

Nation of Origins

Raising Halibut

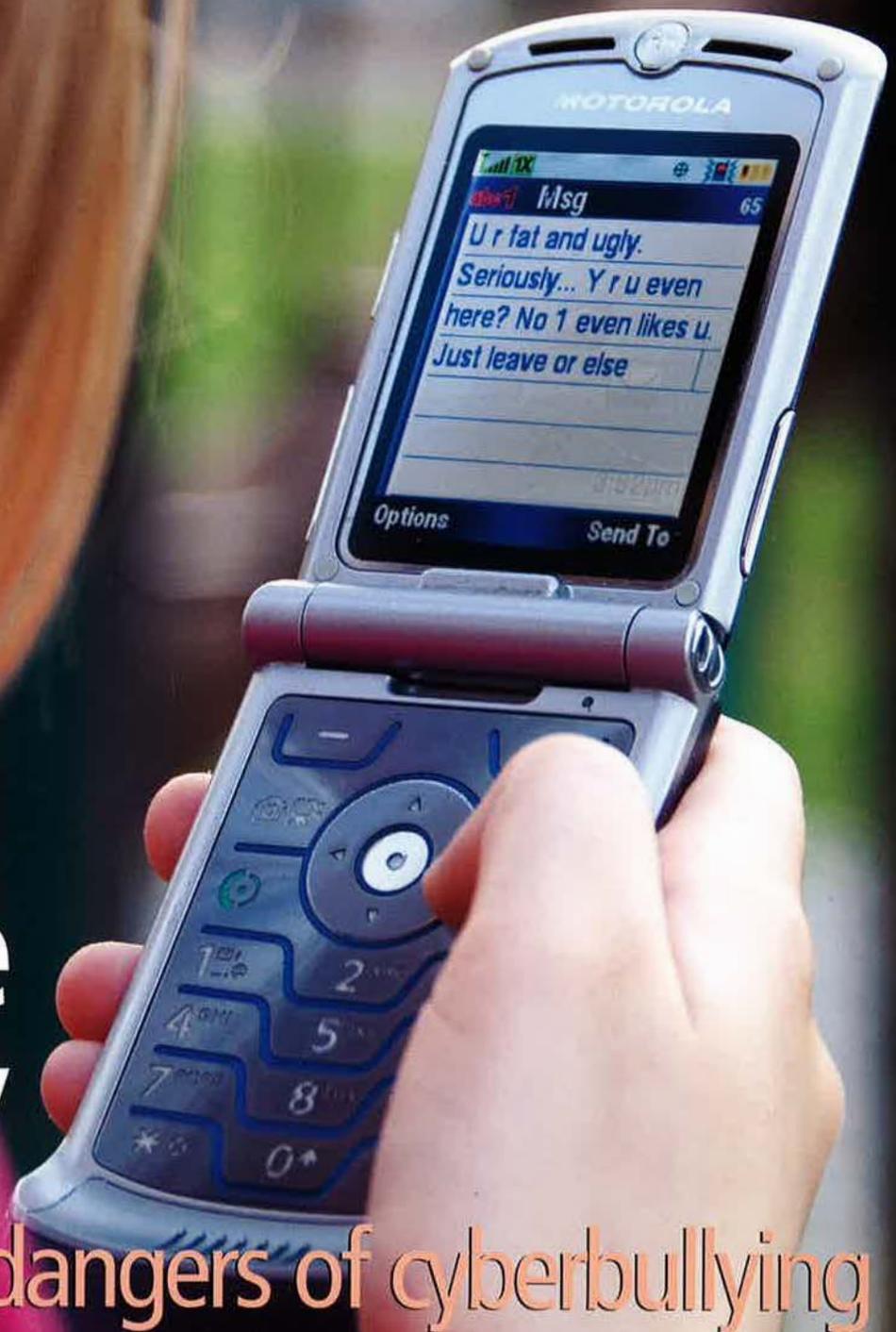
Tamper Resistant

UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

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Extreme cruelty

The very real dangers of cyberbullying

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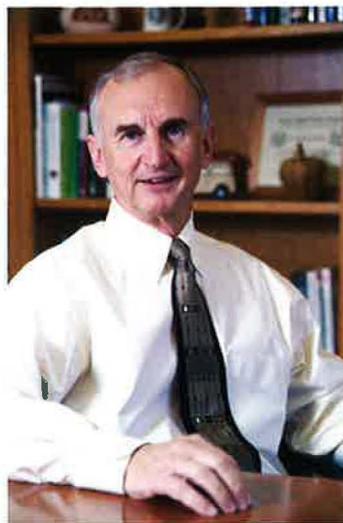
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President's Message



THIS ISSUE OF *UMaine Today* includes several stories about the scholarly achievement that characterizes the University of Maine at this exciting time in our institution's history. In this magazine, we are pleased to once again showcase some of the best examples of UMaine's faculty and students who are living up to our university's high standards and our state's high expectations.

On Nov. 6, the people of Maine demonstrated that they place their hope for a brighter future, to a significant extent, in the University of Maine. Voters approved an R&D bond — the largest such initiative in Maine's history — and a capital infrastructure bond that will fund improvements at several statewide institutions, including UMaine. Ours is not a wealthy state, but our citizens recognize that research, development and education represent the best kind of investment we can make.

At UMaine, we are committed to maximizing every dollar we receive from these two bond measures. We will work hard, every day, to demonstrate the wisdom and value of this investment. Our researchers, frequently in collaboration with UMaine colleagues and those at other Maine research institutions, will continue work toward solving problems, advancing knowledge and creating the new jobs that will drive economic development. By improving facilities for teaching and learning, UMaine will be able to better live up to its responsibility to truly educate — as it has for generations — Maine's leaders.

Taken together, these bond measures provide great opportunity for UMaine and the state of Maine. We are thankful for the people's support and look forward to justifying the investment.

Robert A. Kennedy
President



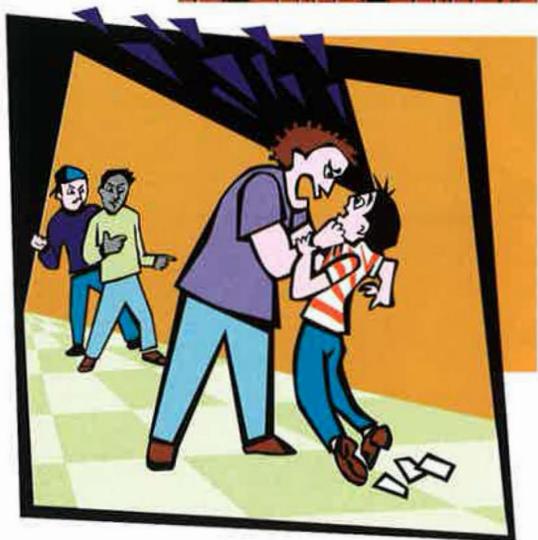
ON THE COVER: Bullying behavior among children and teens has a long history. But in today's society, its intensity and prevalence are fueled by mixed cultural messages and facilitated by technology. Whether face to face or via cyberspace, bullying is increasingly leading children and youths in dangerous directions. At the University of Maine, researchers in psychology and education are looking at the causes and effects of bullying. Each is studying different aspects of this form of aggression and all are coming to the same basic conclusion: Children and teens increasingly don't know how to relate to each other, and the adults in their lives need to help. See related story on page 2.

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Casualties of Bullying

Research by educators and psychologists at the University of Maine shows that what is largely considered an age-old problem of childhood has taken on new dimensions in our technologically driven, media-saturated society. And its effects have long-range implications.

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Raising Halibut

In Franklin, Maine, there's a fish called Wanda. She and her companions seed the production lines of the seven-year halibut aquaculture program at UMaine's Center for Cooperative Aquaculture Research.

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Tamper Resistant

An initiative funded by the U.S. Department of Homeland Security taps UMaine's expertise in composites and sensor technologies to develop a new kind of cargo container — one that can tell its handlers when it has been tampered with.

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Nation of Origins

Throughout American history, issues related to religious, racial and ethnic diversity have bubbled up, especially in times of national crisis. Indeed, cultural diversity shaped the formation of the nation, according to early American historian Liam Riordan.

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The arsenal included a 9 mm semiautomatic pistol, air-powered guns made to look like assault rifles, knives and homemade grenades. Their owner was a 14-year-old who police say was plotting a “Columbine-style” attack at a high school near his Pennsylvania home, allegedly to avenge the bullying he endured in middle school.

“He may have believed that the world would be a better place without the bullies in it,” said Montgomery County District Attorney Bruce Castor Jr., in the *Philadelphia Inquirer*, following the boy’s arrest last October.

Lethal attacks in schools are rare among the estimated 60 million children who attend more than 119,000 schools in the United States, according to *The Final Report and Findings of the Safe School Initiative: Implications for the Prevention of School Attacks in the United States*, a 2002 publication issued by the U.S. Secret Service and the U.S. Department of Education. From December 1974–May 2000, 37 incidents of targeted school-based attacks occurred, committed by 41 individuals.

When these attacks occur, the nation appears to get yet another wake-up call, followed quickly by a feeling of dread that it’s happened again. And the urgency to search for answers is renewed.

One of those searches, the Safe School Initiative, began after the April 1999 attack at Columbine High School in Colorado, hoping to “identify information that could be obtainable, or ‘knowable,’ prior to an attack.” One of the 10 key findings of the study: almost three-quarters of the attackers felt persecuted, bullied, threatened, attacked or injured by others prior to the incident.

The study also pointed to the overall pervasiveness of bullying.

“The prevalence of bullying found in this and other recent studies should strongly support ongoing efforts to reduce bullying in American schools,” the report said.

Bullying is a type of aggression that occurs repeatedly with the intention to harm or disturb, according to researchers from the National Institute of Child Health and Human Development, who studied its prevalence. It is characterized by an imbalance of power that may manifest in physical, verbal or psychological aggression — from hitting to name calling, threats, rumors and shunning.

That prevalence study, published in 2001 in the *Journal of the American Medical Association*, found that nearly 30 percent of the more than 15,500 students surveyed in grades 6–10 reported moderate or frequent involvement in bullying.

By Margaret Nagle
Illustrations by Carol Nichols

casualties of Bullying

UMaine researchers say that children, teens are increasingly ill-equipped to relate to one another

Faced with such statistics and a growing body of research on the immediate and long-term negative effects of bullying, the tide of public sentiment is turning. Schools are reexamining their policies regarding such student behavior. States like Maine are issuing bullying and harassment prevention guides for schools and communities. The U.S. Department of Health and Human Services' National Bullying Prevention Campaign sponsors one of the many educational Web sites.

