

UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

JANUARY/FEBRUARY 2004

**The
Creative
Economy**

Sea & Reef

**Tiny
Technology**

From the President

Photo by Toby Hollis



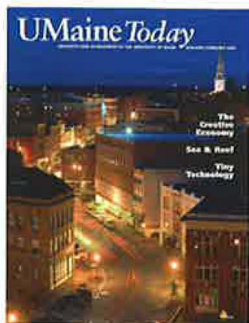
MAINE IS ABUZZ with talk about the potential of the creative economy, and for good reason. According to creative economy expert and Carnegie Mellon Professor of Economic Development Richard Florida, author of the best-selling book, *The Rise of the Creative Class*, "a place's economic prosperity now depends more on diversity, healthy arts and culture scenes, great universities, outdoor recreation and tolerance." At the University of Maine, we couldn't agree more.

UMaine is home to some of the most creative people in the state. We have long believed that arts and cultural activities are important community resources and ingredients in economic development. We have only to look at our own Maine Center for the Arts to find a performing arts program that contributes millions of dollars to the state's economy, provides a regional cultural focus, and serves as an attraction for new businesses and employees coming to the area.

A similar story is found in UMaine's Museum of Art, which recently moved to downtown Bangor and now serves as a cultural anchor in that city's growing creative economy. It has joined other educational, arts and cultural programs like the Maine Discovery Museum in helping revitalize a once bustling commercial district that has more recently struggled. The creative economy involves idea people — software developers and artists, authors and architects, designers, archivists and entrepreneurs, to name a few. Their talents draw other idea people to our state. Their enterprises infuse life into underutilized downtown buildings and dollars into local economies.

In this issue of *UMaine Today*, you'll find stories about some of the university's newest contributions to the creative economy: a state-of-the-art research and development laboratory for digital filmmaking; a start-up company in aquaculture; a new Technology Innovation Center for student entrepreneurs; and some of the latest research involving MEMS technology. They all involve creative people capitalizing on the state's strengths, and pursuing initiatives with the potential to provide opportunities for our young people and to enhance our quality of life in Maine. They represent the kind of creativity needed to help Maine participate in the knowledge-based economy.

Peter S. Hoff
President



ON THE COVER: Downtown Bangor is one of many Maine communities exploring the potential of the creative economy — an economic model with arts, culture and innovation at its core. As part of economic development, a critical mass of artistic and cultural creativity can help revitalize communities, create jobs to retain young people, attract tourist dollars and contribute to a region's quality of life. The creative economy encourages synergies that lead to new companies based on ideas and technology. (Story on page 10.)

Cover image from Indigo Sky Bangor, a photograph by Kenton Williams, a University of Maine graduate student in spatial information science and engineering, and winner of the third annual Downtown Photo Show, sponsored by Bangor Center Corp.



Peter S. Hoff, President

Robert A. Kennedy, Executive Vice President and Provost

Michael J. Eckardt, Vice President for Research

UMaine Today

Publisher

Jeffery N. Mills

Vice President for University Advancement

Executive Director of Public Affairs and Marketing

Luanne M. Lawrence

**Created by the University of Maine
Department of Public Affairs**

Joe Carr, Director

Editor

Margaret Nagle

Contributing Writers and Associates

Gordon Bonin, Carrie Bulduc, Joe Carr,
Nick Houtman, Kay Hyatt, Margaret Nagle,
Christopher Smith

Department of Marketing Designers

Michael Mardosa, Carol Nichols, Valerie Williams

Readers are invited to send comments to:
umainetoday@umaine.edu

Located in Orono, Maine, the University of Maine is the state's land-grant and sea-grant institution. UMaine serves its home state through its explicit statewide teaching, research, and public service outreach mission. Offering 91 bachelor's, 62 master's, and 25 doctoral degree programs, UMaine provides the most varied and advanced selection of programs available in Maine. The Carnegie Foundation for the Advancement of Teaching classifies UMaine as a Doctoral Research Extensive University, the highest classification. UMaine is a member of the University Research Magazine Association.

UMaine Today is produced six times a year by the Department of Public Affairs, University of Maine, 5761 Howard A. Keyo Public Affairs Building, Orono, Maine 04469-5761, 207-581-3744.

In complying with the letter and spirit of applicable laws and in pursuing its own goals of diversity, the University of Maine System shall not discriminate on the grounds of race, color, religion, sex, sexual orientation, national origin or citizenship status, age, disability or veteran status in employment, education, and all other areas of the university. The university provides reasonable accommodations to qualified individuals with disabilities upon request. Questions and complaints about discrimination in any area of the university should be directed to: Director of Equal Opportunity, 101 North Stevens Hall, University of Maine, Orono, Maine, 04469-5754, 207-581-1226.

The University of Maine is a member of the University of Maine System.

© 2004 by the University of Maine System.

Printing and distribution of *UMaine Today* is underwritten by the University of Maine Foundation and the Office of the Vice President for Research.

♻️ *UMaine Today* is printed on recycled paper.

2 Juvenile Onset

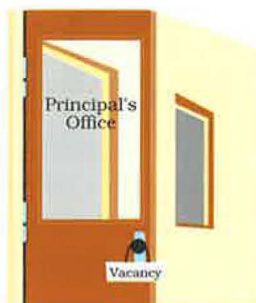
It's a disease that strikes the young and has the potential to devastate more than 90 percent of an oyster grower's annual crop. Microbiologist Kathy Boettcher has now isolated a previously unknown species of bacteria that is the most likely culprit, and is working with Maine oyster growers to reduce the risk.



2

5 The Principal's Office

A survey of Maine's K-12 educational leaders shows that the state's principal population is aging and young educators are reluctant to step into the increasingly complex job. That's where policymakers come in.



