Cameron McLellan, the quest for truth became a 10-year odyssey that continues to blur the line between fishing and science.

McLellan has been fishing for groundfish full time for the last 30 years, having captained his first trawler at 19. His sons, Dustin, 21, and Brendon, 19, make up his crew as the seventh generation of McLellans who have made their living on cod, hake, pollack and flounder. Families like the McLellans have helped to define commercial fishing in Maine, building the industry and the traditions that have become such an important part of the state's cultural identity.

His experience as a commercial fisherman has carried him from the icy gray waters of the Bering Sea to the windswept shores of Chile. Despite his travels, he proudly describes himself as a Maine fisherman, and is as much a native of the waters surrounding Georges Bank and Jeffreys Ledge as he is of the quiet streets of his hometown of Boothbay.

As populations of groundfish continue to struggle, populations of draggermen are dwindling as well, driven out of business by

rising costs, shrinking profits and the ever-increasing weight of government regulations. Unwilling to stand by and watch the fishery collapse, McLellan took a head-on approach, proposing a series of research efforts to better understand Maine's groundfish populations and to develop a more sustainable management plan. From examining the potential benefits of artificial reefs to sampling the sediments on the ocean floor, McLellan has been involved in scientific initiatives and has coauthored several scientific papers.

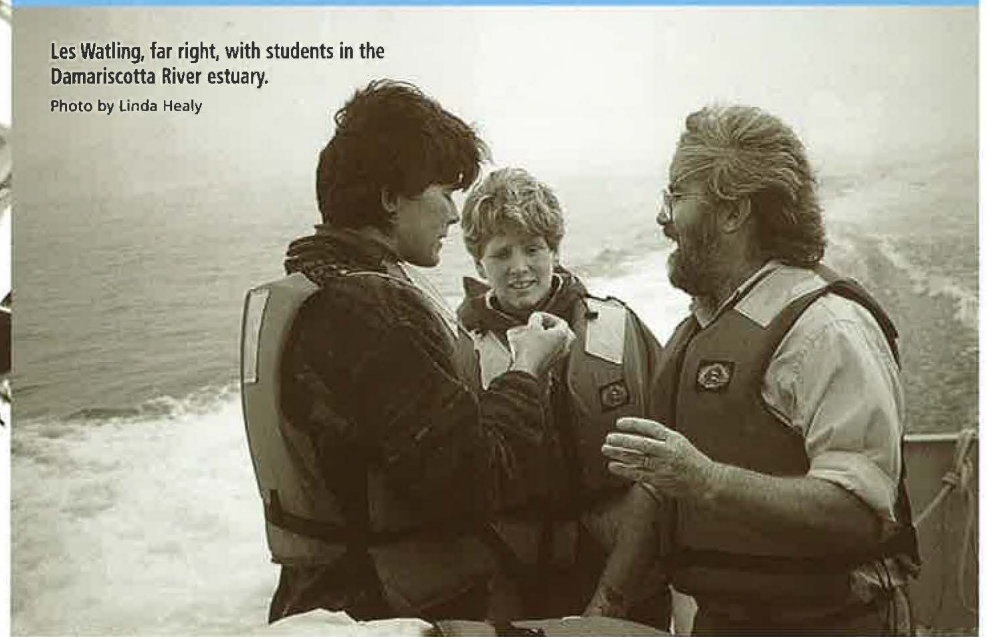
While his research efforts have given McLellan some hard-earned respect in the lab and on the docks, it is hauling nets for groundfish that pays the bills, and the margin between success and failure seems to shrink with every passing year. The seven-trawler McLellan family fleet has shrunk to a struggling three, as McLellan and his sons, his father and his siblings continue to eke out a living with only a fraction of the allowed days at sea they once had.

This season, McLellan has a limit of just over 81 days in which he can fish. Next season, he expects to have 60. As he watches the rising costs of fuel and gear push his expenses past the \$10,000 mark for every run, the idea of breaking even has become even more elusive than the fish themselves. Yet McLellan remains committed to the idea that better management can make a difference, and that collaboration between fishermen and scientists is the best way to get there.