Then there are grassroots efforts, like the one in Nova Scotia last fall. Two high school seniors said enough was enough when they saw a freshman bullied for wearing a pink shirt the first day of school. The pair bought 50 pink shirts at a discount store and gave them to classmates. They also emailed their peers, urging them to join the "sea of pink" anti-bullying cause. The next day, hundreds of teens came to school wearing pink.

Despite the heightened awareness and growing dialogue, the prevailing notion among adults is still that "kids will be kids." Bullying remains largely viewed as a rite of passage; part of learning to socialize and prepare for relationships as adults; an immaturity that passes with age.

But research by educators and psychologists at the University of Maine and elsewhere is showing that what is largely considered an age-old problem of childhood has taken on new dimensions in our technologically driven, media-saturated society. And its effects have long-range implications. The bottom line is that children and teens increasingly don't know how to relate to each other. And the adults in their lives need to help.

One is the loneliest number

FRIENDSHIPS AND GROUP acceptance are important barometers of youngsters' psychological adjustment, says UMaine



Even if a youngster is considered an outsider with peers, all it takes is one best friend to protect that child from being at risk for loneliness, depression, anxiety and low self-esteem, which can lead to victimization, according to research by Cynthia Erdley-Gardella and other UMaine psychologists. Victimized students actively disassociate.

psychologist Cynthia Erdley-Gardella, whose research focuses on children's peer relationships. Children without friends are at increased risk for loneliness, depression, anxiety and low self-esteem, which can lead to victimization.

Victimized students actively disassociate, not talking or sitting with anyone. Such withdrawal or loner mentality becomes more problematic with age, as appeared to be the case with Seung-Hui Cho in the Virginia Tech shootings, and is less normative in males, says Erdley-Gardella.

"In general in our culture, males are not expected to be sad, but they can show anger," she says. "Boys are not given as much emotional support because they're supposed to be tougher. Withdrawn, shy boys are more apt to be victimized."

Nearly all school shooters are males and tend to be "overlooked" as not susceptible to relational victimization — bullying focused on harming a person's sense of belonging or hurting his or her reputation by highlighting weak points, says Erdley-Gardella. But when they tend to be depressed, some of these boys act out rather than internalize their frustration.

Even teens' peers assume that girls are more relationally victimized than boys. But a recent study of students in grades 9-12 by UMaine Ph.D. psychology student Jessica Matthews demonstrated that boys are just as vulnerable.

The finding was the result of boys self-reporting, rather than relying on peers' perceptions of who is relationally victimized.

Victims need to try to find ways to be more assertive and stand up for themselves. They also could benefit from the support of others, but that doesn't often happen. According to Erdley-Gardella, an estimated 70 percent of school-age children and teens stand by in the face of bullying because they don't want to draw attention to themselves and because they believe the victim somehow deserves the abuse.

Bullies have esteem issues as well. Those who bully say they victimize to create excitement, alleviate boredom and increase their status in their peer group. It's important to try to increase their empathy and see the effect of their words and actions, says Erdley-Gardella.

"When it comes down to it, adults can't dictate. Change has to come from the pressure of the peer group. What's needed is a more open, accepting, positive, supportive and safe school environment celebrating diversity. If that becomes a culture in a school, ultimately students will have the greatest success."

Girlfighting

FOR GIRLS, THE cultural messages about how society expects them to behave, act and look are pervasive in the media and in advertising. But the unrealistic portrayals set up a dynamic among girls that is as divisive as it is destructive.

The result is a form of bullying called girlfighting.

Girlfighting is relational aggression girls use against one another in their struggle to gain self-esteem and stature in a male-dominated world. Though largely covert and subtle, the peer targeting hurts girls emotionally, leaving them feeling excluded, betrayed, insecure and isolated.

"As a result of girlfighting, girls understand that relationships are not always what they appear," says Mary Madden, an education researcher at UMaine who focuses on adolescent emotional and social health issues, including girls' development and education, gender equity and hazing.

"They also are aware of how quickly they can become the target. As a result, they try to feel less vulnerable and divert attention from themselves by targeting others."

Women who experienced girlfighting in their youth or have daughters who went through it talk about how damaging it is,



Girls need to understand girlfighting and the labeling and competition behind it, says education researcher Mary Madden. A key to turning girls from adversaries to allies is media literacy, helping them to critically analyze cultural messages and sexist portrayals of girls and women, and to respond constructively.

Madden says. "When women can remember the details of their experiences from 30 years earlier, it tells you something about the powerful impact it has."

Three years ago, Madden coauthored *From Adversaries to Allies: A Curriculum for Change* with Lyn Mikel Brown, a professor of education at Colby College and cocreator of the nonprofit Hardy Girls Healthy Women, based in Waterville, Maine. The middle school curriculum addressing girlfighting prevention was cited in the 2006 *Maine's Best Practices in Bullying and Harassment Prevention: A Guide for Schools and Communities*, published by the Maine Governor's Children's Cabinet.

In a school with such a curriculum in place, girls feel safer emotionally among their peers, Madden says. Not all the girls are friends, but they are all allies.

Evaluation of the curriculum after its piloting in 10 Maine schools found girls who bought into the cultural ideals of how they should look and act had higher rates of depression and lower self-esteem. Depression decreased and self-esteem increased among girls enrolled in the curriculum, says Madden.

With *Adversaries to Allies* in place, girls see the value of taking action to support each other as opposed to downgrading and fractionalizing. In such a school climate, adults are more responsive to girls' concerns, including issues they see as injustices. They help girls figure out constructive ways to respond and make change.

"Once girls see that these are unjust messages by society, then they can start to constructively respond for social change," says Madden, whose upcoming research will involve the study of girlfighting in the context of other social justice efforts aimed at a more comprehensive approach to improving school climate. "They learn to stick up for themselves and for kids on the outs, including interrupting bullying when they see it."

Future shock

FOR TOO LONG, the perception has been that youngsters' friendships and adolescents' romances are innocuous because they are often short-lived and superficial — part of the growing pains to endure on the road to adulthood. But through the work of UMaine psychologist Douglas Nangle and other researchers, there is growing evidence of the connections between children's friendships and teens' relationships, and their implications for healthy adult relationships.

"We're realizing there's a connection between physical and psychological aggression in young kids, and how that can carry into future relationships," says Nangle, whose research focuses on peer relations. "People need to understand that the different problems and issues relating to aggression, bullying and dating violence are connected."

Dissertation research by one of Nangle's graduate students is investigating whether aggressive adolescent behavior in peer groups and friendships is a predictor of similar behavior in dating relationships. One focus is the role of relational aggression.

Nangle is particularly interested in the social skills required as children make the transition from same-sex friendships to larger mixed-sex group interactions and eventual romantic relationships as teens. He and a former doctoral student, Rachel Grover, now an assistant professor at Loyola College, coedited a special section on the development of adolescent romantic competence that will soon be published in the *Journal of Clinical and Adolescent Psychology*. A feature of the section is that certain social and emotional skills and competencies serve to form the foundation for healthy adult relationships. These can be taught and fostered.

"Looking at dating aggression from a competence standpoint, for instance, might show that coercive actions stem from an



Recent research shows that children with bullying histories begin dating earlier, view their relationships as less supportive, and are at increased risk for entering into abusive dating relationships, says UMaine psychologist Douglas Nangle. Research showing the developmental trajectories of physically aggressive children and the longer term implications for their future relationships is sobering.

inability to more constructively problem solve in conflict situations," he says.

Nangle and Grover have been studying teens' heterosocial competence, the ability to effectively negotiate social situations that involve the other sex, including friendships and dating relationships. They developed an assessment tool, the Measure of Adolescent Heterosocial Competence, which asks teens to respond to a range of challenging social interactions with the opposite sex. They developed a parallel assessment instrument for use with college-age students.

"In one study, we found that college students high in a dimension of social anxiety — a fear of people evaluating them in a negative way — were more likely to use psychological aggression in their romantic relationships. Sensing rejection,

these individuals may jump more quickly to coercive and manipulative responses in conflict situations," Nangle says.

Not enough attention is paid to teaching children and teens how to have healthy friendships and relationships, contends Nangle, who also recently studied relational aggression in at-risk preschoolers. From day one, children's behaviors in friendships need to be viewed as bridges to more long-lasting relationships.

"The skills we use in relationships of all types are so complex," he says. "(Yet) somehow we seem to believe as a society that people will learn them through 'osmosis' or something. Why not invest in more systematic educative efforts, perhaps as part of the school curriculum — and more."

Bullying in a virtual world

STUDENT-ON-STUDENT bullying is a challenging enough dilemma for teachers and school administrators. But bullying enabled by technology — making it more anonymous, insidious, instantaneous and far reaching — is increasingly causing safety

and legal issues for schools and students.

"It's clear to me that this is a new and dangerous form of traditional bullying," says Dianne Hoff, UMaine associate professor of educational leadership. "It's (often) about sexually degrading or terrorizing, making someone fearful, which to me is in line with victimization."

A confluence of factors gives rise to cyberbullying, leaving schools at a crossroads, says Hoff, whose research includes contemporary legal dilemmas in education. More courts are ruling that schools are becoming overly restrictive on student dress, speech and behavior. Coupled with the explosion of technology and a generation of parents quick to defend their children, right or wrong, students can bully more efficiently and effectively than ever before.

Students who are cyberbullied by classmates may seek help from school administrators, who can impose disciplinary action as they would for other instances of bullying or harassment, Hoff says, as long as the behavior occurred or has a negative impact at school. But defenders challenge schools' jurisdiction in such matters, claiming that the communication between students occurred after school on a home computer. Parents of victims want the schools to take action, whereas parents of the perpetrators argue their children's First Amendment rights are being violated.



Cyberbullying reality

NEARLY ALL TECHNOLOGICAL developments are mixed blessings, and the use of computers and cell phones to foster bullying is no exception, according to University of Maine historian Howard Segal.

"We might recall the naive 1990s claims about the Internet creating unprecedented democracy and community nationally and internationally. Cyberbullying doesn't exactly foster either. Instead, those high-tech advances enable bullies to engage in verbal abuse, allowing them to say and perhaps portray things about their victims that they might not dare articulate in person," says Segal, who specializes in science and technology history.

One sometimes neglected aspect of cyberbullying is that evidence of youthful misbehavior discovered and retained by either the victim or the authorities may come back to haunt the offender later in life, long after the perpetrator may have changed his or her behavior — or forgotten about it, Segal says.

A 2006 study of students' perceptions of cyberbullying by Dianne Hoff and Sidney Mitchell in the UMaine College of Education and Human Development examined the frequency, methods and impact of cyberbullying on the lives of the victims and their friends. The study also sought to capture students' perceptions of cyberbullying.

