

Weed Warfare

Sound Check

Weighing In

Seeing the Light

UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

SUMMER 2010



Global Worming

What can microscopic 'beasts' tell us about the planet's past — and future?



2
Weighing In

Nutritionist Katherine Musgrave is battling the same health issue today as she did when she began her career in human nutrition more than six decades ago. Only today, malnutrition is in the form of obesity.

6
Discriminating Youths

Sociologist Amy Blackstone studies how age affects workers' perceptions of sexual harassment. Some of her most surprising findings focus on young workers.

20
Sound Check

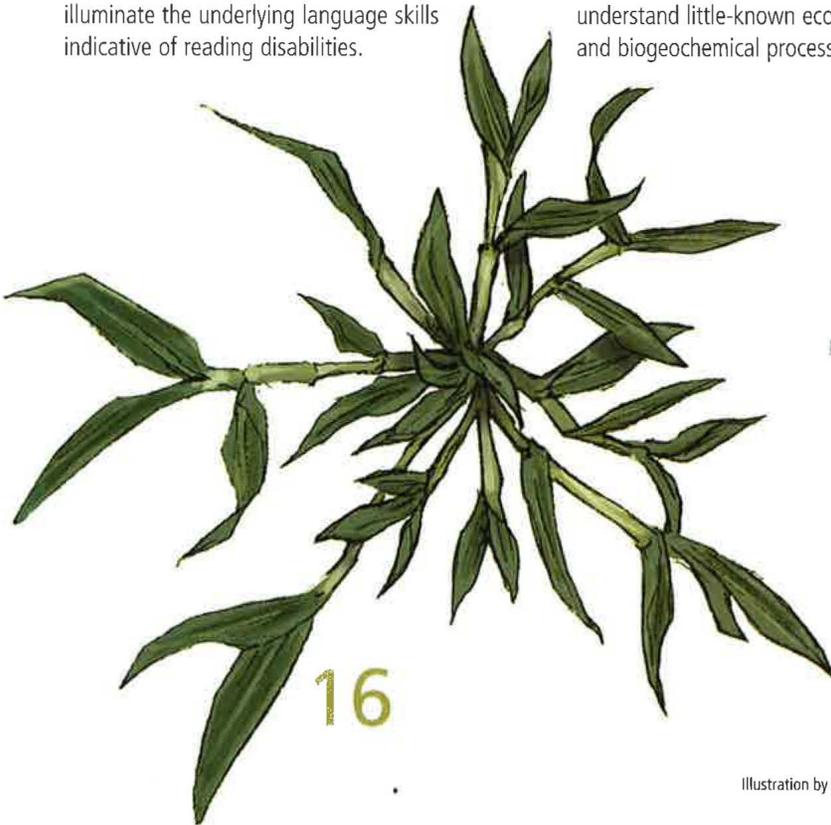
Speech-language pathologist Susan Smith has discovered behaviors in babies as young as 6 months that illuminate the underlying language skills indicative of reading disabilities.

23
Seeing the Light

Oceanographer Emmanuel Boss is using marine optics to probe beneath the ocean's surface to better understand little-known ecological and biogeochemical processes.

26
Global Warming

Biologist Seth Tyler leads a database project to gauge the worldwide biodiversity and phylogenetic relationships of lower marine worms.



+Online umainetoday.umaine.edu

In *UMaine Today* magazine, +Online indicates the availability of additional content — Web-exclusive stories, video and audio clips, photo galleries, full-length versions of articles and a comprehensive editorial archive. More online stories will be added monthly, including answers to questions posed to our In the Know experts.

In the Know

David Townsend on red tide.

Barbara Murphy on what's next after the garden is planted.



16
Weed Warfare

In the epic struggle to control weeds, ecologist Eric Gallandt takes a systemic approach that addresses the seed bank — seeds at the soil surface and those incorporated in the soil.



departments

Scene on Campus	9
Alumni Focus	10
Connection	13
Student Focus	14
Insights	30

Photo gallery

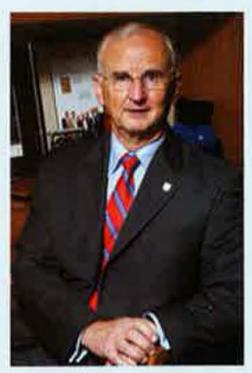
- Sew Fabulous** A 4-H after-school initiative in Lewiston, Maine, reaching girls from local East African and Somali communities.
- Chile Expedition** The February 2010 UMaine research mission to the Tupungatito Caldera Glacier, Chile.

Video features

- Sound Check** The early language clues to reading disabilities.

President's Message

OUR RECENT commencement ceremony reminded us once again of the fundamentally optimistic nature of the higher education enterprise. I shook hands that day with nearly 2,000 new University of Maine graduates. As always, it was most enjoyable to share in a moment they will each long remember.



The Class of 2010 is a wonderful group and I am certain that its members will follow in the noteworthy footsteps of the alums who preceded them.

Perhaps our optimism has been challenged a bit during this academic year as we have wrestled with academic reorganization and other issues related to the budget challenges that we face in unison with all other public institutions. But I truly believe that UMaine emerged this spring stronger and more resolute, determined to find better, more efficient ways to fulfill the unique and vital responsibilities assigned to us as Maine's land-grant university.

Through an open, inclusive process, we have worked together to create a new paradigm that will lead UMaine to a more sustainable future. We are calling our plan UMaine 150, because it will lead us directly into UMaine's sesqui-centennial celebration in 2015.

While it has not been easy, this process does show what a community of capable, committed and creative people can accomplish by working together toward a common goal. For more information on both the process and the outcome, I invite you to visit www.umaine.edu/umaine150.

Robert A. Kennedy
Robert A. Kennedy
President



ON THE COVER: Properly identifying species is important to all biological research. Data on the identification of lower marine worms, most of which are no bigger than specks of dust, are cached in a comprehensive database maintained at the University of Maine. This image from the database is made with a confocal microscope and shows key characteristics of the acoele turbellarian *Haplocelis dichona*, which lives in coarse sand in beaches of southern Brazil. Read more about UMaine's Global Worming project on page 26. Photo by Matthew Hooge

Affordable, healthy food is one of the core tenets of Michelle Obama's anti-obesity campaign, which Katherine Musgrave fully supports.



Weighing in

Katherine Musgrave's ongoing battle against malnutrition in America

By Kristen Andresen

WHEN KATHERINE MUSGRAVE took her first nutrition class in 1937, she learned about six nutrients, and, as she likes to say, "We didn't know much about them." The discovery of the healing power of vitamins for those with vitamin deficiencies was huge, and she and her colleagues saw them as a cure-all.

Fast-forward to 2010. At 90, Musgrave is a registered dietitian and professor emerita of foods and nutrition at the University of Maine, and she still teaches an online course that attracts up to 300 students a semester. In her spare time, she counsels patients with dietary needs and works with a local allergist.

Musgrave is a pioneer who has seen the entire field advance over the course of her lifetime. But while the science behind human nutrition has evolved dramatically from those six vital nutrients, the fundamentals remain the same. So, too, does the field's core concern.

"Back then, the emphasis was on combating malnutrition, as it is now," says Musgrave, who joined the UMaine faculty in 1969 and in 2002 received the regional University Continuing Education Association Faculty Member of the Year Award.

"But malnutrition then was the complete opposite of what it is today. It was a gaunt, thin, hungry person."

Though malnutrition takes many forms today, it's more likely that someone who is malnourished is a heavy, plump, full person. With obesity, the problem isn't not enough food, it's not enough of the right

foods. And it's not quite as simple to combat as its predecessor — which a high-calorie, high-vitamin diet could cure.

WHEN MUSGRAVE went to work as a dietetics instructor and dietitian at the University of Alabama in 1945, even the most cognitively disoriented and physically emaciated patients responded almost immediately to niacin. But vitamins aren't enough to turn things around today.

The solution to obesity and other nutritional disorders requires significant lifestyle changes — and a return to basics.

"Then, the issue was about getting enough food of the right kind," Musgrave says. "Now, our goal is still to get the right food, but this complete reliance on convenience foods is costing us a great deal in health. Convenience foods can't provide the basic nutrients that whole foods prepared at home do."

By "convenience foods," she's talking about everything from prepackaged pudding cups to a drive-through meal at a fast food restaurant. Some, such as bagged whole wheat bread and canned fruits and vegetables, are nutritionally rich. But others are full of empty calories. Because they are often less expensive and less time-consuming to prepare, many families turn to options with less nutritional value.

"I think we have a real economic injustice that is a greater threat to good nutrition than a lack of knowledge," Musgrave says. "When you have a family living on \$17,000 or \$24,000 a year, they often

Weighing in

know what they're supposed to be eating. They've seen the food pyramid guidelines. But when they go to the grocery store, they can't afford some of the more healthful alternatives."

Affordable, healthful food is one of the core tenets of Michelle Obama's anti-obesity campaign, which Musgrave fully supports. Earlier this year, President Barack Obama established a task force on childhood obesity, while Michelle has taken the lead on "Let's Move," a nationwide effort to help American children become more physically active and address some of their most pressing nutritional issues.

According to LetsMove.gov, the United States spends more than \$150 billion annually to treat obesity-related conditions. The incidence of obesity has tripled in the last three decades, and if this trend continues, American children may have a lower life expectancy than their parents.

Michelle Obama's plan targets areas where healthy food options are sparse, presents a revamped food pyramid, and encourages parents to know their children's body mass index, and promote healthful food and play. It also seeks a reauthorization of the Child Nutrition Act, which calls for increased nutrition education and healthier food choices in public schools.