Emily Knight at work in a Darling Marine Center laboratory.

Photo by Bill Drake



Les Watling, far right, with students in the Damariscotta River estuary.

Photo by Linda Healy

## Marine specialists on Capitol Hill

**E**mily Knight's groundbreaking research and professional interest in working with both fishermen and marine scientists resulted in her being tapped for a new opportunity in Washington, D.C.

Last fall, Knight was named one of two University of Maine graduate students to receive a prestigious John A. Knauss Marine Policy Fellowship. This semester, she is working as an oceans and fisheries specialist in the nation's capital. Knight, who received her master's degree in oceanography in December, is now a Knauss fellow in the office of Maine Rep. Tom Allen.

Another UMaine graduate student, marine biology and policy major Sheril Kirshenbaum, also is working in Washington as a Knauss fellow. She is in the office of Sen. Bill Nelson of Florida.

Knauss Fellowships, administered through the National Oceanic and Atmospheric Administration, are awarded to about 40 graduate students each year.

As part of her duties in Washington, Knight is using her expertise in marine science and communication to research policy issues related to the protection of Maine fishermen and the undersea environment on which they depend. She credits her UMaine experience with preparing her for the challenges ahead.

"I wanted to make sure that I did something that both allowed me to work directly with fishermen and had a meaningful connection to the environment," says Knight of her research. "I chose UMaine because I knew the trawler project would allow me to do that, and it worked out really well."

work involved in scientific research. He sees fisherman-scientist collaborations as critical to a workable management plan.

"When I first received money for doing research work, there was a lot of resentment on the waterfront. Some people thought I was getting a handout, and others were afraid that if we got really bad results, we might end up with emergency closures," says McLellan. "I just wanted to make sure that regulations were being based on facts rather than opinion. Ignorance of what's happening out there is just going to work against us in the long term."

Fishermen and scientists will likely continue to be on opposite sides of the proverbial fence when it comes to management of the fishery, and any reasonable management plan will require no small amount of compromise. The irony, of course, is that fishermen's hard-boiled skepticism

is what makes them so similar to scientists. Commercial fishing is certainly a science, filled with trial and error, variables and controls; science is a kind of fishing, where theories are upheld or denied based on the outcome of the final haul. Both fishermen and scientists require patience, skill and experience to achieve competence; both require skepticism and drive to succeed.

Knight hopes to use her training to help ensure cooperation at all levels.

"I'd like to bring science into the policy area," she says. "Not only is there a disconnect between science and fishermen, there's a disconnect between science and management, with a lot of miscommunication on both sides. Academic researchers don't want to get into policy, but somebody needs to interpret research to managers and bring it to the public forum so more of the community can have a voice in what scientists do." ■



**"I am pretty firmly convinced that if the groundfishing industry doesn't soon begin to undertake measures to conserve complex bottom habitat, there will be little chance that fishery will ever recover to levels seen 50 or 100 years ago."**

Les Watling

## A new course for Maine boatbuilding

U.S. NAVY SEAL TEAMS often use Mark V Special Operations Crafts to quickly get in and out of sticky situations. But the aluminum insertion vessels speed, durability and maneuverability come at a cost: repeated impact strain and injuries caused when the lightweight craft skips across the waves.

University of Maine mechanical engineering graduate student Kate Stephens is out to change that. In the process, she also may help point Maine boatbuilding in a new direction.

Stephens, who received a bachelor's degree in civil engineering at UMaine last May, is a key player in a cooperative effort involving the university, the Office of Naval Research (ONR) and the boatbuilding team at Hodgdon Yachts in East Boothbay, Maine. The project brings together cutting-edge composites technologies spearheaded by UMaine's Advanced Engineered Wood Composite Center (AEWC) and the long tradition of quality boatbuilding at Hodgdon Yachts. Its success could mean hundreds of millions of dollars in boatbuilding contracts in the state.

"This is a great opportunity for Maine's boatbuilding industry," says Stephens, a native of Harpswell, Maine. "The lab work that we have done shows real progress. We're setting milestones with every test."