An analysis of the study's data revealed seven general themes:

- The number of students victimized by cyberbullying is increasing with access to advancements in electronic communications.
- With the protection of technology, the number of girls as bullies is nearly equal to the number of boys.
- Students linked cyberbullying incidents most often to relationship issues, including jealousy, envy, breakups, shunned and shifted friendships, and reputational issues.
- Cyberspace has become "a graphic, scary, threatening and generally disgusting virtual world" with few laws or norms.
- Cyberbullied students feel powerless, fearful, angry and sad.
- Generally, students do not seek help and those who do wait until the bullying reaches dangerous levels.
- Students report that school officials were generally unresponsive to requests for help.

"Schools have an obligation to keep students safe," says Hoff, who gives safety training presentations in districts statewide on cyberbullying, intruders and threats. "If the problem is related to school, I tell administrators they not only have a right, but a responsibility to act."

Research by Hoff and UMaine educational psychologist Sidney Mitchell found that cyberbullying causes fear, anger, feelings of helplessness and inability to concentrate. Paradoxically, those who have been cyberbullied said they did not stay off Web sites or cell phone text messaging because the technology is intrinsic to their social life.

"Research shows that students' most common way to deal with bullying is to bully back," Hoff says. "There is also a lot of evidence that cyberbullying can quickly cross over to real-life stalking and physical assaults. What starts online escalates to predatory behavior."

Hoff compares the virtual world that is fostering cyberbullying to a modern-day version of William Golding's *Lord of the Flies*.

"(In cyberspace) kids are on a virtual island with no supervision, norms or rules. The worry is about an escalating uncivilized environment for which they have no moral compass and which has long-term implications," she says.

"Adults have to step up (and) help students develop healthier relationships, social coping skills, and, ultimately, appropriate moral compasses for an electronic age." ■

student focus

Environmental estrogen

EMILY NOTCH SPENT four years involved in salmon habitat restoration in the Pacific Northwest before she decided to turn her attention to research addressing the larger issues concerning the biological effects of toxicants on freshwater fish.

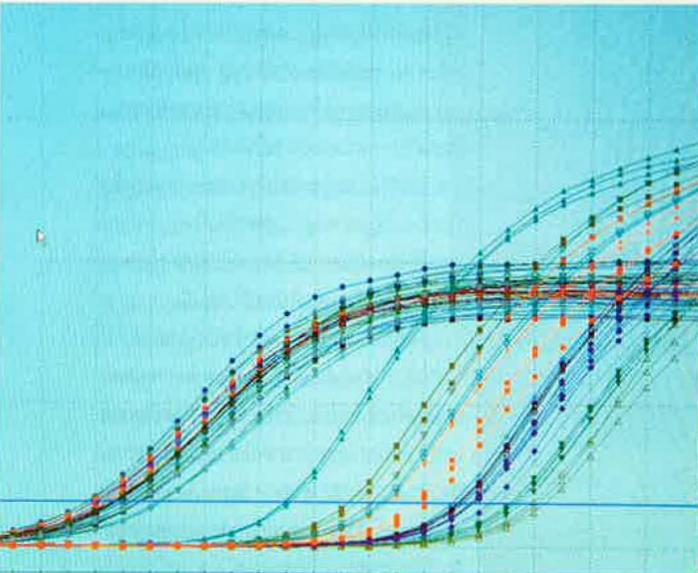
Now, three years into her doctoral research at the University of Maine, Notch has found evidence that waterborne synthetic hormones, like those in oral contraceptives and hormone replacement therapies, do more than impair fish reproduction. Synthetic estrogens and similar hormones have the potential to disrupt an aquatic organism's natural ability to perform DNA repair, which could lead to mutations and tumors.

Her work has implications not only for fish, including endangered wild Atlantic salmon, but also humans.

"There's so much that we don't understand about what we're putting into the environment and how it affects aquatic organisms," says Notch, a native of Scotia, N.Y., who was recently named one of 66 graduate students nationwide to receive a U.S. Environmental Protection Agency (EPA) Science to Achieve Results (STAR) Fellowship.

"Now the research is spinning into a cancer realm, which is how (the focus) comes back

Emily Notch is studying the effects of one synthetic estrogen, ethinylestradiol (EE₂), in zebrafish and its potential to suppress nucleotide excision repair (NER) in organisms. In particular, she has researched EE₂'s ability to decrease the expression of multiple liver repair genes in zebrafish. EE₂ is a synthetic hormone that can be found in oral contraceptives and hormone replacement therapies.



"For humans who take birth control, the question ultimately is what is the effect on them long term. For fish, what is the effect of swimming in estrogen, hydrocarbons, metals and other pollutants? The subtle interactions — how they impact fish and have implications for human health — are fascinating."

Emily Notch

around to (humans). What makes this research so interesting to me is how it all ties together.”

Synthetic hormones like estrogen, excreted by millions of women taking oral contraceptives or hormone replacement therapies, enter the natural aquatic environment via wastewater treatment plants. Estrogens are known carcinogens, but current science lacks a complete understanding of estrogen-induced cancer.

In her research as a Ph.D. candidate in the laboratory of Greg Mayer, an assistant professor of molecular and environment toxicology, Notch has studied the effects of one synthetic estrogen, ethinylestradiol (EE₂), in zebrafish and found it has the potential to suppress nucleotide excision repair (NER) in organisms.

NER is the molecular pathway in organisms — from fish to humans — capable of recognizing and repairing DNA damage caused by environmental carcinogens.

Notch’s research findings on EE₂’s ability to decrease the expression of multiple liver repair genes in zebrafish, a model organism

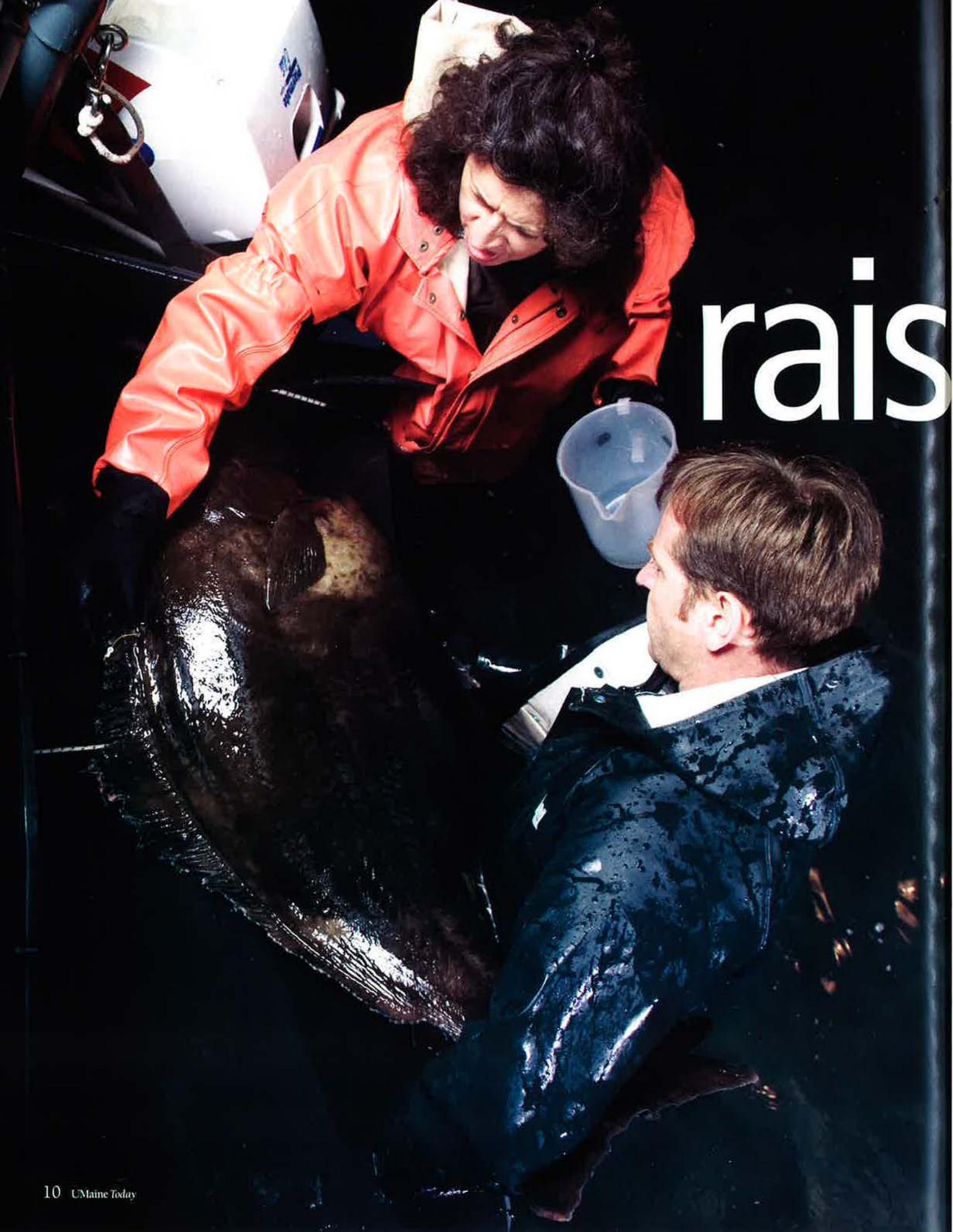
for human health, were published this past summer in the journal *Aquatic Toxicology*.

Now with three years of funding with the EPA STAR Fellowship, awarded to graduate students in environmental fields, Notch will further study whether environmental estrogens alter DNA repair, leading to increased mutations and, ultimately, cancer.