"I believe she will advocate for Head Start and some of these programs that will educate not only the children but their parents," says Musgrave, who serves on Maine's Head Start health advisory committee. "I like her attempt at a ripple effect. To me, the benefit will be a rippling over to the parents and families of the children these programs are targeting."

Musgrave says good nutrition starts at home, and she bemoans the elimination of home economics — or any other practical food-related courses — from most public

school curricula. When some patients come to her seeking advice, the idea of baking their own bread or soaking beans is completely outside their realm of experience.

She maintains that providing children with the skills necessary to prepare food at home would cut down on their reliance on convenience foods as adults and lead to healthier choices in the long run.

"The big emphasis is on more fruits, vegetables and whole grains," says Musgrave, the namesake of a Maine Nutrition Council award. "That's where I think the nutritionist is really challenged today. The public is looking for a quick fix."

AFTER MORE THAN 60 years in the field, Musgrave is convinced that there is no quick fix. MyPyramid.gov, the U.S. Department of Agriculture's interactive new take on the food pyramid, has made it so that



NUTRITION BENCHMARKS

cited by Katherine Musgrave

1930-1940s

Nutrient and energy deficiencies — The Great Depression highlights serious nutritional deficiencies, especially in the rural South. Studies done on pellagra and other diseases caused by poor diet.

1940-1950s

Vitamins — Scientists identify chemical formulae of essential vitamins. Pharmaceutical companies synthesize them, then represent them to physicians as cure-alls. Cornell University nutritionists report on low iron intake in U.S.

1950-1965

Iron and protein anemia widespread — Geritol (12% alcohol) becomes popular. Amino acids and complementary plant proteins identified and studied.

1969-72

Guidelines and food supply — White House Conference on Nutrition reveals need for guidelines. Congress directs development of food supply programs, including food stamps, meals for the elderly, WIC, Head Start, summer feeding for children.

people don't need to consult a nutritionist to get trustworthy eating and exercising recommendations. Musgrave also sees the marriage of nutrition and food science as a boon to the private sector, where firms such as McDonald's have seen the benefits of consulting a dietitian when developing new products.

But in terms of tools, the closest thing to a magic bullet is a food journal. Studies have shown that people who keep track of everything they eat are more likely to lose weight and keep it off.

"Our work is slow to make any definite change," she says.

Musgrave's prescription for maintaining a healthy diet and weight takes time. It requires discipline. Exercise. Cooking. And in many cases, changing bad habits.

But unlike fad diets, as-seen-on-TV exercise contraptions and weight loss pills, it works.

"Back then, the emphasis was on combating malnutrition, as it is now. But malnutrition then was the complete opposite of what it is today. It was a gaunt, thin, hungry person."

Katherine Musgrave



She sees it in her students, who often report that they've lost weight as a result of taking her class in the fundamentals of nutrition. She sees it in her patients, some of whom come in as a result of diabetes or heart disease and end up slimmer and healthier. And she sees it in herself.

At 90, she's slender, fit and active. She starts every day with a healthy breakfast. She feels guilty when she doesn't exercise. And though she admits to not baking her own bread, she only buys whole grain — and she has to restrain herself when she sees people putting loaves of white bread in their carts at the supermarket.

For Musgrave, the more things have changed, the more they've stayed the same.

"The basic principles of getting adequate nutrients in balance with a variety of foods in moderation — those were the principles in 1937 and those are the principles today in the textbooks I'm teaching," she says. ■



1970-75

Sodium prevalence — High salt content in canned and convenience foods leads to increased risk of strokes and high blood pressure.



1970-90

Fat Intake — High incidence of heart disease leads to research on total fat, cholesterol and lipoproteins. Pharmaceutical companies develop statins.



1990-95

Calcium — Aging population leads to high incidence of osteoporosis. Decrease in milk consumption and increase in soft drink consumption implicated.



1995-2004

Carbohydrate — Low-carb weight loss diets in vogue.



2005-2010

Vitamin D — The vitamin is found to have important function in calcium absorption. Use of sun blockers and lack of direct sun north of 40th parallel decrease available amount of vitamin D.



THINK BACK to your first job. You might've worked at an ice cream parlor or a fast food joint. Maybe you waited tables, folded sweaters,

washed cars. But chances are, no matter what you did, your professional life has changed significantly since then.

The experiences of teens and young people in their early 20s differ sharply from those of older workers. When you're young, certain behaviors are considered acceptable by you and your peers more than they would be at any other time of your life. You might flirt with co-workers. Date them. Hang out.

But as University of Maine sociologist Amy Blackstone and her colleagues have found, one workplace experience can happen at any age: sexual harassment.

Since 2000, Blackstone and sociologist Christopher Uggen of the University of Minnesota have studied how age affects workers' perceptions of sexual harassment. They are among the first researchers to consider the experience of young workers in this way.

"The dearth of research on adolescents and those in their early 20s might lead people to assume that sexual harassment isn't a problem for young people, but that would be the wrong conclusion to draw," says Blackstone, an associate professor of sociology whose research interests include gender, social movements, work and families.

It is her hope that this entire body of research will provide greater understanding about the underlying cultural and legal issues surrounding sexual harassment, and lead to better training and prevention efforts in the future.

"Sexual harassment isn't just about some guy asking a woman he's attracted to on a date," Blackstone says. "It's about overpowering someone."

HISTORICALLY, MOST sexual harassment research has centered on mid-career workers, mainly women. That continues to be the case, but as Blackstone says, such a narrow focus only tells part of the story. Through their research, based on survey and interview data from Minnesota's

annual Youth Development Study and the national General Social Survey, Blackstone, Uggen and their team give a broader view of sexual harassment across all ages and both genders.

Because the Youth Development Study has followed the same individuals since it was first administered to 1,010 ninth-graders in 1988, participants have been able to reflect on their experiences. The study started as a way to measure what impact working nights and weekends had on teens' school performance and sense of efficacy. Uggen and Blackstone added questions about sexual harassment, and their findings are somewhat surprising.

For example, it's not just female workers who experience discrimination through sexual harassment. Men do, too, though at lower rates than women. By examining the issue using feminist theories, Blackstone and Uggen maintain that such harassment is a gendered expression of power — one that has more to do with the harasser than the harassed.

"You need to recognize that harassment is less about targeting a particular gender

Discriminating youths

By Kristen Andresen

UMaine sociologist looks at sexual harassment among teen workers

than about elevating a particular expression of gender," she says. "In our culture, we most value a heteronormal sexual expression. It's about privileging a particular male expression of gender."

BLACKSTONE, UGGEN and UMaine alumna (and now a University of Minnesota graduate student) Heather McLaughlin recently found that women in supervisory positions are more likely to experience sexual harassment in the workplace than their female co-workers who are not in management. Though this may seem counterintuitive, the researchers maintain that males may see this as a chance to keep women "in their place."

Another UMaine alum, Jason Houle, now a doctoral candidate at Penn State, recently co-authored a paper based on the Youth Development Study data. Blackstone, Houle and Uggen interviewed 33 participants, who were in their late 20s at the time, to see how their attitudes toward appropriate workplace interactions have changed.

"If you ask five different people, you get five different definitions of harassment," Blackstone says. "That's especially true with younger workers. They're learning what it is

to be a worker, and they're also at the age where they're more likely to be sociable with their co-workers in a way that people who are married or have kids aren't. They're at the age when they're looking for potential mates."

Researchers have found that adolescents are exposed to more sexualized interactions in the workplace, in part because they tend to work in service industries, where flirting

"Harassment is less about targeting a particular gender than about elevating a particular expression of gender."

Amy Blackstone

and other sexual behaviors are more common. That's not to say that these interactions are necessarily unwelcome. Nor does this mean that the workers automatically consider these behaviors to be harassment — especially at the time.

And even if they do perceive the actions of their co-workers as sexual harassment, younger workers tend to deal with it differently than more mature employees.

"They may not follow formal channels in terms of reporting, but that doesn't mean they do nothing," Blackstone says. "Somebody could perceive what happened as sexual harassment, tell a friend about it and feel like they've exercised their legal rights."

In her research, Blackstone has found that people use a variety of strategies to deal with sexual harassment. Understanding those coping mechanisms is important when it comes to developing more effective workplace training programs — a subject that Blackstone plans to explore.

Last summer, she also launched a Maine-based survey that studies sexual harassment, bullying and age discrimination among workers age 62 and older. Some of the early responses indicate that sexual harassment among older workers is as prevalent as it is among adolescents.

"In our culture, age is a fundamental dimension of power that can make workers at both the very beginning as well as those in the later stages of their working lives more vulnerable to harassment," she says. "Understanding the experiences of both groups is essential for employers and policy makers interested in maintaining a healthy workforce." ■

Lunar living

A NASA project offers hands-on learning and a glimpse of future habitation

NASA HAS MADE a big investment in the University of Maine in recent months that will result in students getting the chance of a lifetime to be involved in research related to lunar habitation.

The project, led by electrical and computer engineering professor Ali Abedi, is funded by nearly \$2 million from NASA. An additional \$2.2 million from the Maine Technology Institute will be used to purchase equipment and fund a wireless broadband project on campus that will have statewide benefits.

The research will involve a 42-foot by 10-foot inflatable lunar habitat, the only one of its kind in the world. Over the next three years, UMaine electrical and computer engineers, along with 10 undergraduates and four Ph.D. students, will outfit the structure with wireless sensors to monitor structural integrity, micrometeoroid impacts and internal environmental conditions.

The goal of the new technology is to ensure the safety of astronauts undertaking missions on the moon, Venus and Mars, expected by 2030.

Applications for the sensor technology also include monitoring of inflatable bridges and domes for

defense and emergency management.