While the project's aim is to improve the original Mark V, a primary goal is to use specialized composite materials in the hull



Photo by David Munson

and elsewhere that can absorb the shock created by high-speed travel. By dampening the effects of the boat's repeated impacts as it skims across the waves, the new materials can help protect the crew from back, neck and joint injuries.

Working with her adviser, AEWC technical services manager Bob Lindyberg, Stephens has developed and refined an innovative impact test that was used to select the composite material with the greatest shock-absorbent properties. Ultimately,

**UMaine graduate student Kate Stephens is one of the engineers working with the Office of Naval Research and the boatbuilding team at Hodgdon Yachts to improve the U.S. Navy's Mark V.**

ONR believes Stephens' test will be of great value when designing new composite boats.

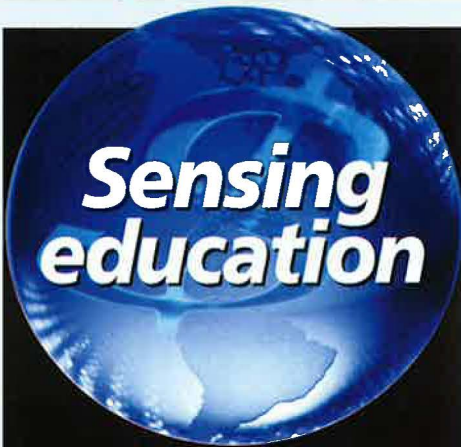
Maine has a long history of building military vessels, but contracts for smaller, high-tech designs have largely been awarded elsewhere. By combining the facilities and expertise at Hodgdon Yachts with the technological advances being made at UMaine, the project has the potential to open a new market for the state. The project has already resulted in the creation of a new company, Maine Marine Manufacturing LLC, the prime contractor for the construction of the full-scale technology demonstrator called the Mark V.1, plans on competing for the contract to replace the Mark V fleet.

"Through collaboration with the university, our team is able to compete for the Mark V replacement contract, which is in the range of \$200 million. We didn't have that opportunity before," says Steve Von Vogt, president of Maine Marine Manufacturing. "Bob and Kate's work in the composites lab has played an important part in the project all along. This is not just theoretical research that they are doing, this is about putting a deployable, high-tech design in the water for actual use by the military."

**The U.S. Navy's high-performance Mark V Special Operations Craft is designed to improve maritime capabilities.**

U.S. Navy photo





**BY THE YEAR 2011**, more than \$4 million in funding from the National Science Foundation (NSF), including \$1.9 million in newly awarded monies, will translate into nearly a decade of science and engineering education in Maine middle schools and high schools through the University of Maine's GK-12 Sensors! and Research Experience for Teachers (RET) Sensors! initiatives.

In this state, GK-12 Sensors! spins off UMaine's high-profile sensor research in the Laboratory for Surface Science and Technology. The initiative is directed by Electrical and Computer Engineering Professor John Vetelino, assisted by Constance Holden, spatial information science and engineering instructor, and Steve Godsoe, a Bangor High School teacher.

Graduate student scientists and engineers in sensor research take their knowledge into the classroom. The graduate fellows collaborate with teachers, many of whom become involved in sensor science and engineering in RET summer sessions.

Students learn about sensor science and engineering in their chemistry, physics, biology, environmental science, math, computer science or social sciences classes, which increasingly include community outreach projects. Ultimately, they come to understand the sensor technology that is all around them, and are encouraged to pursue careers in science and engineering.

At the end of its third year in 2005, UMaine's GK-12 Sensors! was integrated into 11 rural and urban schools.



## Momentum

The Research Plan to Create Jobs

A NEW STRATEGIC plan at the University of Maine called Momentum aims to increase funding for research and development, and to grow programs that contribute to economic development in Maine.

Research at the university has experienced hearty growth in the past several years; expenditures topped \$65 million in fiscal year 2005, and UMaine leveraged \$5 for every \$1 invested by the state. But the state's base-funding contributions through the Maine Economic Improvement Fund (MEIF), established by the legislature, have been mostly stagnant since 2002. Momentum asks for an increase in base funding to bring the state's research investment up to par with that of the region and the nation.