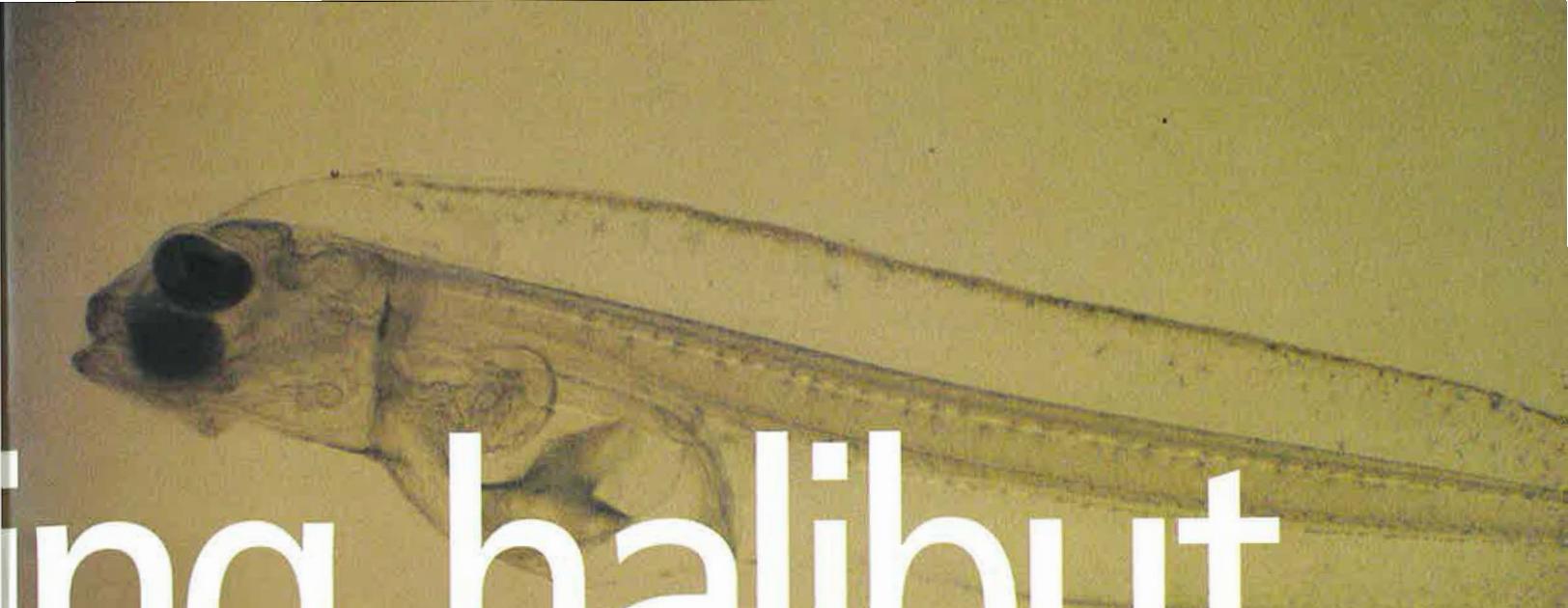
Notch is UMaine’s third EPA STAR Fellow in the past three years. In 2004, Ph.D. student Karen Merritt in civil and environmental engineering, and Nicolas Blouin, a master’s student in marine sciences, were named fellows.

“For humans who take birth control, the question ultimately is what is the effect on them long term,” says Notch. “For fish, what is the effect of swimming in estrogen, hydrocarbons, metals and other pollutants? The subtle interactions — how they impact fish and have implications for human health — are fascinating. A big puzzle to me.”





rais



ing halibut

Seven years of UMaine aquaculture research is paying off

By David Munson

Wanda swims lazily in an 8,500-gallon black plastic tank until she senses the approach of visitors. Then she breaks the surface of the cold, clear water in a frenzied greeting exacerbated by the natural orientation of her head, permanently cocked to one side in the trademark twist of her species.

Far removed from her deepwater ocean haunts, she is one of more than 100 adult Atlantic halibut being raised as brood stock at the University of Maine Center for Cooperative Aquaculture Research (CCAR) in Franklin, Maine. Wanda and her companions supply the eggs and milt that seed the production lines of CCAR's halibut aquaculture program, turning a diet of carefully formulated krill, squid, crab and fish sausages into the next generation of *Hippoglossus hippoglossus*.

Wanda weighs in at a hefty 120 pounds, the first big hint that there are peculiarities of the halibut's life cycle that make the rules for raising

such bottom-hugging beauties unlike those for raising goldfish. In truth, the halibut's journey from egg to plate is as complicated as its twisted visage is bizarre. A tremendous research investment is required to achieve success in the feeding, breeding and rearing of each tasty filet. UMaine's halibut program represents more than seven years of research into the unusual lives of the flatfish and benefits to Maine's aquaculture industry that have only begun to be realized.

"There has been a lot to discover with halibut," says Nick Brown, CCAR operations manager. "Marine species are notoriously difficult to raise in terms of nutrition and other factors, and since halibut spawn in deep water, we know even less about them."

Brown and his UMaine research colleagues have applied their considerable expertise to unraveling the secrets of halibut growth and development, pairing their discoveries with an adaptive,

Collecting eggs from an adult female halibut are CCAR research assistant Marcela Hincapie and operations manager Nick Brown. Every three days during breeding season, a single adult female halibut can supply several liters of the fragile eggs, which are carefully blended with milt collected from the males. In a darkened room humming with the sound of pumps and filters, long columnar tanks act as swirling incubators for the fertilized eggs.

raising halibut

One of CCAR's most important advances has been in the recirculation systems being used to house the adult brood stock, and in the incubation and larval rearing. To maintain healthy conditions for growth and breeding, the huge tanks require a complete water change every hour, amounting to almost a million gallons per day cycling through the brood stock facility.

innovative approach to developing successful systems for large-scale production. Utilizing the facility's resident adult population, wild caught in Maine waters in 2000–01, the scientists began harvesting eggs and milt from the huge fish and identifying optimal conditions for hatching and rearing halibut larvae.

Every three days during breeding season, a single adult female can supply several liters of the fragile eggs, which are carefully blended with milt collected from the males. In a darkened room humming with the sound of pumps and filters, long columnar tanks act as swirling incubators for the fertilized eggs. Once hatched, the tiny, translucent fry are at the most delicate stage in their development.

For nearly 10 weeks, they swim in much the same way as other fish. After absorbing their yolk sac, they seek out minuscule prey to build energy for their surprising metamorphosis. With the proper food and environmental conditions, the bodies of the tiny fish transform from a typical salmon-like design to the horizontally flattened form of the adult. Their bodies twist and flatten, their eyes migrate to one side and they slowly descend through the

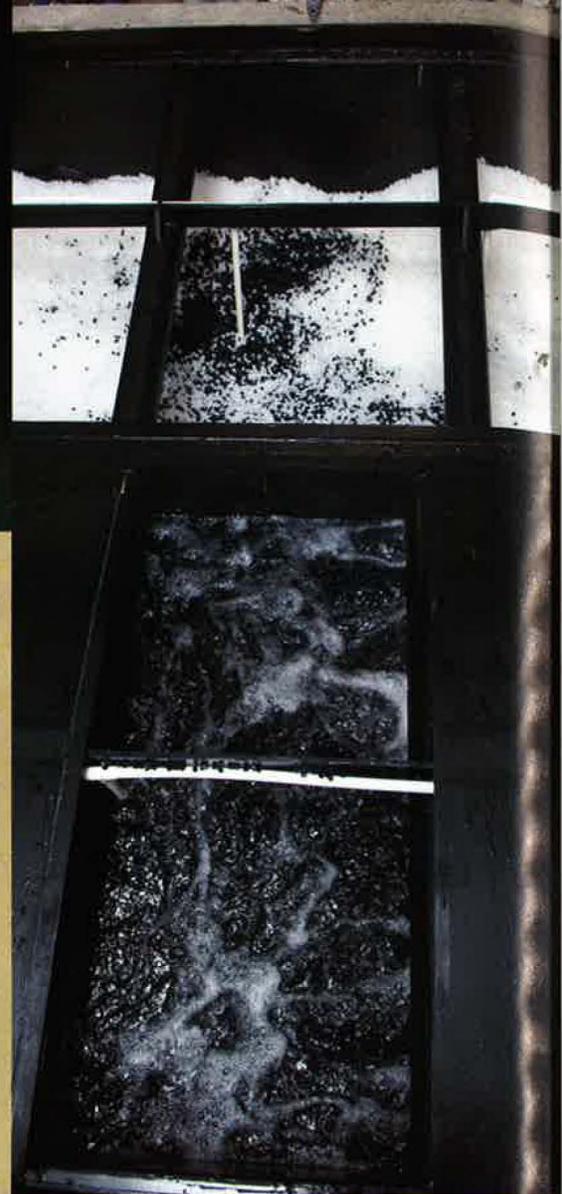
water column to their new home on the ocean floor.

The slightest environmental disturbance or nutritional deficiency can throw the halibut larvae's delicate systems off balance, causing an irregular or incomplete metamorphosis that leads to deformities. Brown and his team have successfully identified the environmental and nutritional requirements for larval growth, and can now rear tens of thousands of larvae in the Franklin facility for research and commercial aquaculture.

Brown also has teamed up with UMaine aquaculture nutrition expert Linda Kling. Their research, funded by a grant from the USDA Northeastern Regional Aquaculture Center, includes the longest-running halibut brood stock nutrition study ever conducted. Testing two specially formulated diets against a control diet of raw herring and squid, Brown and Kling have made significant strides toward understanding the complex nutritional needs of adult halibut, comparing differences in growth rates, egg production rates and larval success based on feeding regimes.

Addressing the challenges of halibut aquaculture in a comprehensive way has allowed the center to become a true partner

The innovative filtration system takes advantage of the natural ability of bacteria to break down fish wastes such as ammonia into harmless nitrates. As pumps churn billions of bubbles through a mixture of tank water and dime-size plastic nuggets, bacteria growing on the surface of the plastic work their magic, creating a giant biofilter for processing the considerable waste produced by dozens of adult halibut.





in the development of the state's aquaculture industry. By examining everything from breeding to feeding, UMaine has been able to offer its industry partners a head start in the growing halibut aquaculture market.

"We have been working with UMaine since 2002 in a business incubator-type relationship, and we are very enthusiastic about what the future holds," says Alan Spear, president of Maine Halibut Farms LLC of Orono. "Raising halibut commercially is a process that requires a long lead time and considerable capital investment. Our relationship with UMaine has given us the chance to prove our model works and carve a niche for ourselves in the industry."

The successful relationship between CCAR and its industry partners was highlighted by the sale of a bumper crop of more than 25,000 healthy juvenile halibut to Maine Halibut Farms in 2006. The fish represent the first large-scale population of commercially grown halibut in the country and are an important step toward establishing a halibut aquaculture industry in Maine.

Research into nutrition and rearing methods has been critical to the program's success, but UMaine's role in developing the fledgling halibut aquaculture industry isn't limited to researching the fish's unique biology. CCAR's innovative facilities and management methods are helping ensure that raising halibut will be a commercially viable enterprise in the state. From temperature-controlled incubation rooms to

advanced recirculation technologies, CCAR's facilities and techniques have revealed new ways to reduce costs, increase growth and prevent disease.

One of CCAR's most important advances has been in the recirculation systems being used to house the adult brood stock, and in incubation and larval rearing. To maintain healthy conditions for growth and breeding, the huge tanks require a complete water change every hour, amounting to almost a million gallons per day cycling through the brood stock facility.