The inflatable structure, which will be housed in a temporary facility on campus, will take about three months to erect. In addition, NASA has granted Abedi an additional \$252,425, with matching funds from two partnering institutions — Jackson Laboratory and the University of Southern Maine — and the Maine Economic Improvement Fund. Once work on the initial structure is completed, testing will begin on two smaller inflatable habitats using sensors now being created by UMaine researchers.

The new sensors will incorporate MEMS accelerometers to detect impacts on the structure and assist an intelligent ultrasonic chip in detecting leaks.

UMaine engineers will lead the wireless sensor research; USM faculty will develop research and education aspects of the MEMS sensors; and Jackson Lab scientists will work with Women in Engineering of the Institute of Electrical and Electronics Engineers to coordinate outreach activities, and hold workshops and seminars promoting STEM (science, technology, engineering and mathematics) career paths for girls in Maine.

Important journalism

Covering the other side of Haiti's story

By Matt Wickenheiser



"On our last day there, Dr. Youseline Telemaque, an ob-gyn funded by Konbit Sante, took us into Petite Anse, a slum built on the plains of garbage and trash. She showed us the work done there by the nonprofit's health care workers. As we walked along causeways of garbage that kept us above the contaminated water, small children followed us, begging for food. It was awful, horrible and heart-wrenching. It's hard to imagine that poverty on this level exists in this hemisphere." Matt Wickenheiser



Photo by Greg Rec

Editor's Note: Within days of a massive earthquake that devastated Haiti this past January, The Portland Press Herald staff writer and University of Maine alumnus Matt Wickenheiser was there. UMaine Today magazine asked Wickenheiser to share his experience.

THE EARTHQUAKE that destroyed Port-au-Prince and devastated Haiti hit on a Tuesday (Jan. 12). The first thing Wednesday, my editor and I were talking about heading down to

cover the disaster for my newspaper.

On Saturday, photographer Greg Rec and I were in the Dominican Republic, making arrangements to take a daylong bus trip overland into the northern part of Haiti. Sunday evening, we arrived in Cap Haitien, Haiti's second-largest city, and we immediately began working the story.

I'd like to say this sort of thing happens all the time. That I live the exciting life of a global journalist, bag always packed, ready to head into war zones and disaster areas to cover the world's breaking news. When I was studying journalism at the University of Maine, working as a reporter, (sub-par) photographer and city editor at the *Maine Campus*, that was the life I envisioned — either globe-trotting or covering the city-seedy-underbelly beat at a major metro daily newspaper.

The truth is, I work at a regional daily newspaper. Granted, *The Portland Press Herald/Maine Sunday Telegram* is Maine's largest daily newspaper, but it's not a huge paper with unlimited resources, by any stretch of the imagination. So my professional lifestyle tends to be less than international.

But it's a paper I worked up to over the years. I graduated from UMaine in 1994 with a J-degree, and moved to Baltimore to live with two good friends who had graduated from Orono two years before. I worked at a small daily northwest of the city, the *Carroll County Times*, covering courts and the bustling heroin trade.

After a few years, I moved east, to Lowell,

Mass., where I covered a too-steady fare of gang murders as *The Sun's* nighttime cop reporter. I took over the city hall beat, and then went to the paper's business desk.

IN 2002, I WAS hired in Portland as a business reporter. At the time, the paper was still acting bigger than it actually was, sending reporters international for various stories with Maine connections. Over the next few years, we sent journalists to Iraq, Ireland, Guatemala and other countries on assignment.

The economy plummeted, and travel — all travel — stopped. That was the case, at least, until my newspaper was bought in 2009 by a new owner who wanted to reassert the newspaper as a leading information source in the state.

That fall, I found myself on a gubernatorial trade mission to Spain, Germany and Norway, covering Maine companies (and UMaine professor Habib Dagher) as the state explored wind power relationships abroad.

After 15 years of working as a daily newspaper journalist, I was doing international reporting. I was shooting pictures, writing stories — building on basics I learned a decade-and-a-half ago at UMaine. I was also doing things my professors probably never envisioned back then — using my BlackBerry to post tweets to Twitter and update the paper's official trade mission Facebook account. Photos shot on my digital Nikon D-200 were easily e-mailed back to the newsroom, along with my stories, all via my Mac laptop.

And then, in January of this year, I found myself in Haiti.

The reason for going was simple: Portland and Cap Haitien are sister cities. A Portland-based

nonprofit, Konbit Sante, has worked in Cap for almost a decade on improving the city's public health system.

The group has been sending doctors, electricians, nurses, public health experts, water engineers and other skilled Mainers to Cap for a decade. Doctors and nurses have worked at the city's Justinian Hospital, a horribly poor, under-resourced public teaching hospital. Electricians and other tradesmen have installed new wells, replaced leaky water pipes that fed through cesspits and put in uninterrupted power supplies in critical areas, so lights and technology in surgical suites and emergency rooms worked during the frequent blackouts.

Mainers have sent multiple shipping containers filled with health care supplies. Funds raised here have supported the hospital. This small nonprofit, which has less than three full-time equivalent positions in Maine, funds 27 positions in Cap, including doctors, nurses and health care outreach workers who provide critical women's health aid in the poorest slums.

WE HAD COVERED the story from Portland for some years, but never traveled to Haiti. Then, in the wake of the earthquake, we headed down with Nate Nickerson, Konbit Sante's executive director.

While everyone else in the world was in Port-au-Prince, we were 85 miles and three mountain ranges north, in Cap, a city undamaged by the earthquake. Our job was to report on that connection to Maine. Our focus permeated all the stories: How had Konbit Sante's work to date prepared Cap's health care system for the deluge in refugees that would be seeking help in the city?

Sunday night, we sat in as Nickerson met with hospital executives, regional health care officials and the United Nations

representative in the city. I wrote about how Nickerson prodded the officials to begin to prepare for the refugees. Since the earthquake, victims had made their way north, in the backs of pickup trucks, crammed into cars. The Justinian had seen 130 patients with horrible wounds, broken bones, amputated limbs, and severe emotional and psychological trauma.

"We were providing an important piece of the picture from Haiti that the other global media were missing. Even without earthquake damage, the poverty was staggering."

Matt Wickenheiser



Greg and I covered the stories, interviewed and photographed victims, and documented the work of Konbit Sante. We took a side trip to meet with some women from central Maine whom we had met by chance on the bus ride down, who were working in a village about 15 miles away. It was another chance to tell the story of Mainers' impact on Haiti.

ON OUR LAST DAY there, Dr. Youseline Telemaque, an ob-gyn funded by Konbit Sante, took us into Petite Anse, a slum built on the plains of garbage and trash. She showed us the work done there by the nonprofit's health care workers. As we walked along causeways of garbage that

kept us above the contaminated water, small children followed us, begging for food. It was awful, horrible and heart-wrenching. It's hard to imagine that poverty on this level exists in this hemisphere.

And I realized: We were providing an important piece of the picture from Haiti that the other global media were missing. Even without earthquake damage, the poverty was staggering. And the entire country, not just the capital region, was being affected by that earthquake. The fragile, pretty much nonexistent economy and health system were taxed even further.

And, I hope, through our journalism we showed what sort of impact a small group of people could have, through their time, dedication, effort and work.

There was no way I could have imagined I'd ever be doing this kind of work when I was at UMaine. When I started there, I studied anthropology. I got tired after a semester of anthro, and dropped all my courses for the next semester, thinking I could easily add different ones (Ha!). Sue Rocha in the Journalism Department took pity on me and helped me get into several classes, including a newswriting class with Alan Miller, who was a professor there at the time. He was a great storyteller, a passionate journalist, and I was hooked.

He taught me about the importance of journalism in this world, of writing stories that connected human beings to each other — something reinforced by other professors and instructors: Doug Kneeland, Paul Grosswiler, Marie Tessier, Kathryn Olmstead, Brooks Hamilton and others.

I'm glad I fell into this, and I've been proud of the work I've been able to do. I consider the Haiti stories some of the most important journalism I've done in my career. And I hope to do more like it. ■



"It is an amazing bridge between the Somali culture and American culture."

Cassie Defillipo

Sew fabulous

A 4-H program helps Somali, East African girls

TWELVE-YEAR-OLD Naima Arte is making a traditional East African black dress and Naima Odowa, 14, has cut and sewn a black and white scarf with embroidered red hearts.

Making clothes with traditional colors "is who we are," says Odowa, who immigrated to the United States from Kenya with her family when she was 2. "My mom and dad like it. They want me to make more stuff. In some ways, it makes me feel closer to my culture."

That emphasis on handmade clothing and household furnishings in East African

and Somali cultures was the impetus for Sew Fabulous, an after-school 4-H club offered in Lewiston, Maine, by University of Maine Cooperative Extension. In its first year, more than 20 girls are participating.

Sew Fabulous teaches more than just sewing and knitting, says program creator Kristy Ouellette, an Extension educator in 4-H youth and family development in the Androscoggin-Sagadahoc counties. It also engenders mentoring, camaraderie and self-expression.

The program started in March 2009 with donated bolts of cloth, and \$1,000

from the Wal-Mart Distribution Center Community Fund and \$650 from the Auburn-Lewiston Rotary Breakfast Club to buy sewing machines. It is led by up to five community volunteers with sewing and knitting skills.

Ouellette and AmeriCorps VISTA volunteer Cassie Defillipo, who works with youth and adults at the Lewiston Housing Authority development, oversee the program. They also meet regularly with the girls to talk about life skills, aspirations and a future that includes college, according to Ouellette.



Rachel Hathaway, left, in Bangladesh

Banking on people

A UMaine senior interns in Bangladesh to learn how microfinance helps the rural poor

LAST SUMMER, IN A COUNTRY where nearly half the population of 135 million lives in poverty, Rachel Hathaway solidified her commitment to a career devoted to human rights advocacy.