"The University of Maine's research is unique in the state, in that our faculty develop research into products that create jobs, while

Investing in research to strengthen Maine

**"We want to spark innovation and support new ideas across campus, and help them to grow. We also want our already successful programs to become world-class. Ultimately, UMaine research will help improve life for everyone in the state by creating jobs and growing the economy."**

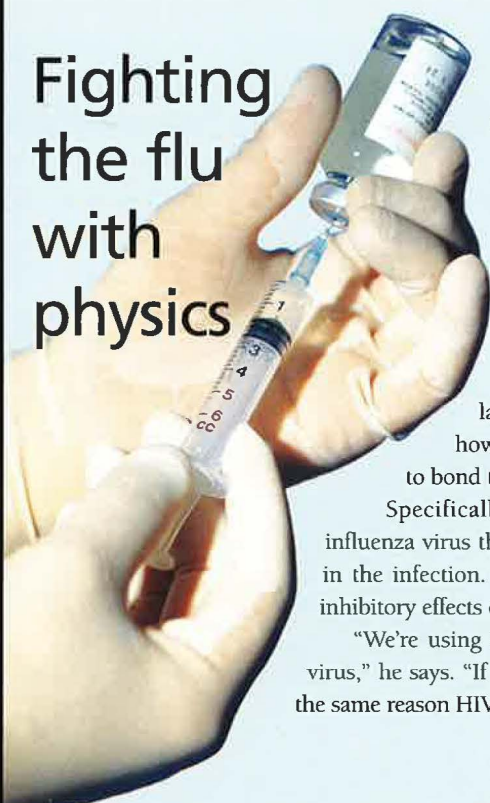
**Michael Eckardt**

contributing to science and providing an exciting education," says UMaine Vice President for Research Michael Eckardt.

Momentum builds on a tiered investment strategy: several faculty research growth projects will receive small awards; a more select

group of new and emerging areas will receive larger awards. The largest portion will be invested in three to four strategic focus areas, which will be expected to become self-sustaining within five years, creating space for growing other programs.

"We want to spark innovation and support new ideas across campus, and help them to grow," Eckardt says. "We also want our already successful programs to become world-class. Ultimately, UMaine research will help improve life for everyone in the state by creating jobs and growing the economy."



## Fighting the flu with physics

FINDING A WAY for human cells to reject invasions by influenza, HIV, Ebola and other viruses is the focus of research by a University of Maine physicist, funded by a five-year, \$615,000 grant from the National Institutes of Health (NIH).

Assistant Professor of Physics and Astronomy Sam Hess, a former NIH biomedical researcher, received the career award to study how viruses penetrate cellular membranes and what might be done to block infection.

Hess is collaborating with UMaine physicist R. Dean Astumian and NIH colleague Joshua Zimmerberg. Using laser-scanning fluorescence microscopes, Hess is studying how cholesterol and lipids play a role in assisting viral proteins to bond to the surface of cells, then penetrate and infect them.

Specifically, Hess is looking at hemagglutinin, the protein from influenza virus that opens a fusion pore in membranes of host cells to allow in the infection. Removal of cholesterol from membranes appears to have inhibitory effects on hemagglutinin.

"We're using these lasers and spectroscopy to see what's going on in a virus," he says. "If we can find out why influenza needs cholesterol, it may be the same reason HIV, or some other virus, needs cholesterol."



## HUD grant builds downtown coalition

THEY ARE QUESTIONS that plague many urban areas: How does a city make youths feel welcome downtown while avoiding conflicts with businesses and residents? How does a community provide enough affordable housing for elderly and low-income residents? How do people build and maintain a level of connectedness that fosters a vital, dynamic downtown?