Seawater inputs this large not only increase energy and maintenance costs for pumps and associated equipment, but also make temperature, salinity and other water conditions nearly impossible to control. CCAR's recirculation system not only cleans the water and allows technicians greater control, it also limits fresh seawater inputs to just 4,000 gallons per day.

"With this system, we are able to filter the water and sterilize it using ultraviolet light, as well as control salinity and temperature in the tanks," says Brown. "We are always trying new things to boost the efficiency of the system and reduce costs."

The filter takes advantage of the natural ability of bacteria to break down fish wastes such as ammonia into harmless nitrates. As pumps churn billions of bubbles through a

mixture of tank water and dime-size plastic nuggets, bacteria growing on the surface of the plastic work their magic, creating a giant biofilter for processing the considerable waste produced by dozens of adult halibut.

With 25,000 young halibut at CCAR, a major facility expansion is under way. Giant

concrete tanks and new technologies have been installed to expand the program's ability to grow halibut to a market size of 5–10 pounds, and market tests are being conducted to determine if smaller, plate-sized halibut would appeal to consumers. Capable of supporting 500,000 fish, the new expansion will allow CCAR and its industry partners to complete the progression from proof-of-concept experimentation to demonstrable, large-

scale production.

The successful expansion is clearly a good sign for Maine's aquaculture industry.

"Restrictions on wild-caught halibut have opened up more markets in Boston and New York for farmed halibut, and most of what's being raised currently is coming from Norway, Scotland and Canada," says Spear.

"This new phase of the project will bring us up to a production level of 20 tons per year," he says. "When we take the next step to 200 tons per year, we'll have a real, viable business under way." ■

"There has been a lot to discover with halibut. Marine species are notoriously difficult to raise in terms of nutrition and other factors, and since halibut spawn in deep water, we know even less about them."

Nick Brown

Tamper resistant

By David Munson

Composite and sensor technology combine to create shipping containers that can warn of security breaches

THEY DON'T LOOK like much. Big and rectangular, dinged at the corners and bespeckled with rust, oversized shipping or cargo containers are the building blocks of international commerce.

According to the U.S. Department of Homeland Security (DHS), almost 7 million cargo containers are off-loaded at American seaports annually. But their ubiquitous use in the supply chain also makes them a security risk.

On Capitol Hill last year, DHS Under Secretary Jay Cohen testified before a Congressional subcommittee that "one of the most significant potential terrorist threats to the nation is the vast number of shipping containers that flow through our borders each year, most of which enter without physical inspection."

For that reason, DHS has made port security a top priority, funding a variety of technologies and initiatives intended to increase cargo handlers' ability to monitor the thousands of shipping containers that enter U.S. ports daily.

One technology being investigated taps into the University of Maine's considerable resources and expertise in the areas of composites and sensor technologies to develop a new kind of container —

one that can tell its handlers when it has been tampered with.

UMaine graduate student Anthony Viselli and Advanced Engineered Wood Composites (AECW) Center Director Habib Dagher spearhead the research at UMaine, being done in partnership with Maine Secure Composites LLC.

Maine Secure Composites, based at the Target Technology Incubator, focuses on the development of maritime container construction using composite materials for homeland security, international shipping and the U.S. military. In

2005, Maine Secure Composites, led by Fred and Cynthia Smith from Angel Secure Networks LLC, and Professor Dagher from AECW, received a DHS Advanced Research Program Agency contract to develop a composite anti-tamper container with embedded sensors.

With the help of AECW's research personnel, equipment and testing services, it was one of six organizations to receive DHS awards. Applications for the highly competitive awards came

from more than 100 research institutions nationwide, Viselli says.

"The purpose of the project was to develop a container that could detect intrusions on all six faces," says Viselli. "What we developed is a container that utilizes composite panels for security, but can also be fully integrated into the existing manufacturing and shipping infrastructures to promote acceptance by the industry."



"With projects like this, research and development complement education to the point where they become inseparable."

Habib Dagher



VISELLI WAS A JUNIOR in civil engineering when he was hired as a research assistant at the AEWCC Center and began work on development of the composite containers. He managed a team of other student engineers who developed a half-scale model that helped earn Maine Secure Composites DHS funding for a second phase.

When he completed his undergraduate degree, Viselli chose to stay at UMaine to continue the tamper-resistant containers project and work toward a master's degree in civil engineering. Dagher sees the combination of research and academic experience that projects like this provide as a true strength of UMaine.

"This project illustrates how research, education and economic development are linked," says Dagher. "By working for Maine Secure Composites, Anthony and the other students involved not only received a salary and help toward their tuition, they also had the opportunity to learn about new technologies, and to apply their skills in engineering and science that they learned in the classroom."

The Maine Secure Composites/UMaine design team is now developing a pilot production line for the containers to demonstrate how the technologies can be incorporated into a manufacturing process capable of quickly producing multiple units.

Unlike other composite container products that have proved to be largely unsuccessful in the field, UMaine's design promises to be user-friendly at multiple levels. The research team has focused considerable time and energy on creating a prototype that integrates easily into existing infrastructure for container manufacturing and use.

"As evidenced by Senator (Susan) Collins' leadership in developing the Port Security Act, there is a national need to do more to enhance port security, with real concerns about the possibility of cargo coming into the U.S. that contain weapons, bombs or hazardous materials," Dagher says. "In this project, we need to address the issue of national security, but we also need to make sure that what we do doesn't interfere with the flow of commerce. In addition, we wanted to provide incentives that would help to ensure that the container manufacturing industry would adopt the new design."

BY CREATING THE NEW patented design, manufacturers could begin to utilize existing manufacturing lines without any costly equipment or changes in production techniques. Recent tests of the first full-scale composite container at an independent International Standards Organization (ISO) certification facility in New Jersey showed that the new design will meet all of the industry's strength requirements.

In addition, the new design is more durable and requires less maintenance than steel, according to Viselli and Dagher.

"In terms of industry acceptance of the anti-tamper container, our composite container is more resistant to corrosion, and doesn't need as much painting and other maintenance like steel. Another advantage is the reduction in self-weight," says Viselli. "The composite components make the containers 15–20 percent lighter than existing steel containers, which helps to offset the initially higher costs of using composites. Less weight means less fuel costs or increased payload."

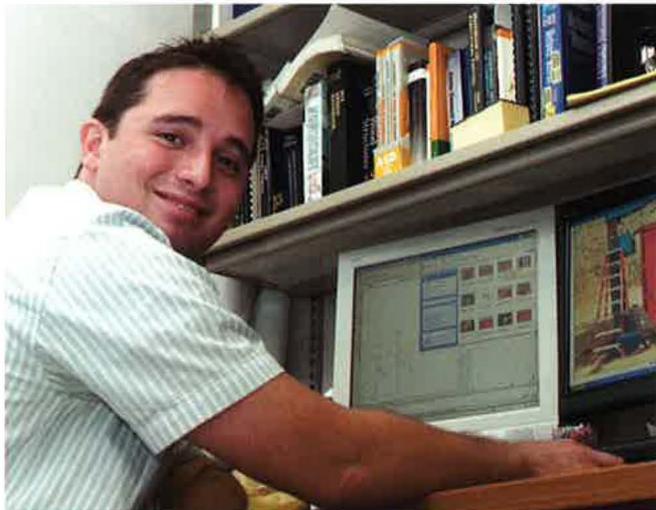
Since the new containers can be manufactured to the same design standards as traditional steel, they can be packed, stacked and shipped like any others on the market, maintaining a constant flow of commerce.

Another advantage of the new container is its adaptability. The composite panels are designed in such a way so that

they can "host" a wide variety of sensor systems already on the market. Embedded sensors in future containers could not only help maintain port security, they could monitor environmental conditions inside the container or detect damage to the contents during shipping.

Once completed, the pilot production line will provide Maine Secure Composites, UMaine and DHS with several full-scale containers for field-testing.

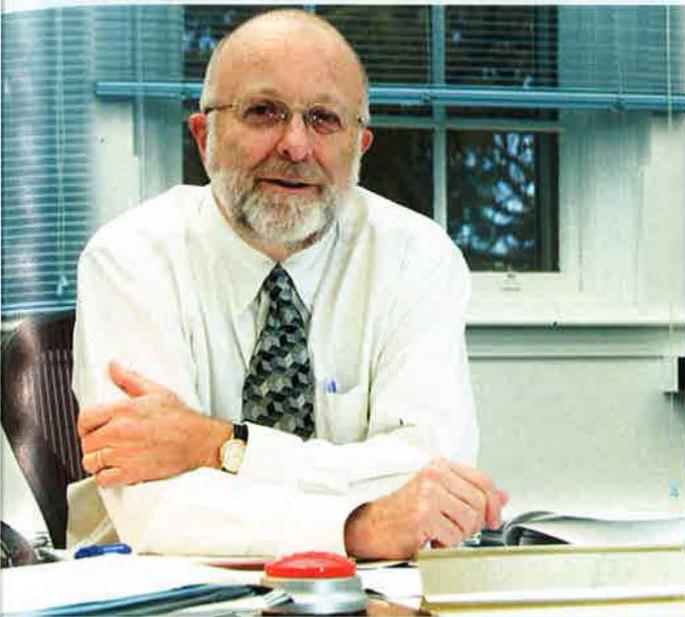
"The economic potential of this project is really exciting," Viselli says. "This is a great opportunity to create new manufacturing/R&D jobs while helping meet the challenges of securing our nation's ports." ■



Civil engineering graduate student Anthony Viselli is the onsite program manager for Maine Secure Composites.

perspective

UMaine Research



Michael Eckardt

Title: Vice President for Research

Personal Research focus: Ph.D. in medical psychology from the University of Oregon Medical School; 25 years at the National Institutes of Health; 20 years as a laboratory chief of clinical brain research and five years as planning and evaluation officer for the National Institute on Alcohol Abuse and Alcoholism; more than 150 scientific publications. Practiced as a clinical psychologist for more than 20 years.

Years at UMaine: Four

Milestones: Since FY 2003, NSF-calculated research expenditures for UMaine have increased 35 percent and U.S. Congressional earmarks have increased more than 50 percent. Since FY 2004, the Maine Economic Improvement Fund has increased 36 percent for UMaine. Determination of Return on Investment (ROI) for research investments was initiated in 2004. The University Research Council was reconstituted with representatives from every college, providing faculty input in UMaine's major research initiatives.

Question: What is the role of research at a land-grant institution like the University of Maine?