She plans to do it using microfinance.

“When the five senses are engaged and you see children forced to beg in the streets, when you see women who are desperate to work but are told by their husbands and society they aren’t capable, when these women watch their children starve, you realize the injustice,” says Hathaway, a University of Maine senior who spent 10 weeks in Bangladesh last summer as an intern with Grameen Bank. “The challenges of this country can’t be understood from a

big business perspective or textbooks. We also can’t sweep them under the rug, which is too easy to do when you don’t have to look it in the face every day. That’s why I wish more people could go to these countries to see what’s happening.”

Hathaway went to Grameen Bank to learn from the experts in microfinance, a strategy designed to help the poor out of poverty, typically by providing microcredit or small loans to the rural poor in developing countries. She came away from the experience inspired by people’s stories of the difference such a financial strategy can make and determined to help replicate the model elsewhere in the Third World.

Next summer, she hopes to return to Bangladesh to continue her research, exploring other microfinance models, including the Progress Out of Poverty Index, a Grameen Foundation poverty assessment tool. She isn't sure yet where she will attempt to replicate the Grameen model. She's considering South Asia or Africa.

"In times of financial crisis and bad banks, it's heartening to hear of bankers to the poor, the idea of a social agenda for people to work toward, that it's not about greed but how to improve the lives we're touching," says Hathaway, a financial economics and business administration major who grew up in Millinocket, Maine. "I believe we all have this obligation to be community members locally and globally. I hope to turn it into my life's work in human rights advocacy."

Grameen Bank, which started in Jobra, Bangladesh, in 1976 and is now headquartered in Dhaka, is led by Muhammad Yunus, founder of the microcredit movement, whose many worldwide honors include the 2006 Nobel Peace Prize and a 2009 United States Presidential Medal of Freedom.

As of January 2010, Grameen has more than 8 million borrowers, 97 percent of whom are women, according to its Web site. With 2,563 branches, Grameen provides services to all of the 81,343 villages in Bangladesh.

"These are women who are hard working and have skills, but have no opportunity to make a life for themselves. They're not poor because they're lazy. They are stuck in a cycle of abject poverty," says Hathaway.

"Approximately 70 percent of women in rural Bangladesh are unable to read or write. When Grameen teaches women how to write their names as a mandatory part of the borrower initiation, it is a source of great pride.

"I see these women as beacons of hope."

The key is in Grameen's "trickle-up" economics, she says. "When given the means to reach productive capacity, families, communities and the whole economy benefit. And it can reach world scales. Microcredit offers a real hope of solving inequities where no hope previously existed."

"In times of financial crisis and bad banks, it's heartening to hear of bankers to the poor, the idea of a social agenda for people to work toward."

Rachel Hathaway



Hathaway was one of 107 students who came from around the world to learn from the pioneers in microfinance last summer. Her five-week basic training program included an extended village visit and a week with a newly established branch in Netrokona. Her internship with Grameen Trust involved field visits and assignments. She also consulted for four weeks on two projects in India.

As part of her internship, Hathaway traveled with a branch manager in an effort to better understand the challenging external environment — from political corruption and lack of modern conveniences like running water and electricity to extreme weather such as monsoon season that required visits by boat to borrowers in the villages.

She also was there when bank officials met with potential new borrowers seeking small loans — often 10,000 taka or roughly \$150.

"They're told of the benefits and trained in what it is to be a borrower, and how they could make it work," Hathaway says. "That's when you get to see the light come on in these women's eyes.

"When these women, who have been told their whole lives that they are nothing, go before the branch manager for their first loan, they are so scared. They worry that they can't do it, that they don't know how to handle money.

"Despite questioning their (own) skills and capabilities, the women stand in front of the manager, state their names and their loan purposes — to buy a rickshaw, to cultivate a rice paddy. Starting loans are usually for a combination of livestock and cultivation. It's an enormous step for these ladies — the first step to a productive life."

The result, Hathaway says, is real change in people's quality of life.

"Women are feeding their children and facing less violence because they're seen not as burdens, but contributors to their families and to society. Their status has elevated. They are realizing a sense of purpose and empowerment. They're starting to educate their children because they see the value in it and can afford it." ■

Weed

In the epic struggle, Eric

WHEN FICTIONAL poltergeists and phantoms descended on Manhattan, New Yorkers called Ghostbusters.

When hairy galinsoga, ragweed and redroot pigweed — which are very real and equally scary, by the way — descend on Maine, farmers call weed busters. Specifically, they call Eric Gallandt and his team of researchers at the University of Maine.

For small-scale organic farmers, weeds can be as haunting and confounding as shape-shifters. They compete with crops for water, nutrients and, if they grow more quickly than the desired plants, light. This can cause the quality of a crop to suffer, and in some cases can reduce or even eliminate yield, which cuts into growers' profits. Left to their own devices, weeds can quickly proliferate.

Organic standards forbid the use of synthetic herbicides, which are inexpensive and highly effective. The alternative is cultivation — weeding between rows by hand or with tractor implements or a hoe — but that's costly, time-consuming and kills far fewer weeds.

Gallandt, a UMaine associate professor of weed ecology and management, has made it his mission to help small-scale growers who plant diversified crops. He takes a systemic approach to weed management by focusing on the ways in which growers address the seed bank — the seeds at the soil surface and the seeds incorporated in the soil.

By Kristen Andresen

Illustrations by
Carrie Graham

common
lambsquarters



common lambsquarters
redroot pigweed
hairy galinsoga
wild mustard
shepherd's purse
purslane
common chickweed
quackgrass
yellow foxtail
barnyardgrass
large crabgrass
yellow nutsedge

warfare

Gallandt is the small-scale growers' staunchest ally



Weed warfare



hairy galinsoga
quackgrass



AS ANY GARDENER knows, weeds grow like, well, weeds. They'll do whatever it takes to ensure their survival, and a lot of this depends on the seed bank. Some weeds have seeds that remain dormant for a period. Others rely on animals to spread their seeds and still more develop seeds that can remain viable in the soil for decades.

In the past, Gallandt has researched microbial decay of seeds in the soil, looking for conditions that may accelerate seed loss, but without much success. He's currently working with small farmers to find ways to manipulate the environment so that there are fewer weed seeds in the soil to begin with.

"How do we get the number of weeds killed during cultivation higher?" Gallandt asks. "How can we get it closer to that of an herbicide? And if we can't, how can we make the tools more effective? If we have to use them twice, can we make it even more efficient?"

According to U.S. Department of Agriculture census data, more than 300,000 new farms began operating nationwide between 2002 and 2007. The trend among these farms is that they tend to have diverse crops, fewer acres, lower sales and younger operators who also work off-farm. In fact, the majority of U.S. farms are smaller operations.

More than 36 percent are classified as residential/lifestyle farms, with sales of less than \$250,000 and operators with a primary occupation other than farming. Another 21 percent are retirement farms, which have sales of less than \$250,000 and operators who reported they are retired.

The sector may be growing, but weed management technology hasn't kept up. Until

recently, the options for small-scale farmers have been hand tools. Tractors are engineered for larger, less diversified plots of land.

"If you look at smaller organic farms, they're basically using hoes," Gallandt says. "They're very nice hoes. They're precision hoes. But they're hoes. The technology hasn't changed much since the 1800s."

Until recently, that is.

GALLANDT AND HIS team spent last summer researching the effectiveness of the Weed Master, an innovative Finnish machine that's best described as a small, human-powered tractor. During a sabbatical in Copenhagen several years ago, Gallandt met European colleagues who work on weed management in organic systems. One of them introduced him to the Weed Master.

The device combines the best aspects of hand tools — lightweight, small, portable — with the versatility and add-ons of a tractor. Gallandt wanted to know if a machine like this would benefit Maine farmers, and he received a grant from the Maine Agriculture Center to import a Weed Master and tools such as a flamé weeder.

During the 2009 growing season, he worked with three Maine organic farms — Peacemeal Farm in Dixmont, run by UMaine alumnus Mark Guzzi; Fisher Farm in Winterport, run by Rose, Joe and Dennis Fisher and UMaine alumna Beth Haines; and Fail Better Farm in Montville, run by Clayton Carter. Students at UMaine's Black Bear Food Guild ran a concurrent experiment comparing the efficiency of weeding by hand or with a short- or long-handled hoe, a wheel hoe and the Weed Master.

They found that overall, the Weed Master



crabgrass

redroot pigweed



didn't provide superior weed control, but it was exponentially faster than cultivating by hand or with any of the other tools. And in a small-scale operation, time is money.

"Farmers were pretty impressed with how fast it worked and how easy it was to adjust the tools to the unusual crops and planting patterns that they have," Gallandt said. "It was very simple."

Gallandt and his colleagues in New Hampshire and Vermont recently wrote a \$2.4 million grant to purchase Weed Masters, along with specialty hand tools from Johnny's Selected Seeds in Albion, Maine, for on-farm research in those states, as well.

"Farmers could really use some innovation on their farms," Gallandt said. "We'd like to retool northern New England for small- to mid-scale diversified vegetable farming by getting farmers exposure to innovative tools."

THE COST OF importing the Weed Master may be prohibitive for many small-scale organic farmers — the whole setup runs a little less than \$7,000. And in certain situations, hand-powered tools may be a better alternative anyway.

But innovation is more important now than it has ever been. The fact that the number of such farmers is growing points to a need for more effective products and methods. But so does the prospect of climate change. According to Gallandt, an overall rise or fall in temperature won't make a huge difference, but variability in weather patterns will.