In Bangor, Maine, a battery of newly funded and far-reaching community programs may provide some answers. The U.S. Department of Housing and Urban Development (HUD) recently awarded nearly \$400,000 to the University of Maine to establish a UMaine-Bangor Community Outreach Partnership Center (UMB-COPC), a collection of



**At the heart of many UMB-COPC initiatives is service learning. UMaine students are applying their skills in the field for the benefit of the community. The project will combine the enthusiasm of dozens of UMaine students with the expertise of 27 faculty members representing all six of the university's colleges.**

people and programs aimed at fostering a positive environment for all in Bangor's downtown neighborhoods.

The project, spearheaded by Kathryn Hunt of the Margaret Chase Smith Policy Center, involves more than 20 downtown organizations. Distributed over three years, the federal funds will support three main initiatives: the Community Inclusion Project, helping homeless teens and other disenfranchised residents to reconnect with the city; the Salvation Army's Powerhouse Teen Center; and a needs assessment of housing and special services for elderly residents and persons with disabilities.

The project is expected to create new avenues of communication between UMaine and the community.

## Dogfish sharks Down East

NEW TENANTS at the Center for Cooperative Aquaculture Research in Franklin, Maine, are proving that the facility lives up to its name.

A school of 30 common spiny dogfish, *Squalus acanthias*, are now swimming around in two 12-foot, 3,500-gallon tanks at the center, where research includes studies of halibut, cod and salmon. The small sharks, which average 4 feet long, belong to the Mount Desert Island Biological Laboratory (MDIBL) in Salisbury Cove, Maine. They are helping geneticists understand human diseases, including cystic fibrosis.

The migratory sharks show up in the Gulf of Maine in May or June. But to maintain their stock year-round, MDIBL researchers had to buy live dogfish in Cape Cod, which then had to be trucked to Maine — a time-consuming and expensive process, not to mention a missed opportunity for Maine fishermen, says MDIBL Associate Admin-

istrative Director Charlie Wray.

Boarding the fish in Franklin is a win-win solution. UMaine's new building includes a high-tech, temperature-controlled, closed-circulation system, providing a warm environment that is much to the fishes' liking. MDIBL researchers now have a relatively short trip to retrieve the dogfish as needed, and can continue to buy them live from local groundfishermen.

The arrangement demonstrates the university's ability to extend its services to enterprises throughout the state.



## Maine Women

In an online women's studies course on Maine women, taught by Carol Toner, coordinator of the Maine Studies Program at the University of Maine, each student starts the semester by listing five of the most important women in state history. In observance of Women's History Month in March, we're sharing the most frequent names on that list. The first six are mentioned most.

**Sarah Orne Jewett** — author

**Edna St. Vincent Millay** — poet/author

**Margaret Chase Smith** — politician

**Susan Collins** — politician

**Olympia Snowe** — politician

**Ruth Moore** — author

**Mabel Wadsworth** — women's health reformer

**Elizabeth Russell** — geneticist

**Mildred Brown Schrupf** — home economist

**Joan Benoit Samuelson** — marathon runner

**Molly Spotted Elk** — dancer

**Chansonetta Stanley Emmons** — photographer

**Lillian Nordica** — opera singer

**Dorothea Dix** — mental health reformer

**Cornelia "Fly Rod" Crosby** — outdoorswoman

**Carolyn Chute** — author

**Martha Ballard** — midwife

**Harriet Beecher Stowe** — author

**Rhea Côté Robbins** — author

**Louise Bogan** — author

**Edith Patch** — author and entomologist

**Gail Laughlin** — lawyer and women's rights activist

**Emma Eames** — opera singer

**Cathie Pelletier** — author

**Donna Loring** — politician

## oil crops for



## BIODIESEL

**W**ITH THE HELP of a University of Maine Cooperative Extension crops specialist, the Houlton Band of Maliseet Indians is exploring the logistics of establishing a biodiesel refinery in northern Maine.

Assistant Extension Professor Peter Sexton, based in Aroostook County, provided expertise as part of a feasibility study for the Maliseets, conducted by the consulting firm Regent Associates. He contributed research data and field expertise for the initial grant proposal, and helped to outline the potential for oil crop production in the state.