Answer: Today's land grant should be responsive to the needs of the public, with approximately 50 percent of its research and scholarly activity applied or of obvious significance to the lay person. In Maine, the legislature has assisted in defining those areas of significance with the seven Maine Economic Improvement Fund (MEIF) areas: agriculture and forestry; aquaculture and marine sciences; precision manufacturing; environmental technology; biotechnology; information technology; and composites and advanced materials. As a result, UMaine's research priorities include alternative energy sources, climate change, homeland security, biomedical research and research to enhance the competitiveness of Maine's natural resources-related industries.

Question: What are the challenges in achieving that fundamental mission?

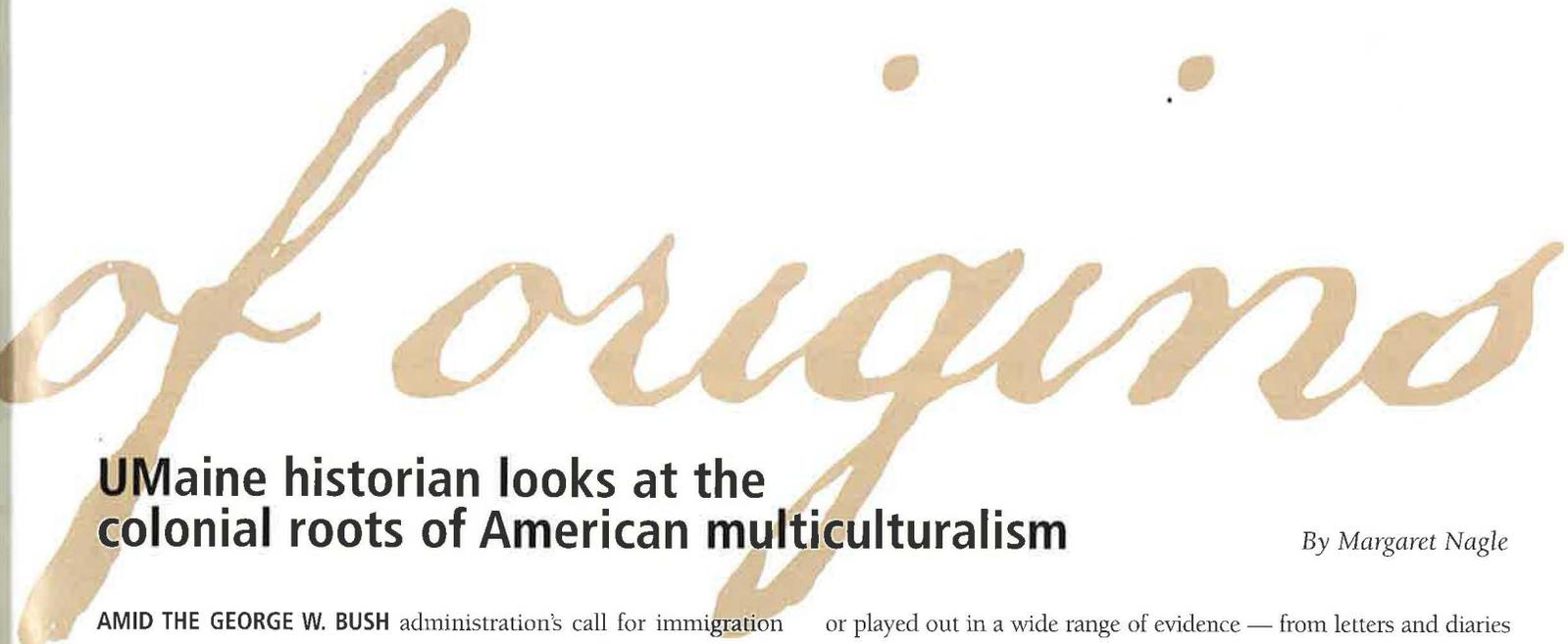
Answer: The challenges include increasing funding for graduate students, especially doctoral candidates; increasing MEIF awards; introducing new models for funding R&D at the state level; and accelerating production of university-related economic contributions to Maine, intellectual property, translational research, jobs and successful businesses that partner with or emerge from the university.

Question: How does science and engineering research dovetail with UMaine's liberal arts foundation?

Answer: Appreciation of the liberal arts is what makes us human and also provides the context for conducting research in science and engineering. Recognition of the importance of the liberal arts was apparent in the original land-grant legislation that acknowledged that the emphasis on agriculture, military tactics and mechanic arts should be conducted within the framework of a liberal arts education. The emphasis in Maine on the creative economy also is recognition of the importance of the liberal arts in the economic development of the state.

Question: How do we measure the success of UMaine research?

Answer: Ultimate Return on Investment (ROI) is enhanced economic development and the creation of new jobs resulting from investments in university R&D. I use a number of proxies for this ultimate goal: the number and amount of federal grants leveraged; the number of businesses assisted by UMaine; the number of graduates who have developed skills enabling them to be employed in high-paying jobs; the number of research publications, presentations and books; the number of patents and licenses resulting from university-developed intellectual property; the number of graduate students who earn degrees; and the number of national and international awards to faculty.



UMaine historian looks at the colonial roots of American multiculturalism

By Margaret Nagle

AMID THE GEORGE W. BUSH administration's call for immigration reform and allegations of civil rights violations in the name of homeland security, the multicultural diversity on which the nation has prided itself in recent decades is increasingly being second-guessed.

But that's nothing new.

Throughout American history, issues related to religious, racial and ethnic diversity have bubbled up, especially in times of national crisis, like reality checks on the country's long-held self-characterization as a bastion of individual liberty.

Indeed, cultural diversity shaped the formation of the nation, according to early American historian Liam Riordan.

Contrary to popular views of colonial America reflecting either the Puritanism of New England or the slavery of the South, the mid-Atlantic states were the proving ground for some of the country's earliest multicultural growing pains. From the eve of the American Revolution through the 1830s, Riordan examines diverse cultural groups in Pennsylvania, New Jersey and Delaware that heeded the growing call of nationalism to create a new American way.

In this Revolutionary period of stress and transition, issues involved in living in a multicultural society forced themselves to the forefront.

"The great uncertainty of the Revolutionary era led to a search to try and figure out the basis of the new society being created," says Riordan, a University of Maine associate professor of history, whose most recent book, *Many Identities, One Nation: The Revolution and Its Legacy in the Mid-Atlantic*, focuses on three groups in the region — Quakers, Pennsylvania Germans and African-Americans. "That included the nature of public authority, how to provide order and security, and how to protect group as well as individual rights — very contemporary questions for us, as well."

Riordan's approach to early American multiculturalism involves cultural and social history, anthropology and historical ethnography. In his research of a 60-year period, 1770–1830, Riordan compiled a database on several thousand people, taking "a close measure" of the everyday encounters in which cultural diversity became significant

or played out in a wide range of evidence — from letters and diaries to tax lists and religious records to newspapers, clothing, architecture and folk art.

He found that in the pluralistic mid-Atlantic colonies, the American Revolution forced members of diverse ethnic, religious and racial groups to choose patriot or loyalist identities. Tensions only intensified as the struggle to build a unified front — and, ultimately, a nation — continued in the postwar years.

"Local people's exploration of how one retains ethnic distinctiveness — a cultural sense of self — while still sharing in a broader public culture was perhaps the most pressing political question of the postwar era," he says.

IDENTITY POLITICS has the potential to be both liberating and repressive. For instance, Quakers' pacifist values contrasted starkly with the patriotic spirit of the day. Their pacifism placed them outside the patriot movement, Riordan says, and led to a dramatic change in the Delaware Valley's political leadership. The Quakers, whose members had been influential and prominent, were pushed to the margin of Revolutionary society.

There was a general distrust of foreign cultures and fear that newcomers would cause social turmoil. In the case of Pennsylvania Germans, many Anglo-American leaders considered them "swarthy and inferior," incapable of understanding English liberty and in need of reeducation in charity schools.

"Why should Pennsylvania, founded by the English, become a Colony of Aliens, who will shortly be so numerous as to Germanize us instead of our Anglifying them, and will never adopt our Language or Customs, any more than they can acquire our

"The core of my research is about how to understand religious, racial and ethnic relationships in early America, a theme of great interest today that also has deep roots in our past."

Liam Riordan

A Map of Pennsylvania, New-Jersey, New-York, and the Three Delaware Counties. L. Hebert, sculpt. Second edition, published in Philadelphia, 1752. Library of Congress, Geography and Map Division

Complexion?” Benjamin Franklin asked his readers in a 1755 essay.

Such rhetoric is “a wonderful example of both change and continuity in America’s multicultural experience,” Riordan says. “You change some of the words around a little bit and he could sound like a spokesman for anti-Latino immigration to

especially targeted “signs of respectability” in the black community.

The identity politics of the broad Revolutionary era took new form in the partisan politics of the Jacksonian movement starting in the late 1820s. Andrew Jackson’s election as the country’s seventh president included Irish American and German American

to understand diverse religious, racial and ethnic relationships in early America, a theme of great interest today that also has deep roots in our past,” he says. “For a long time, we thought about Colonial and Revolutionary America as solely the province of Englishmen. Clearly, that distorts and flattens a much more varied early American society.”

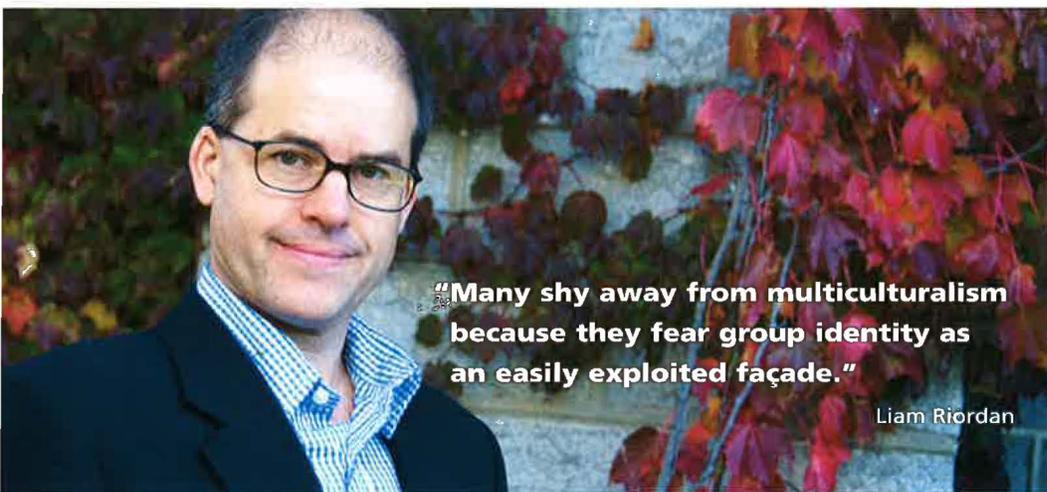
Examining group identity past or present elicits sensitivity because it touches a “deep impulse to make sense of the world by knowing and often disliking what you are not,” Riordan wrote in a chapter for the book *Germans and Indians: Fantasies, Encounters, Projections*. Today, he says, “many shy away from multiculturalism because they fear group identity as an easily exploited façade.”