That's because the window for ideal cultivation conditions is very small — and timing is everything. The weather needs to be

moderately dry at the same time the weeds are at their smallest growth stage — called the "white thread" phase — early in the season. An evening rainstorm can take regular weed-killing rates — usually around 80 percent to 85 percent — down to 60 percent. That means more passes with a hoe, which means more time, which means more labor, which means money lost.

"Organic farmers are going to be in trouble," Gallandt says. "Cultivation is really dependent on the environment and as the weather begins to get more unpredictable, you can see why we're more interested in some of these tools with high efficiency rates."

Weeds can tell us a lot about our environment, the weather and the farming practices we employ. Some, such as the edible wood sorrel or the attractive common purslane, are even fairly pleasant. But most of them are as pesky as the poltergeists in *Ghostbusters* and as hard to bring down as the Stay Puft Marshmallow Man.

Gallandt's advice to farmers and gardeners? Persevere. And don't be afraid. He and his team of weed busters will be around to help.

"Over time, as you start managing the seed bank, you start to solve some of your weed problems, but the things that you still see are the things that are slipping through in the unfriendly environment you've created. You end up with a new species that has a trait that allows it to thrive in the environment it's in," Gallandt says. "They're basically doing their job, and to think that we're going to solve this problem and make them go away completely goes against eons of evolutionary strategy." ■ 

Early warning signs
of reading disabilities
found in preschoolers'
language skills

Sound check

By Aimee Dolloff

Can you **hear** this?

Can you **rhyme**? Does it take you a long **time**?

Name as many words as you can think of that start with the **b** sound: **b**all, **b**at, **b**ench, **b**read, **b**in, **b**oy, **b**ike, **b**ank, **b**ath, **b**ag, **b**anana, **b**ark, **b**ang, **b**ig, **b**ox.

Say the word **bat**. Now say the word **bat** without saying the sound **b**. **At**.

Here is a picture of a **cat**. Which of these other words starts with the same sound as **cat**? Frog. Man. **C**an. Pin.

FOR PRESCHOOLERS on their way to becoming proficient readers, these tests aren't difficult. But for others who struggle with the sounds of language, tasks like these can be difficult, and may be among the first cues of reading disabilities.

"If we have red flags early, we can begin putting intervention measures in place before formal reading instruction begins," says University of Maine speech-language pathologist Susan Lambrecht Smith, whose research examines the role of phonological awareness — the conscious sensi-

tivity to the sound structure of language — in predicting reading disability in at-risk youngsters.

In the last several years, Smith has led a number of studies exploring identification and intervention in reading disabilities, and she has discovered behaviors in babies as



In a sound-symbol correspondence program that UMaine researchers are piloting in an area school, children learn to map sounds onto letters during two 20-minute sessions each week. The goal is to discriminate sounds. One of those researchers is first-year communication sciences and disorders graduate student Susanne Mallon of Springvale, Maine.

young as 6 months that illuminate the underlying language skills in children with reading disabilities. She has looked at a variety of testing methods to identify reading disabilities in preschoolers. And she continues to use microanalysis to examine these traits in order to further refine ways of identifying and treating individual children.

While it's not possible to determine in infancy which children will become reading disabled, Smith says, it is possible to recognize differences in language behavior that may be related to later reading difficulties.

"Babies 6 months to 18 months may use fewer canonical syllables — vowels and consonants combined — in babbling, an important development in infants' sound systems," says Smith, an assistant professor of communication sciences and disorders.

ONE OF THE challenges is that children with reading disabilities are not a homogeneous group. That's why it takes a combination of tests to recognize a reading disability. For instance, in a group of seven children with reading disabilities who have been followed since infancy, Smith says she has seen at least three different profiles.

"What I'm seeing in these profiles is a combination of language strengths and weaknesses," she says. However, all have problems with phonology (the sound system of language) at some point.

For example, some toddlers do not have overt signs of language weaknesses until they hit preschool age. Then it is discovered that they have difficulty with the deletion test (the "cat" to "at" example), Smith says.



"In the final analysis, we may not be able to fix a reading problem so that it no longer exists, but with appropriate tools such as systematic phonological approaches to decoding, we can ameliorate these difficulties."

Susan Lambrecht Smith

While some children have difficulty with other language skills such as vocabulary or syntax as early as toddlerhood, others only show weakness in phonological skills. In spite of normal language comprehension skills, children with this weakness may be diagnosed with a specific reading deficit known as dyslexia.

Dyslexia is one of the most commonly recognized reading disabilities, but Smith says not all children and adults with reading disabilities are dyslexic. Many with reading disabilities have trouble with reading comprehension, not with decoding words.

Youngsters with dyslexia often slip through the cracks because they can memorize whole written words, says Smith. However, the strategy will only work up to

a certain reading level before beginning to break down, often at fourth or fifth grade when the complexity of reading material in school greatly increases.

TWO INDICATORS of reading disabilities are children who have a positive family history and are late to talk. If one or both parents have a reading disability, children are nearly 50 percent more likely to also have a reading disability.

"But many children don't have these signs, so it is vitally important to have early assessment as a part of preschool and kindergarten screenings," she says. "We need to use a combination of tests to find children at the preschool and kindergarten levels," including tests of phonological awareness such as sound deletion, and later reading tasks that will capture children's ability to read words accurately and quickly. If one can identify these children in preschool or kindergarten, then it is possible to teach some of these phonological skills that are so important for early reading.

And even if children don't have an identified reading disability, some will need extra training to help develop their language skills, precluding their ability to "slide by until about middle school" without notice or intervention.

"I think it's more harmful for a child, especially a child who's very capable, to go through school thinking that he or she is not as competent as her or his peers," says Smith. "Letting (these) children languish without recognizing them for their strengths is doing them a disservice." ■



Seeing the light

By Aimee Dolloff

FOR OCEANOGRAPHER Emmanuel Boss, uncovering secrets underwater isn't about finding buried treasure or unearthing sunken ships.

Using specialized sensors, Boss studies the effects of particles on the underwater light to understand what lies beneath. His research focuses on what marine optics can tell us about what's in the ocean and how those particles — most no bigger than a few micrometers — impact processes in the water, as well as in the global system.

Knowing what's below the surface throughout the oceans is needed in researching the role of the water in cycling elements such as carbon that are fundamental in understanding Earth's climate and monitoring climate change. With marine optics, Boss and other scientists use satellite ocean color imagery to study ecological processes, such as what species of phytoplankton dominate, and biogeochemical processes, including how fast carbon is fixed by phytoplankton into organic material.

"There are many events in the ocean that are happening that we're completely missing

Currently, more than **3,200** floats are gathering ocean data as part of Argo, the Global Climate Observing System/Global Ocean Observing System.

The floats mainly measure the temperature and salinity of the upper **2,000** meters of the ocean.

About **200** of these floats also measure oxygen.

A handful of these floats are equipped with optical sensors.

Floats have a data-recording life of about **five** years.

Each float can perform **300** profiles, then transmit the data to a satellite each time it surfaces.

Marine optics research has the potential to tell us more about what lies beneath

using current sampling techniques,” says Boss, an associate professor in the University of Maine School of Marine Sciences. “With data from new systems, potentially we can start accounting for those.”

Most recently, by using novel robotic technology he equipped with optical sensors, Boss has been able to probe beneath the ocean’s surface to layers not observable from space. At first, when he began recording data with the sensors on profiling floats, there was nothing unusual in the data.

“Then in 2006, a float got stuck in an eddy and suddenly, at 1,000-meter depths, we saw an elevated amount of particles we had not seen during the whole mission,” he says. “The sensor had been stable over three years. There’s nothing at the surface that could explain how these particles were produced. I still have no idea where they came from. That’s what makes this research exciting.”

Scientists are particularly interested in particles sinking to great depths — an important process in carbon sequestration from the atmosphere. Boss is focused on the connection between the ocean physics and the biosphere — the part of the Earth and its atmosphere that is capable of supporting living organisms.

During photosynthesis, plants convert carbon dioxide into organic particles that are distributed throughout the upper water column. Some remain suspended while others are carried to depth.

“It’s crucial we understand their dynamics if we want to understand the role of the ocean in the carbon cycle,” Boss says.

FOR BOSS, that starts by determining what is in the ocean and why it’s there. Using

passive sensors that take advantage of the sun’s light as a source, and active optical sensors that produce their own light source, he quantifies particle concentration, composition and size distribution. Optical properties of suspension reveal changes in concentration of material in the water.

Boss is also beginning to study acoustical properties of the water column by measuring sound intensity scattered by particles at different frequencies.



“We have the opportunity to make a huge difference in the future of our field and its ability to provide much-needed information on how carbon and other material are processed globally.”

Emmanuel Boss

“Acoustical and optical properties of material reflect on their size, composition and, to a lesser degree, on their shape and internal structure. Different wavelengths of light or frequencies of sound interact with the material differently, meaning they are sensitive differently to the properties of the particles,” says Boss.

Those properties were primarily measured by sensors on stationary buoys or aboard ships. Boss has pioneered the use of profiling floats designed to collect ocean temperature and salinity profiles to measure biogeochemical properties. The battery-powered devices drift with the currents, descending and ascending by taking in or releasing oil in an external bladder. At the surface, the float relays data via a satellite to users, as well as international databases.

“Oceanographers have collected a lot of data in the open ocean, but during spotty campaigns and on moorings lasting only a few years,” says Boss. “The floats allow you to have a persistent presence.”

WHILE MORE than 3,000 profiling floats now measure ocean temperature and salinity, only a handful have optical sensors to measure properties such as fluorescence, scattering and attenuation. Boss hopes to change that with national and international collaborative programs to equip floats with advanced sensors.