Sexton also is pursuing research that involves testing the viability of Maine-grown canola and other oil crops as potential sources of raw material for the manufacture of biodiesel.

According to John Cancelarich of Regent Associates, the proposed refinery would produce 5 million gallons of biodiesel annually for distribution in the state. Currently, Maine does not produce enough oil crops, including soybeans, to supply such a facility, but Cancelarich predicts that acreage in the state would double or triple in a short time.

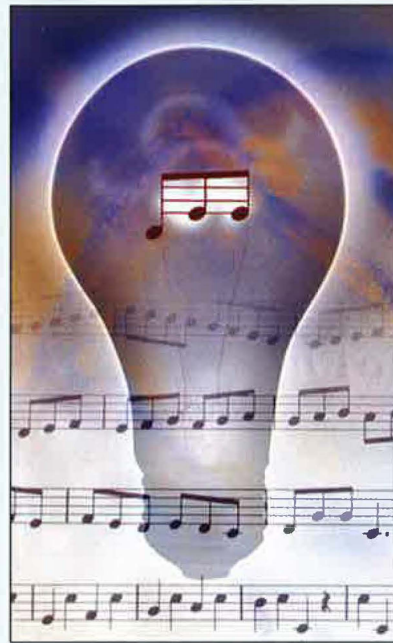
Talks have begun regarding potential markets and investors.

## What is an idea?

SPARKING AND SUPPORTING student entrepreneurship is an important new dimension of the undergraduate experience at the University of Maine. A number of initiatives are under way, setting the stage for the Student Innovation Center, scheduled to open on campus this year.

One of these initiatives is an interdisciplinary studies course, designed to help students develop a systematic, engineering approach to inventing, evaluating and selling innovative ideas with commercial viability.

Innovation Engineering I: The Beginning of an Idea is taught by UMaine chemical and biological engineer Darrell Donahue, English scholar Margaret Lukens and musician Eliz-



**The new Innovation Center on campus will be an incubator for student entrepreneurs. Here, they will tap into faculty expertise and other resources to develop innovative products and services, and take the first steps toward creating businesses.**

abeth Downing. Together, the three faculty members offer perspectives from their fields on how a variety of bright ideas can come to fruition.

Students learn how to separate big ideas from smaller ones, and how to know if an idea is worth the investment of time and money.

Entrepreneurs, both novice and seasoned, have to know how to confidently talk about and present an abstract idea in concrete terms in order to increase the odds of marketplace success. They also have to understand the logistics that are involved in taking an innovation from concept to reality.

The three-credit class is in its second semester.

**A** THREE-MONTH GEOLOGICAL expedition to gather data on the history of sea level change along Ireland's spectacular coastline has produced new evidence about the Emerald Isle's historical relationship with Scotland.

University of Maine geologist Joe Kelley, and fellow researchers Andrew Cooper and Derek Jackson of the University of Ulster used seismic reflection and coring techniques, finely tuned through years of similar data collection in the Gulf of Maine, to disprove some previous theories about the composition of marine sediments. The data suggest that Ireland was never linked to Scotland via a land bridge, thus answering an important geological and anthropological question.

Using carbon dating of buried seashells as a temporal point of reference, Kelley examined the stratification of sand, gravel and marine mud deposits, establishing a timeline for the emergence of the unique geological characteristics of the Irish coast spanning tens of thousands of years. That timeline contradicts the long-held notion that Ireland's first human population walked to Ireland from Scotland.

## Secrets of the Irish coast



# lasting impression

From the collections of the Maine State Museum



LAST FALL AT THE University of Maine, secretary Karen Stormann made history. In Alumni Hall, she was sorting through boxes of inactive files from the Office of the Vice President for Administration and Finance when she discovered three bound volumes containing the earliest board of trustee records for the University of Maine, then called the Maine State College of Agriculture and the Mechanic Arts. Fogler Library Special Collections Head Richard Hollinger and archivist Brenda Steeves confirmed the ledgers' authenticity. The documentation of UMaine's earliest days will be part of a university archive being established in Special Collections with the help of a \$5,000 grant from the Maine Historical Records Advisory Board. The college's first board had 16 trustees elected by the legislature, each representing a county. The trustees included Hannibal Hamlin, pictured left, who was selected president. Hamlin, a Penobscot County lawyer, served in the Maine legislature and the U.S. Congress, and as Maine governor, Abraham Lincoln's vice president and a minister to Spain.