But Riordan contends that cultural identities valuably inform individuals’ understandings of their world. “The complexion of one’s country has many facets that are enriched by transcending strictly material markers,” Riordan wrote.

While the meaning of diversity changes over time, it’s important, Riordan says, to try to understand the experience of the people in that historical moment. And because the world confronts us with complex issues we’d like to better understand, there’s often a sense of urgency to comprehend similar situations in the distant past, he says.

“For decades, there was almost nothing said about women, working people, Native Americans and African Americans in early America. That very narrow sense of our past compromised our ability to understand the world we live in today,” he says.

“Only when a range of overlapping human relationships are understood in their local context can we begin to grasp how power operated and changed in a given society,” Riordan says. It’s a subject that demands attention, he contends, because disagreement continues about how best to reconcile distinctive group identities with national unity. ■



California today. Yet, his core argument that Germans were not white and had a different ‘complexion’ from Anglo-Americans strikes us as bizarre. Studying early American cultural diversity can help us recognize the deep roots of the United States as a multicultural society.”

The American Revolution was a turning point in the formation of white racial identity. For instance, among German Reformed and Lutherans, there was broad support for the Revolutionary movement and, as a result, their quasi-outsider status in colonial British America changed. In what Riordan sees as a significant transition, these “church Germans” acquired a more central place for themselves in the new national society.

The Revolution also offered some hope to African Americans. In the region Riordan studies, African Americans go from overwhelmingly enslaved to overwhelmingly free in the 1790s. Once free, African Americans used their roots in Christianity to found churches and fraternal organizations. However, by the 1820s, their efforts were met with escalating white violence that

supporters in its coalition, while rejecting Native American and African American efforts to participate in formal politics. This “new significance to whiteness” brought the more dynamic possibilities of Revolutionary identity politics to a close.

THE LINK BETWEEN the past and present is key to historical scholarship like Riordan’s. It also offers a perspective different from the way much of the general public thinks of history and the past. “At its core is the fundamental idea that the past and present are closely connected to one another. Professional historians negotiate between questions we’re asking about ourselves today and how that changes our perspectives on the past,” he says.

History should not be the rote memorization of 2,000 key dates, individuals, battles and elections to “understand everything you need to know about the past.” It’s not solely a quest to understand the “truth” about the years gone by. Above all, history is not static, says Riordan.

“The core of my research is about how

Flower power



Rick Kersbergen is nationally recognized for his role in building the state's organic dairy research and the University of Maine Cooperative Extension program. He has helped foster strong collaborations for organic dairy research between USDA agencies and the Cooperative Extensions of UMaine, the University of Vermont and University of New Hampshire.

Photos by Michael Mardosa



THE LATE-SUMMER scene was enough to make passersby stop and stare.

In a two-acre field at the University of Maine's Rogers Farm in Old Town bobbed the weighty heads of 45,000 organic sunflowers.

UMaine Cooperative Extension researcher Rick Kersbergen admits that the sight was an attraction in the landscape. But for him and members of Maine Organic Milk Producers (MOMP), the value of the sunflowers was evident long after the beauty of the flowers faded in the field.

The sunflowers were grown and harvested for their potential as a value-added crop for organic milk producers in the state. Kersbergen, an Extension educator in Waldo County, led the research to grow organic sunflower seeds that could be cold pressed to produce oil for human consumption and a high-protein meal to feed livestock.

Quality organic feed protein is expensive and hard to find in the livestock market, says Kersbergen. For that reason, MOMP members are exploring alternatives, such as organic sunflowers

that also might yield a by-product to sell on the human market.

The sunflowers grown for the pilot project were a type high in oleic acid. The monounsaturated oil is a healthy, trans-free alternative for consumers, according to the National Sunflower Association. With a neutral taste, it can be used for baking, frying and spray coatings.

For now, the sunflower oil resulting from the pressed seeds is considered experimental, with marketing opportunities still being explored, Kersbergen says. The dry seed residue resulting

from the pressing will be analyzed for its protein and amino acid content as a livestock meal.

Kersbergen and MOMP are applying for a grant

from Northeast Sustainable Agriculture Research and Education to conduct more trials to determine if organic sunflowers can be an economically viable crop for Maine.

The sunflower research is one of a number of joint grant projects spearheaded by Kersbergen in cooperation with MOMP to feed organic herds, expand grain production and usage on organic dairies in Maine and Vermont, and reduce dependence on grain brought in from the Midwest and Canada. Similar studies are under way at the University of Vermont.

Maine has the highest percentage (20 percent) of organic dairy farms in the nation, says Kersbergen.

Organic milk production is one of the fastest-growing agricultural sectors, with more than 275 organic dairies operating in Maine, New Hampshire and Vermont.



Hunting LYNX

CANADA LYNX prefer to hunt in the Maine woods where their favorite food — snowshoe hare — is relatively accessible, but not necessarily the most abundant, according to newly published research by University of Maine wildlife ecologists Angela Fuller and Daniel Harrison, and Maine Department of Inland Fisheries and Wildlife biologist Jennifer Vashon.

The researchers found that three female and three male lynx snow tracked for more than 40 miles during two winters preferred woods with 11–26 years of postharvest growth — regenerating clear-cut forests with tall regrowth (nearly 24 feet tall) and established, partially harvested stands.

Not as much to their liking were regenerating clear-cuts with tree height less than 14 feet, stands partially harvested in less than a decade, and mature second-growth forests.

Even though some stands have higher densities of snowshoe hares, lynx selected tracts that provided intermediate cover for hares. Lynx are visual foragers that hunt by stalking or ambushing.

In the contiguous United States, Maine has the only population of Canada lynx east of Minnesota. The study, published in the *Journal of Wildlife Management*, sheds light on how the wild cats, designated as federally threatened, use human-altered habitats in the southeastern portion of their range. Data on their winter habitat selection and foraging success in relation to silvicultural treatments is vital to lynx conservation.

UPDATE

Location, Location, Location

BUSINESSES ARE ATTRACTED to locations with high quarterly and six-month employment stability, according to a study of Maine companies that began operation in 1999–2000. This suggests that business owners favor places with a strong year-round economy over areas with seasonal spikes in economic activity, according to University of Maine economist Todd Gabe.

Gabe studied nearly 1,600 businesses that began operations in 317 Maine municipalities. His analysis, which accounted for other location factors such as taxes, population size and industry clusters, found that annual fluctuations in local economic activity and employment do not appear to deter new business activity. But in municipalities with seasonal employment spikes, there are far fewer businesses opening their doors.

These findings are particularly pertinent in Maine, where strong seasonal swings are of concern in some parts of the state in the summer and fall.

Writing in the journal *Land Economics*, Gabe noted that policymakers need to take into account the effects of instability when evaluating economic development strategies.



Follow the Teacher

WHEN IT COMES to leaders in our school systems, most people think only of administrators. But it takes many people to really mobilize a school for student learning, according to University of Maine education researcher Gordon Donaldson.

The most important among them are teachers. “At issue is our understanding of leadership itself,” says Donaldson, writing in the journal *Educational Leadership*. “Most of us hold

the deep-seated assumption that leaders must have appointments and titles that formalize their leadership and officially confirm their knowledge, traits and competencies.”

Such a narrow definition underestimates the role of teacher leaders and the difference they can make in education, Donaldson says.

Teacher leaders are individuals and groups of educators whose professional relationships and commitments in a school foster instructional innovation. As leaders, they help build relationships among their peers, maintain a sense of purpose and improve instructional practice. Teacher leaders’ assets complement principal leadership.

“Whereas principals can shape teachers’ beliefs, attitudes and behaviors, other teachers do shape them,” says Donaldson. “Teacher leaders understand this and are deliberate about shaping their environment in a positive, responsible way. They draw on their relationships and their strong sense of purpose to help colleagues explore, share and improve the practices they use daily with students.”





Birds in the postharvest woods

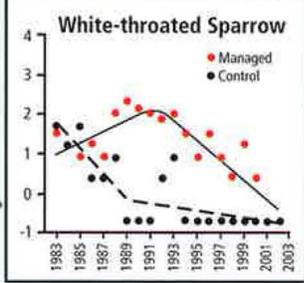
IN THE LONGEST experimental investigation to date of the effects of a group-selection timber harvest on forest birds, University of Maine researchers found that nine of the 22 species abundant enough for individual analysis in a Maine woods study area responded positively in the postharvest period.

In particular, the Eastern Wood-Pewee, Winter Wren, Pine Warbler and White-throated Sparrow increased in abundance in the managed half of the area following timber harvest, which involved removal of small groups of mixed-aged trees at short intervals.

Eight other bird species were apparently unaffected. Of the five species that suggested a negative effect, only one, the Veery, a medium-size thrush, showed a strong negative response to the timber harvest that occurred on half of UMaine's 100-acre Holt Research Forest.

The first-cutting cycle of a group-selection

timber harvest creates patches of habitat similar to the small openings caused by natural disturbance. These patches provide habitat for species that inhabit early-successional forest growth, yet have little effect on the abundance of mature closed-canopy bird species.



The 20-year study by UMaine wildlife ecologists Steven Campbell, Jack Witham and Malcolm Hunter, published in the journal *Conservation Biology*, provides important information on the strength, direction and duration of temporal changes in bird populations following forest management.

The study is particularly pertinent as managers of woodlands turn to group-selection harvesting as an alternative to clear-cutting. In addition, the number of small privately owned forests in the United States of comparable size to the Holt Research Forest is rising.

BY THE numbers

New Minerals Discovered

ON A GEOLOGICAL EXPEDITION along the windswept slopes of the Larsemann Hills in Antarctica, samples of the area's unique rock formations collected by University of Maine geologist Edward Grew revealed three minerals — stornesite-(Y), chopinite and tassieite — previously unknown to science.

The unique mineralogy of the Larsemann Hills, located on the eastern shore of Prydz Bay in Princess Elizabeth Land, inspired Grew and his colleague Chris Carson of Geoscience Australia to make the three-month expedition in 2003–04.

In UMaine's Department of Earth Sciences, Grew and Martin Yates identified the minerals using photomicrographs and a powerful electron microprobe. After determining each sample's optical, chemical and crystallographic properties, in collaboration with mineralogists in Germany and Switzerland, Grew submitted the data to a special commission of the International Mineralogical Association, which formally approved the three new minerals.