Last fall, he was awarded \$1.5 million from NASA under the National Oceanographic Partnership Program for the development, assessment and commercialization of biogeochemical profiling floats for calibration and validation of ocean color and carbon studies. The project is a collaboration between UMaine and global leaders in sensor, platform and communication tech-

nologies: Satlantic Inc., of Halifax, Nova Scotia, and WET Labs of Philomath, Ore., are manufacturing the sensors; Teledyne Webb Research of East Falmouth, Mass., the floats; Maryland-based CLS America, tools for the floats' satellite communication and data dissemination.

"What we are pioneering is a new end-to-end float-sensor system that measures physical, chemical and biological parameters," says Boss.

The sensors Boss previously deployed on floats measured bio-optical properties — scattering (the process of shooting a beam of light and measuring what comes back), and the fluorescence of chlorophyll (shining a blue beam of light and looking at only what returns in the red light). The goal of the new project is to develop an advanced biogeochemical profiling float.

The float work will focus on organic carbon dynamics in the upper ocean, including measurement of the color of available light, as well as proxies of particulate organic carbon, chlorophyll and colored dissolved material. Oxygen sensor data will be compared with the optics-based estimated productivity in water. The sensors will be powered by and attached to a Teledyne Webb Research APEX float with conductivity temperature and depth sensors.

A MAJOR THRUST of the effort is to establish the potential of this technology for calibration and validation of satellite-based ocean-color measurements. The new floats are enabled with a two-way communication system that allows researchers to control when the floats descend and ascend, and when they take measurements.

"Radiometers allow us to do a better job in modeling primary production," says

Boss. "We're trying to see if we can use them to calibrate satellites, and plan on having other sensors measure for scattering. That allows us to get more information on what's in the water."

Most of the existing floats are programmed to descend and ascend for specific periods of time to take a predetermined number of measurements. Using wireless communication and data dissemination created by CLS America, researchers will provide the floats with commands during missions, including changes in response to events such as hurricanes.

The data collected will be sent to a centralized Web site for all researchers to analyze and for future input into assimilating ocean ecosystem models.

With more advanced communications systems, it may also be possible to increase the life of profiling floats. Currently, researchers can record about 300 profiles from one float. The devices are limited by battery life, and once the batteries die, it's not possible to recapture the devices. One of Boss' goals is to test recovery possibilities, so that floats can be reused.

Scientists from the NASA Goddard Earth Sciences Data and Information Services Center, partners in this project, are building a tool that will provide crucial remotely sensed information around the float surfacing location for measurement context. Every time a float reports its location, NASA will provide real-time data on weather, temperature and events in a 50-kilometer radius.

"We have the opportunity to make a huge difference in the future of our field and its ability to provide much-needed information on how carbon and other material are processed globally," says Boss. ■



An instrumented tripod deployment.

Ocean formulas

THROUGH the years, Emmanuel Boss has developed and contributed to the creation of several algorithms that now are routinely used to typify ocean particle concentration, composition and size from optical measurements. That includes co-development of an algorithm that provides phytoplankton growth rates from space, as well as a recent algorithm to assess phytoplankton physiological stress.

Boss' first optical float provided 221 profiles in a three-year period, revealing ocean processes in ways never seen before. His pioneering work motivated the marine sciences community to deploy many more.

In coming years, a few hundred are expected to be deployed worldwide, says Boss.

Contributing to the development of such a global ocean observing system is where Boss will spend much of his energy in the coming years, largely in collaboration with other leading oceanographers such as UMaine's Mary Jane Perry.

Boss brings his research into the classroom as well. Students in his SMS 491 class (Engineering Literacy for the 21st Century) are currently building autonomous underwater vehicles controlled by a Lego brain, measuring temperature as they move about the water.



GLOBAL WORMING

By Aimee Dolloff

MOST ARE NO BIGGER than a speck of dust, yet some have the power to kill fish with their toxic slime. A few are herbivores, but the majority are predators. All have the ability to regenerate any part of their body. First documented in Europe in the early 18th century, new species are still being described at the rate of up to 50 each year.

“To the microscopic world, they’re ferocious, dreaded beasts,” says University of Maine biologist Seth Tyler of his favorite invertebrates, marine turbellarians or flatworms, which he has been studying around the world for almost three decades. “They’re like vacuum cleaners going around sucking up other little animals.”

A worldwide database at UMaine compiles what we know about age-old and newly discovered microinvertebrates



Image at left, *Clione* sp. (planktonic mollusk) larva, Bocas del Toro, Panama. This image by Matthew Hooge placed 20th in the 2007 Nikon Small World Photomicrography Competition. Images above, left to right, *Plagiostomum* sp., Belize; *Eusyllis* sp., California; *Acanthodasys* sp., Belize; *Eumecynostomum evelinae*, Brazil; *Stomatricha hochbergi*, Australia. Photos by Matthew Hooge

Perhaps even more remarkable is the potential of turbellarians to help answer fundamental questions about the relationships of all animals, including their origins in the primitive Earth and genetic connections to the major branches of the animal kingdom.

“They tell us how animals changed from what we know are the primitive forms, such as jellyfish, to being bilaterally symmetrical,” says Tyler, who started studying turbellarians as a graduate student at the University of North Carolina. “These animals also have a very special type of stem cell. They essentially invented the stem cell among early bilaterally symmetrical animals.”

WHILE MARINE WORMS come in all shapes and sizes, most of the acoela turbellarians that intrigue Tyler are between 100 micrometers and 300 micrometers long. A few, such as *Hofstenia* that live in tropical mangrove swamps, can stretch up to 4 millimeters. And while the marine environment is their habitat, their homes can be in sand and mud, on algae and corals, in the interstices of polar marine ice or free-swimming in the water column. Other turbellari-

ans, including the more familiar polyclads and planarians, reach sizes of several inches to as much as 2 feet, and range into freshwater and terrestrial habitats.

However, the size of most turbellarians isn't proportionate to their role in the ecosystem. As top predators in the microscopic world, they control populations of other microinvertebrates and clean the sands of planktonic organisms that get filtered out of the water by wave action. Indeed, if the acoel turbellarians are as primitive as their genetic connections indicate, then concepts of how the first bottom-crawling animals reproduced and populated new habitats have to be changed, Tyler says.

There are more than 5,000 known species of these invertebrates on the planet and all of them are documented in a database begun in the late 1980s by Tyler and the late Louise Bush of Drew University. Through the years, the data have expanded considerably with the help of taxonomists in Maine and around the world, as well as graduate and undergraduate students and postdocs working in Tyler's lab.

Because new species frequently are discovered, the task of data collection is seemingly endless. The known species of

these worms are probably fewer than 10 percent of the extant species. In the lab, profiling the animals' morphology includes lots of electron microscopy and confocal laser microscopy — the high-powered means of truly appreciating the remarkable diversity in the features of the tiny invertebrates.

“Many are discovered, but it takes a while to describe them, so that's the bottleneck,” says Tyler. “Every time we visit a new site, we find undescribed species. Even in Maine, there are still many species of turbellarians yet to be described.

“These, like other marine worms, are still evolving and still adapting to new environments that arrive,” Tyler says.

IN 2001 WITH the help of a more than \$754,000 grant from the National Science Foundation, the database was funded as part of research on the systematics of several groups of primitive marine worms. The research was led by Tyler and Wolfgang Sterrer, curator of the Natural History Museum at the Bermuda Aquarium, Museum & Zoo. Sterrer is the world authority not only on several groups of turbellarians, but of the Gnathostomulida, an enigmatic phylum of

Global worming

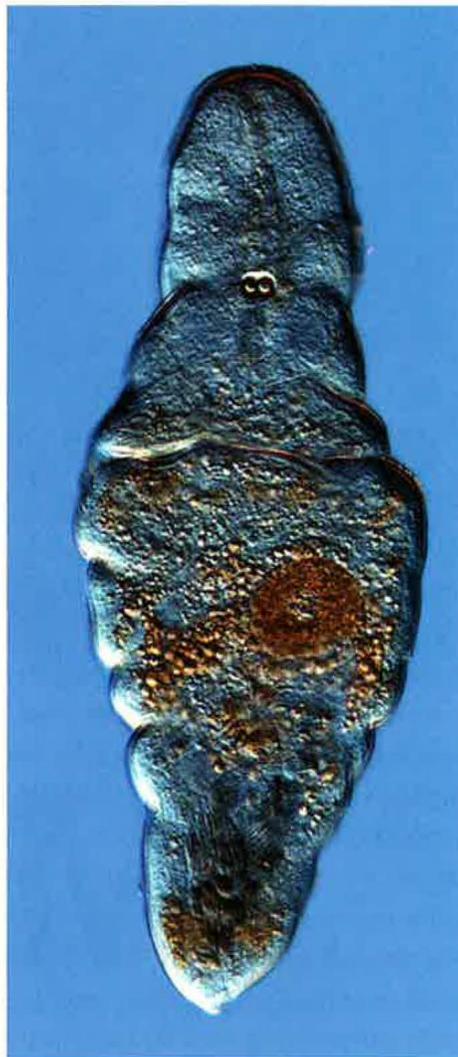
“We’ve been able to understand the relationship of all these families largely from molecular data, and then we use those data to reconstruct how these animals have changed through time — how their strange shapes and peculiar organ systems allowed them to adapt to different habitats.”

Seth Tyler

worms living mostly in anoxic, smelly muds. Seeking examples of all these worm groups — gnathostomulids, acoel and catenulid turbellarians — required far-ranging travel, and so the research team dubbed the project Global Worming.

The online database, which also includes a complete taxonomic listing of all gnathostomulids as well as turbellarians, is providing a single place where all the relevant information on these worms can be stored and used by researchers, reducing the need to search through piles of obscure paper journal articles. The database tracks current concepts of the relationships of these worms to one another and helps those working on phylogenetic relationships of invertebrates gauge their diversity.