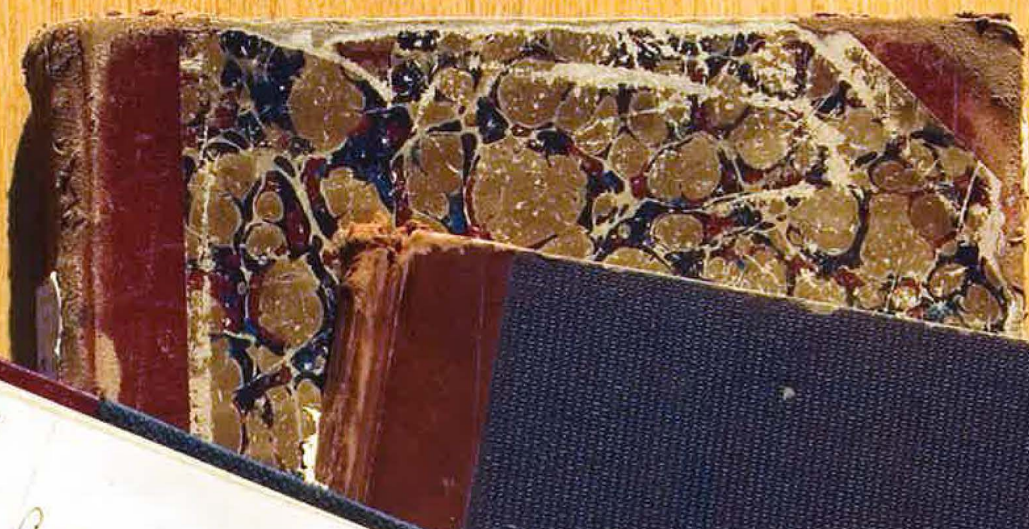
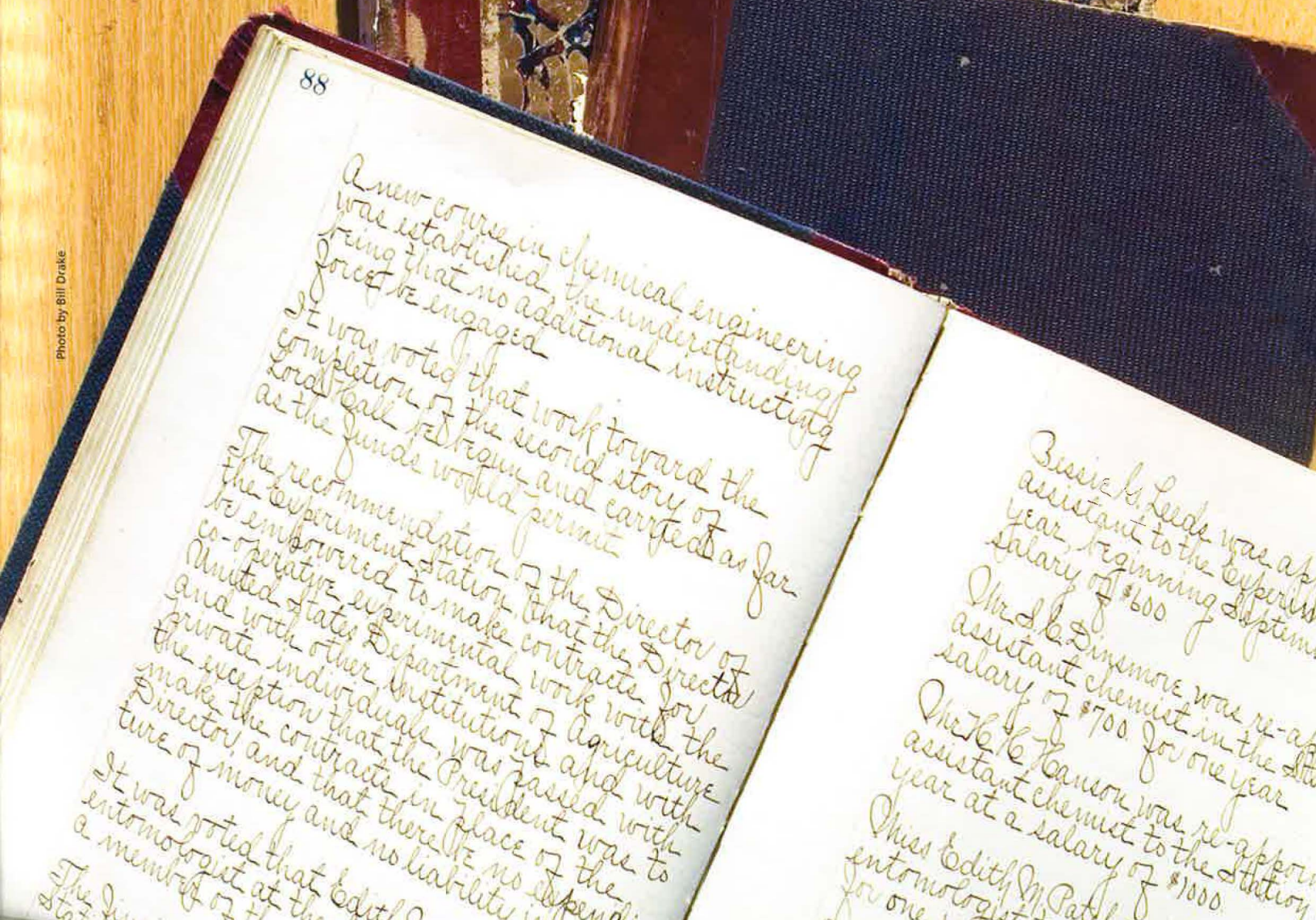