When new minerals are identified, some have little significance while others end up being tremendously important, says Grew, who has discovered 10 in his career. "Ultimately, discoveries like these contribute to our understanding of the origin of rocks, plate tectonics and other processes, and give us valuable insights into temperature, pressure and other conditions at different points in the Earth's history," he says.

This past October, Grew and UMaine Climate Change Institute Director Paul Mayewski were among 471 scientists named American Association for the Advancement of Science Fellows. Grew was recognized for "distinguished research on the role of lithium, beryllium and boron in metamorphism at high temperatures and pressures, with emphasis on the Precambrian of Antarctica." Mayewski was cited for "seminal contributions to our understanding of climate change through ice and snow studies."

SOUTH ASIAN MONSOONS

AN ICE CORE from Mt. Everest shows evidence that the South Asian monsoon, the largest seasonal reversal of wind patterns and precipitation on Earth, has weakened in the past 1,000 years in the northerly, high-elevation regions of monsoon influence, according to climate change researchers at the University of Maine and the Joint Key Laboratory of Cryosphere and Environment in China.

However, low-elevation records from south of the Himalayas demonstrate that the monsoon has strengthened in the past few centuries.

The researchers, who reported their findings in *Geophysical Research Letters*, noted that the ice core revealed a decrease in marine and increase in continental air masses related to relatively high summer surface pressure over Mongolia, resulting in a reduction in northward incursions of the summer South Asian monsoon since around 1400 AD.

The north-south regional differences in the Asian monsoon reflect a southward shift in its mean summer position, say the researchers, led by Susan Kaspari, a Ph.D. candidate in UMaine's Climate Change Institute. The change in monsoon circulation at 1400 AD coincides with a reduction in solar output and the onset of the Little Ice Age.

Arts and sciences

A NINETEENTH-CENTURY oceanographer and navigator Prince Albert I of Monaco once called art and science “the two directive forces of civilization.”

Indeed, oceans are replete with literary, artistic and musical allusion and vice versa, according to University of Maine marine scientist Malcolm Shick. That’s why, for the past three years, his introductory course on the biology of marine organisms has incorporated an arts and humanities component in an effort to “put marine biology into its wider aesthetic and historical context.”

In an essay written for the Chamber Music Society of the Maine Center for the Arts, Shick details his extensive approach to “an aesthetic marine biology” in the classroom. He uses works of marine biologists who were also artists, and pieces by artists whose works were based on their direct, sympathetic experience with ocean life.

They include naturalist Philip Henry Gosse, whose illustrated books about marine life on the Devonshire Coast helped drive the Victorian craze for seaside natural history, and marine ecologist T.A. Stephenson; artists Andrew Wyeth, Henri Matisse and Jackson Pollock; musicians and composers such as J.S. Bach; and writers from Shakespeare to Steinbeck.

Last February at the American Society of Limnology and Oceanography’s national conference in Santa Fe, N.M., Shick coproduced “Plankton as an Artistic Inspiration,” an art exhibit, lecture and documentary exploring the influence of the microscopic shapes and forms in art and design. The exhibition captured the attention of the principal international science weeklies, *Nature* and *Science*.

A chandelier in the Monaco Oceanographic Museum and Aquarium was designed to capture the beauty of a medusa, like that drawn by German naturalist Ernst Haeckel (1834–1919).

Images ©Musée océanographique de Monaco. M. Dagnino photographer



ARSENIC in zebras

IN ONE OF THE first reports of its kind, microbiologists at the University of Maine have shown that arsenic exposure, at levels deemed safe in drinking water, suppresses the overall innate immune health in zebrafish.

Zebrafish are used as model organisms for studying immunotoxicity of environmental toxicants.

The researchers studied the effects of low concentrations of arsenic on zebrafish resistance to infection. They found that exposure to two concentrations of arsenic, both of which are considered safe in drinking water, resulted in zebrafish embryos being more than 50 times more susceptible to viral and 17 times more prone to bacterial infections.

Exposure to 2 ppb and 10 ppb (parts per billion) arsenic resulted in slight increases in total arsenic content in the zebrafish. The increases were enough to bring about dramatic declines in essential innate immune functions. Exposure to arsenic inhibited the ability of the fish to clear both viral and bacterial infection from their systems.

Arsenic is a naturally occurring element in soil, air and water that is generally considered nontoxic. However, it can accumulate in the environment at toxic levels due to pollution and human activities such as mining.

The researchers — graduate student Akshata Nayak, postdoctoral researcher Christopher Lage and associate professor Carol Kim — published their findings in the journal *Toxicological Sciences*.



U NIVERSITY OF MAINE audiologist Amy Booth has spent her career providing hearing services to underserved populations in this country and around the globe. In October, she was in China as a member of an international team of health professionals providing audiology screenings and hearing aid assessments to one such group — Special Olympics athletes.

Booth was invited to the Special Olympics World Summer Games in Shanghai, Oct. 2–10, to provide training and to help implement the Healthy Hearing segment of the Special Olympics Healthy Athletes initiative.

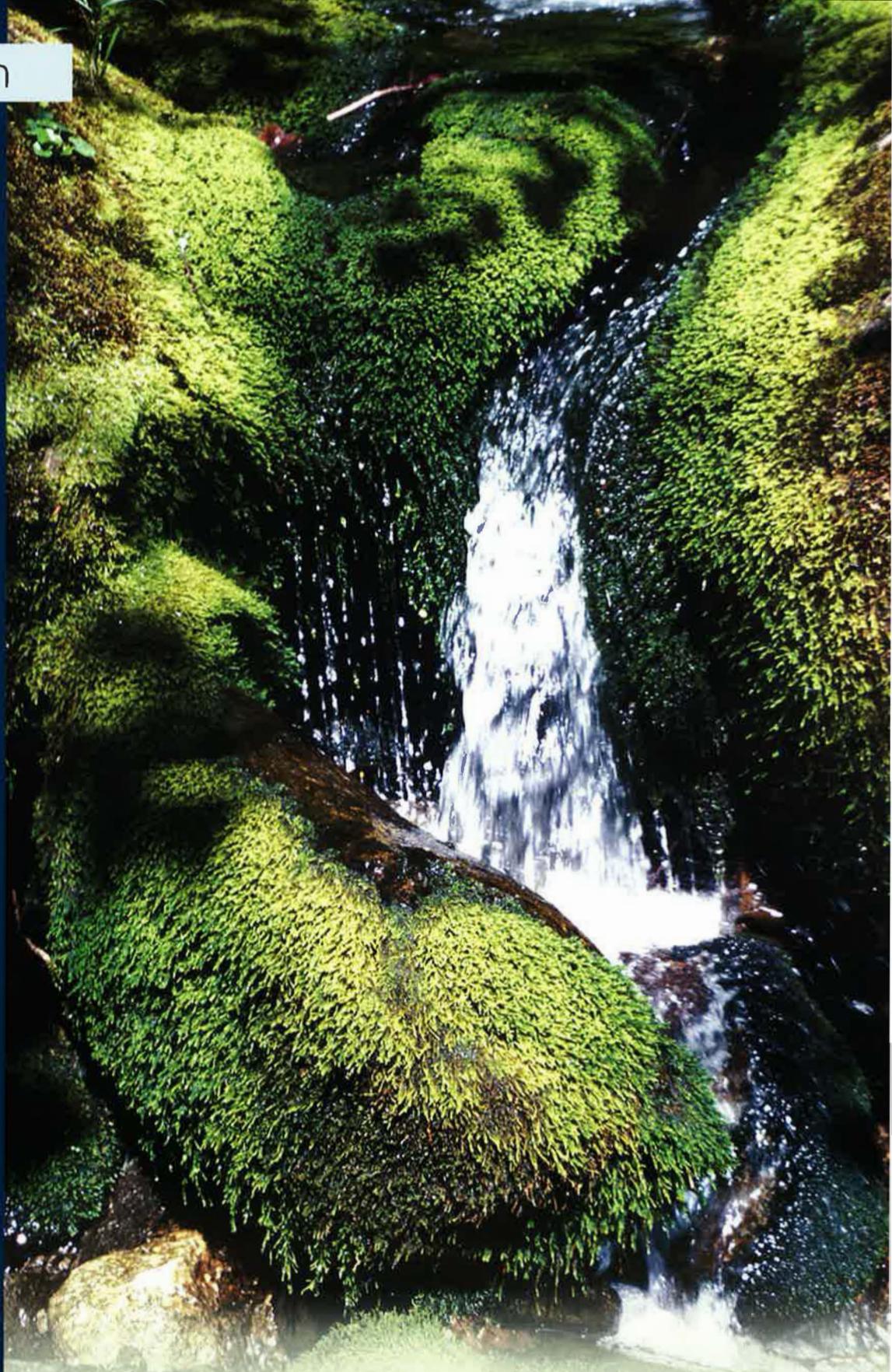
With more than 7,000 athletes competing in the Special Olympics World Summer Games, Booth and her colleagues did nearly 450 hearing screenings and hearing aid assessments daily. In a day and a half, the team dispensed 120 hearing aids donated by various hearing aid manufacturers.

Booth has been invited to participate with Healthy Hearing in the World Winter Games in Idaho in 2009 and the World Summer Games in Greece in 2011.

Special screenings



last impression



RESEARCH THAT PROTECTS OUR NATURAL RESOURCES is pervasive and prominent at the University of Maine. As the state's land-grant institution, UMaine is committed to addressing those issues that affect citizens' quality of life and the future of Maine. Helping protect water quality, studying the habitat needs of wildlife, understanding the dynamics of the Gulf of Maine and ensuring the health of forests that dominate the state's landscape are all part of UMaine's multifaceted, multidisciplinary approach. The result is research related to natural resources that makes a difference in Maine — and beyond.



Academics and athletics

THE NEW COACH of University of Maine Women's Basketball knows what it's like to be a UMaine student-athlete. From 1994–98, she was one of them.

Cindy Blodgett was an education major who received UMaine's Dean Smith Award, given annually to the university's top female and male student-athletes for academic excellence. A powerhouse on the hardwood, she graduated with 20 UMaine records and led her teams to the NCAA tournament four consecutive times.

Now Blodgett has returned to her alma mater, this time to coach. In honor of her head coaching debut, the **Cindy Blodgett Women's Basketball Education Fund** was established in the **University of Maine Foundation** in 2007 with a gift from Russell S. Bodwell '44 and Barbara Higgins Bodwell '45. Income from the fund will be used to provide scholarship aid for deserving student-athletes on the UMaine Women's Basketball team.

It is scholarship aid, says Blodgett, that will address one of her priorities: ensuring academic strength in the student-athlete equation.

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