“We’ve tried to sample a wide variety, but we feel that we’ve barely scratched the surface of where these animals can be found,” says Tyler. “The thrust with NSF was clarifying the relationship in the taxonomic hierarchy. We’ve been able to understand the relationship of all these families largely from molecular data, and then we use those data to reconstruct how these animals have changed through time — how



Flagellophora apelti, North Carolina
Photo by Matthew Hooge

their strange shapes and peculiar organ systems allowed them to adapt to different habitats.”

Through the years, Tyler’s travels have included Scandinavia and other parts of Europe, Bermuda, the Caribbean, Belize and Panama, western Canada, New Zealand and Australia to study the lower-level flatworms of the meiofauna or small animal world. Others in his lab have conducted research in Brazil, Thailand, Tanzania, Ethiopia, Honduras, Panama, the Virgin Islands, Australia, China, South Pacific islands, arctic Alaska and Russia.

Researchers from around the world also have made contributions to the database, providing characteristics of worms they’ve discovered, diagnoses, geographic data, links to related literature, free-form notes regarding taxa and images.

Those researchers include Sterrer, whom Tyler describes as “an avid world traveler, chasing worms like this to as many exotic and little-visited places as he can.”

THE FOUNDATION OF the database came from Louise Bush, a zoologist who spent her career studying marine worms and



Renowned zoologist Louise Bush of Drew University was a scholar of Turbellaria and other animals of marine interstitial environments. UMaine biologist Seth Tyler described her as “a remarkably devoted student of invertebrates, observing and systematizing them as avocation as well as vocation.” Throughout her career, Bush cataloged an extensive collection of turbellarian material. Her data and sketches, kept on hundreds of index cards, became the foundation of UMaine’s Global Worming project, devoted to “gauging global biodiversity and phylogenetic relationships of lower worms of the meiofauna.” Bush and Tyler were collaborating on the database when she died in 1992 at the age of 84.

keeping meticulous records of their characteristics and habitats on index cards. While Tyler knew of her research through her publications on turbellarians, it was a post-doctoral researcher in his lab, Julian Smith, who first contacted her about a new species the two of them discovered.

Before her death in 1992 at the age of 84, Bush worked with Tyler to transcribe her extensive collection of handwritten index cards into Global Worming’s digital database.

“She long had a vision of providing access to her database to other scientists through digital connections, and she kept me motivated to accomplish that,” says Tyler. “We’ve made her goal a reality.”

Through the years, a number of students in Tyler’s lab have helped capture Bush’s “massive” manual files for the database. There was also a volunteer, Steve Schilling, a former U.S. Environmental Protection Agency employee for whom biology has always been an avocation.

“I was inspired by Rachel Carson in 1963 as a high school senior,” says Schilling. “I wanted to make a small contribution to the biodiversity crisis.”

Before retiring from the EPA, Schilling worked on an intra-agency project to create a taxonomic list that could easily be used by a variety of federal agencies. He retired from the EPA and moved to Brooksville, Maine, in 1997. A former colleague reminded him that Tyler was one of the experts the EPA contracted with on its taxonomic list project.

“I found Dr. Tyler was a rare combination of a world-class biologist and informatics expert,” says Schilling, who now lives in Colorado and still works on the database, entering information almost daily.

“You don’t know what biodiversity you are losing without the inventory,” he says of the importance of the database.

Also instrumental in the growth of the Global Worming project is former UMaine graduate student and postdoctoral researcher Matthew Hooge, whose contributions to the database have included some spectacular photography of the invertebrate species.

“For many of these worms, Dr. Tyler and I are the only people who have ever viewed them while they’re alive,” he says. “I put a lot of effort into taking digital images that accurately show what the living worms look

like, and hopefully capturing how interesting and, often, pretty they are.”

At UMaine, Hooge focused on the systematics of the Acoela. He was the first to explain the phylogenetic relationships of these worms, which, until recently, had simply been pigeonholed into various types without consideration of their evolution.

“This involved describing new species, especially because most of the species I collected in the field were previously unknown to science,” says Hooge, who is now a senior environmental scientist for Wilson Construction Co., in Oregon. He also looked for new physical features in the worms he collected in an effort to help understand the interrelationships of the species.

“I benefited from the project management experience gained while working in Dr. Tyler’s lab to go along with the construction experience I had prior to pursuing a higher degree in biology,” says Hooge, who also continues to make occasional updates to the database.

“There are so many species yet to be described and so much more work to be done,” says Hooge. ■



Potato pest prevention

FARMERS and gardeners have been trying to defeat the Colorado potato beetle for more than 100 years — something University of Maine Associate Professor of Applied Entomology Andrei Alyokhin finds fascinating (and frustrating). Typically, the insecticide imidacloprid and, to a lesser degree, other neonicotinoids (neuroactive insecticides similar in structure to nicotine) are the basis for control measures on commercial farms. However, the Colorado potato beetle is known for developing resistance to a wide range of chemicals. With a more than \$409,000 U.S. Department of Agriculture grant, Alyokhin and collaborators in New York and Michigan are developing management plans to prevent imidacloprid resistance. Because resistance mechanisms can be diverse in potato beetles even within a relatively limited geographic area, the goal is to customize plans that can meet specific grower needs in a variety of locations.

Photo by Edwin Remsburg, USDA

Factors in reunification

RESEARCHERS at the University of Maine looked at the factors child protective service caseworkers believe lead to change for the domestic violence abuser and victim, and ultimately, the successful reunification of children and their parents. The in-depth interviews with caseworkers examined their cases, half of which resolved with successful reunification. The findings by UMaine researchers Mary Ann Cole, a graduate student who has since received her degree and is now a child protective caseworker in Maine, and Professor of Family Relations Sandra Caron were published in the *Journal of Family Violence*. Caseworkers said successful reunifications occurred in families that:

- Fully engaged in multiple services (e.g. counseling and parenting classes) to address all the needs of family members
- Admitted the issues in the home
- Set clear boundaries with each other
- Sought and maintained support systems
- Had open, honest working relationships with their child protective service caseworkers based on mutual trust and respect

The study also highlighted the need for caseworkers to find strategies to engage abusers — not just victims — to work toward reunification with their children. The findings suggest that abusers/victims must find a way to address their “internal unwillingness” to accept responsibility for their actions.



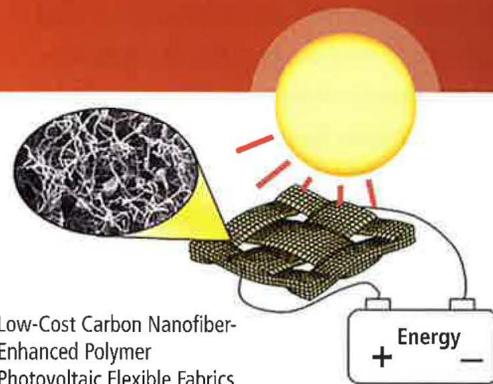
Photographs by Erica Cooper, courtesy of the Robert S. Peabody Museum and Peabody Essex Museum

The more than 8,000 tools found at Bull Brook reflect intense activities related to communal hunting and processing. In their findings, published as the cover story in the *Society for American Archaeology* journal *American Antiquity*, the researchers suggest that the settlement subsisted on resources from the woods and wetlands, including caribou, which may have used a now-submerged island east of Bull Brook as a summer refuge. Among the Bull Brook artifacts are those pictured above: (a) fluted point, (b) unifacial flakeshaver, (c) endscraper, (d) graver, (e-h) drills, (i) side scraper.

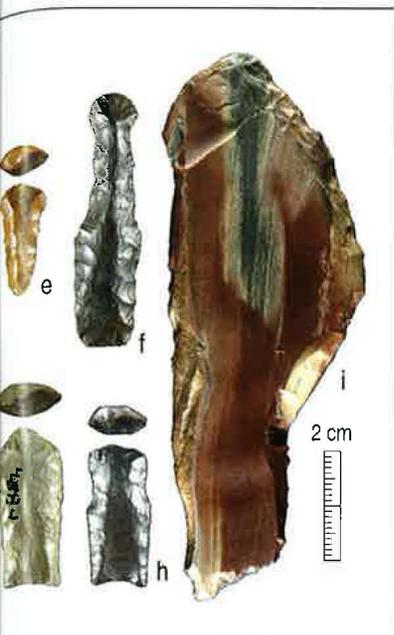
Here comes the sun

DURING A STANDARD five-day mission, the average Army soldier uses 88 AA batteries to power the equipment he or she must carry — from cell phones and global positioning units to night vision goggles. Finding an alternative energy source is now a focus of research at the University of Maine. UMaine engineers, along with industry partners, are developing a photovoltaic fabric that will act like a solar panel on a house, converting the sun’s rays to energy.

The research is funded by a more than \$478,500 award to UMaine from Tex Tech Industries of Portland, Maine, which is administering the Recovery Act funds from the U.S. Department of Defense (Army). To develop the technology, Tex Tech has partnered with D2 Systems of Windham, Maine, and UMaine’s AEWAC Advanced Structures & Composites Center and Forest Bioproducts Research Institute.