Photo by Bill Drake



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A new course in chemical engineering was established, the understanding of being that no additional instruction of forest be engaged.

It was voted that work toward the completion of the second story of Lord Hall be begun and carried as far as the funds would permit.

The recommendation of the Director of the experiment station, that the Director be empowered to make contracts for co-operative experimental work with United States Department of Agriculture and with other institutions and with private individuals, was passed with the exception that there be no dependence of money and no liability in the making of the contracts.

It was voted that Edith A. [unclear] entomologist at the [unclear] a member of the [unclear]

Burriel L. Leeds was appointed assistant to the experim. station, beginning Sept. 1st, 1890, salary of \$600.

Mr. S. A. Dinsmore was re-appointed assistant chemist in the station, salary of \$700. for one year.

Mr. J. E. Cannon was re-appointed assistant chemist to the station, year at a salary of \$1000.

Miss Edith M. [unclear] entomologist, for one year.



*A Bit of Stonington, Maine* by John Marin, watercolor, 1926  
Collection of the University of Maine Museum of Art, Anonymous Donor  
Photo illustration from images by Gina Platt

## Exhibition framework

**W**ORKS OF MAINE ARTIST John Marin are among the more than 5,700 pieces in the University of Maine Museum of Art's permanent collection that could be reintroduced to the public with the help of a new endowment fund. The **Museum of Art Acquisition and Conservation Endowment Fund** has been established in the **University of Maine Foundation**. Support to help fully endow the fund will make it possible to increase efforts to restore and preserve existing pieces, and to expand the collection.

With the Museum of Art's move to a new, larger, state-of-the-art location in downtown Bangor in 2002, many more pieces from the permanent collection are on exhibit. An 80-year-old Marin painting, *A Bit of Stonington, Maine*, recently returned from conservation treatment and framing as part of the contemporary art museum's enhanced conservation efforts. With the help of the new fund, pieces like a 1922 etching by Edward Hopper and a circa 1946 watercolor by Andrew Wyeth also will be available for rotation into the museum's exhibitions.

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