Low-Cost Carbon Nanofiber-Enhanced Polymer Photovoltaic Flexible Fabrics



Ice age socializing

NATIVE AMERICAN populations may have been small 12,000 years ago during the Pleistocene, but that may have given added incentive for mobile hunter-gatherers to get together when opportunities arose. Now a team of anthropologists from the United States and Canada has confirmed that the largest-known Paleoindian aggregation site is in Ipswich, Mass., shedding new light on early human social organization. Research led by University of Maine anthropologist Brian Robinson and three UMaine graduate students, working in cooperation with colleagues at the Peabody Essex Museum in Salem, Mass., and the University of Montreal, has reconstructed the site plan and completed a full analysis of artifact distributions. The researchers conclude that the 36 house-size activity areas arranged in a ring-shaped pattern covering nearly 4.5 acres is evidence of an organized event dated to 10,400 radiocarbon years (or more than 12,000 years ago when calibrated to calendar years). The circular settlement pattern has concentric rings of activity, providing a window on social contexts at a large, well-organized gathering.



Peanuts in perspective

TO BETTER PROTECT students with potentially life-threatening peanut allergies, schools should implement comprehensive food allergy action plans that include age-appropriate accommodations, personnel training and communication with parents, according to two education researchers. Dianne Hoff at the University of West Georgia and Sid Mitchell at the University of Maine studied the practical, legal and psychological issues related to the peanut allergy controversy. Many schools are being pressured to become peanut-free zones — a strategy medical and legal experts say is not a good idea. The researchers conducted literature and law reviews, and interviewed doctors, school superintendents and parents of children with and without peanut allergies. They conclude that food allergy action plans are legally defensible, realistic approaches for schools, supporting students with allergies in ways that protect them from harm and promote their independence. Hoff and Mitchell published their findings in the journal *Phi Delta Kappan*.

experts on topic



THE EARTH has been shaken to its core in recent months by a series of substantial earthquakes in Haiti, Chile, Turkey and Mexico. All the events were captured by a seismometer at the University of Maine that is used by Earth Sciences Instructor Alice Kelley to teach about the nature of earthquakes. The technology, installed in 2008, links UMaine to the New England Seismic Network based at Boston College. Kelley uses the equipment and its real-time signals to help students learn about earthquake locations and the travel of seismic waves.



Alice Kelley



ATV networks

FORMATION of all-terrain vehicle (ATV) rider clubs throughout Maine has garnered social capital returns, including improved image and relations with private landowners, according to a new study by two University of Maine researchers who focus on human-environment interactions. The study explored the purpose of such clubs, and the salient elements of their goals and activities that produce social value. A 2003 ATV Task Force Report to Gov. John Baldacci cited a 136 percent increase in registered ATVs and a 574 percent increase in sales in the state from 1992–2002. According to the Maine Department of Conservation, ATV riding contributed \$230 million of direct and indirect economic activity in 2007. However, ATV use in Maine has been mired in conflicts between riders, landowners, other recreationists, communities and tourism development leaders. The study demonstrated return on investment that is important for clubs that want to improve their marketing and reputations, and enhance volunteerism, as well as provide documentation when seeking funding such as trail grants. The researchers — Marilynne Mann, a research associate in the Center for Tourism Research and Outreach (CenTRO) at UMaine, and Jessica Leahy, assistant professor of human dimensions of natural resources in the School of Forest Resources who is affiliated with the Center for Research on Sustainable Forests — published their findings in the journal *Environmental Management*.

Stormy déjà vu



FOR CENTURIES, ships' protests have been the legal documents captains have used to report damages to their crafts, cargos and crews. An analysis of 13 protests from 1785, combined with other documents of the day, have been used to reconstruct evidence of a hurricane-force storm in October of that year — an event that bears striking similarities to one that occurred in 1996, right down to the days both hit hardest in southern Maine. Meteorologists Louis McNally and Kimberley Zuill of Embry-Riddle Aeronautical University and the Bermuda Weather Service, respectively, and professor Kirk Maasch of the University of Maine Climate Change Institute use a method called forensic synoptic analysis, developed by McNally, to reconstruct weather patterns from old diaries and other written works. Those works can include journals of travelers and trappers, ships' logs and protests, and newspaper stories.

Sustaining Eden

IN MORE than a decade of public debate about the future of Maine's forestlands, sustainability has been a linchpin, with stakeholders arguing that it be either reinvented or restored, depending on their view of human-nature relationships.

In a new study aimed at better understanding the environmental issues at stake, Stephanie Welcomer of the Maine Business School studied competing sustainability narratives published during an 11-year period (1994–2005) in support of and opposition to proposed development of 3.2 million acres for a Maine Woods National Park and Preserve.

The study highlights the centrality of sustainability for community stakeholders debating their response to environmental challenges, says Welcomer, whose findings were recently published in the journal *Organization & Environment*.

It is a portrait of sustainability "as it is lived and contested" in Maine, she says.

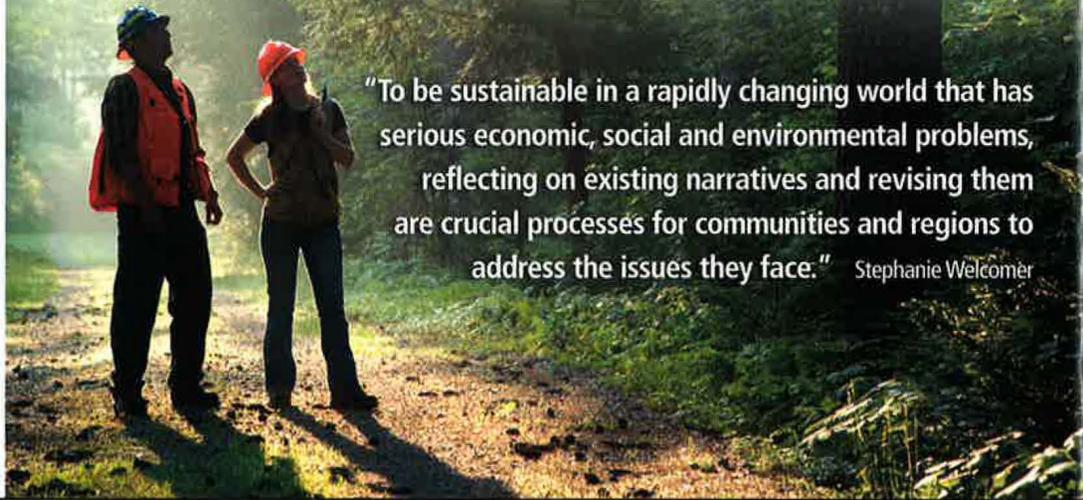
"While providing different perspectives through their plots and actors, both narratives argue for an existing or desired recovered sustainable ecology,

economy and society," writes Welcomer, an associate professor of management at the University of Maine.

With the 1994 proposal to establish a Maine Woods National Park and Preserve, two narratives were in play, both in pursuit of the North Woods version of the Garden of Eden. The park narrative focused on recovery of pristine forest that has been harmed by industry and technology, while the working forest narrative centered on a "civilized," managed resource, with technology and ownership structures providing jobs, recreation and healthy woodlands.

Contrasts between the two narratives are in their approach to science and technology. In the park narrative, the forest is hurt by industrial practices and mechanized recreation. The working forest narrative argues for corporate ownership and forest control.

Significant changes in the narratives occurred in 2000 with the confluence of multiple factors: large land sales, an economic study of the park, statewide polls showing a majority of Mainers supporting the park, and the last U.S. paper company ending its ownership of Maine timber.



"To be sustainable in a rapidly changing world that has serious economic, social and environmental problems, reflecting on existing narratives and revising them are crucial processes for communities and regions to address the issues they face." Stephanie Welcomer



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Director of University Relations
Joe Carr

Managing Editor
Margaret Nagle

Designers
Michael Mardosa, Carol Nichols,
Valerie Williams

Photographer
Michael Mardosa

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what's next



By tapping into the nearly 150,000 megawatts of offshore wind capacity within 50 miles of Maine's coast, UMaine is leading the way to reduce our reliance on fossil fuels, create thousands of clean-energy jobs and mitigate the risks of climate change."

Habib Dagher

Director

AEWC Advanced Structures & Composites Center

Led by professor Habib Dagher and his AEW Advanced Structures & Composites Center team, the University of Maine has established itself as a world leader in research related to deepwater offshore wind power. UMaine is at the center of a collaborative organization, the DeepCwind Consortium, that includes about 30 businesses and organizations working to determine the best technological approaches to tapping this vast resource as a component of a national energy independence strategy. Earlier this year, the state approved a UMaine plan for developing the first deepwater offshore wind energy demonstration site in the United States, to be located at least 10 miles off the mainland. Dagher and others see significant economic development potential for Maine and beyond as they work to establish a Maine-based green energy industry while providing educational and research opportunities for UMaine students.



All business

MATTHEW BOUCHARD of Lewiston, Maine, says he “grew into the role” of a University of Maine business administration student. His dad and two older brothers got their degrees from the Maine Business School. This past May, so did Bouchard.

“Learning to make money grow really interests me,” says Bouchard, the salutatorian of the Class of 2010 with a 4.0 grade point average. “That’s why I knew finance was the road I wanted to go down and accounting would give me an edge.”

While at UMaine, Bouchard has been involved in SPIFFY, the University of Maine Foundation’s Student Portfolio Investment Fund, and intramural sports. He also went to Russia as part of a travel-study course. He received a Beta Gamma Sigma Scholarship and the 2009 UMaine Finance Award.

He’s now headed to New York City, where he will be an analyst with Nomura Securities International.

“I was not a shining star in high school, but when I got to UMaine, I knew I had to make things happen to get a top job,” says Bouchard, named the Outstanding Graduating Student in the College of Business, Public Policy and Health. “My brothers’ advice was to always look long term and know that the knowledge you get will propel you forward.”

Many scholarships, research opportunities and academic offerings for University of Maine students are made possible by donations to THE FUND. Annual gifts give UMaine the flexibility to address its most pressing needs and to take advantage of new opportunities. Please consider a gift today.

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