8 3D

As part of the infrastructure of the state's creative economy, UMaine will soon have a state-of-the-art research and development laboratory for digital filmmaking.

As envisioned by new media faculty member Raphael Di Luzio, the initiative has the potential to put Maine on the leading edge of a changing film industry.



8



12

12 Aquaculture to Save Coral Reefs

Capturing tropical fish in the wild for saltwater aquariums can be detrimental to the delicate reef habitat. It also can shorten the lives of the fish. That's why UMaine Ph.D. students Søren Hansen and Chad Callan want to make the home aquarium industry more ecologically sound.

15 Tiny Technology

A new chapter in microelectronics is unfolding, and at UMaine, faculty members Rosemary Smith and Scott Collins are among the leaders. The researchers specialize in microinstruments that ultimately could improve healthcare and quality of life.



15

18 Advancing Manufacturing

Since it opened a year ago, the Advanced Manufacturing Center has done product design and development for companies statewide, filling a gap in Maine's economic development capacity with its prototyping expertise.



18

21 student focus 22 insights

A Material World
Starting with versionZero

Setting Up Shop
Digital Delivery
Senior Sense
Meaning in Middle School
Put to the Test

What Lies Beneath
Losing Loggers
A Gift for Growing
Clean Joints

UMaine researchers study a previously unknown species of bacteria that threatens oyster offspring

Juvenile onset

MAINE'S DAMARISCOTTA RIVER estuary is an ideal place to grow oysters. In the summer, they thrive in the algae-rich broth created by the mixing of a warm river with the upwelling sea. However, for oysters and oyster farmers, there is trouble in paradise.

An organism that causes juvenile oyster disease (JOD) also finds the estuary to its liking. With a touch of irony, it makes infected oysters starve in the midst of plenty. It has been the target of a concerted University of Maine research effort for more than a decade, one that is paying off.

Throughout much of the 1990s, researchers worked to identify a cause. Former UMaine shellfish pathologist Bruce Barber and his graduate-student-turned-oyster-farmer Chris Davis led that work. They showed that oyster growers could cut their losses by selecting for fast-growing stock.

In 1999, Kathy Boettcher, Barber and John Singer, all of the Department of Biochemistry, Microbiology and Molecular Biology, and the School of Marine Sciences, reported a milestone in the search for the cause of JOD. They demonstrated that the



Research assistant Aaron Maloy and microbiologist Kathy Boettcher

disease could be treated with antibiotics and thus must have a bacterial origin. Then they used new laboratory culture techniques and DNA analysis to discover the presence of a previously unknown species of bacteria on oysters that were sick. The bacteria were not found on healthy oysters. Additional studies with the bacteria, tentatively named *Roseimarina crassostreae*, have confirmed its primary role in JOD.

Boettcher's efforts to understand both the disease and what oyster farmers can do to minimize losses have earned praise from the industry. "Her work has given the industry an understanding of what causes JOD and what we can do to prevent it. She has shown a real determination to work with people in the oyster industry, and we appreciate it," says Dick Clime, one of the state's pioneer oyster farmers on the Damariscotta.

First recognized as a significant problem in Maine in 1988, and subsequently in New York and Massachusetts, JOD can kill more than 90 percent of the cultured young oysters in a farmer's stock. That's a tough loss in an industry just getting on its feet. Maine growers raise high-quality American oysters, *Crassostrea virginica*, for what they call the white tablecloth market. In 2002, market-size oysters brought in revenues of about \$850,000.

The Maine Aquaculture Innovation Center (MAIC), a state-supported organization located at UMaine, is leading efforts to establish new oyster farms, but JOD is a significant barrier. "JOD is the one thing that has kept oyster culture in Maine from expanding," says Clime, MAIC board chair and a UMaine graduate.



Photos by Kathy Rice

The Maine Aquaculture Innovation Center is leading efforts to establish new oyster farms, but juvenile oyster disease is a significant barrier.

Not a threat to people, the disease continues to affect oysters in other parts of the Northeast. In 2003, it was reported for the first time at Martha's Vineyard, where a major producer lost about half of his juvenile stock.

As its name implies, the disease kills young oysters. It generally strikes between July and October after they've been placed in open water to grow to adult size. The Damariscotta

is both the heart of Maine's commercial oyster industry and the location of most JOD outbreaks in the state.

In 1996, Barber and Davis demonstrated a way to reduce losses. They showed that once young oysters grow to be at least an inch across, they are largely out of danger. Taking advantage of that result means growers need to select for fast-growing oysters. Such manage-

The bacterium also was isolated from all outbreaks of JOD in Massachusetts and New York last year.

ment practices can reduce, but not eliminate, the threat of JOD.

"One of the signs of JOD is that the oysters look like they've starved to death," says Boettcher. "The animals grow really well when they are first put out, and then the disease hits them, and they just stop growing.

"For a long time, people thought this was a starvation problem. We colonized oysters with bacteria in the lab and found that the oysters have a reduced capacity to filter algae. That's consistent with what we see in the river. They are starving because (bacteria cover) the tissue surfaces. This is not an invasive disease. Instead, it appears to grow as a film."

The species is not related to any human pathogens, she adds. Moreover, it is not seen on nearby mussels, clams or other marine organisms. Boettcher calls it an opportunist because it takes advantage of culture conditions and vulnerable young oysters.

Using DNA analysis, Boettcher has placed the bacteria in the *Roseobacter* group of microorganisms. Within the last decade, new detection methods have led to the conclusion that *Roseobacter* species are abundant in marine waters. They include some that live under extreme conditions in the deep sea, as



"Her work has given the industry an understanding of what causes JOD and what we can do to prevent it. She has shown a real determination to work with people in the oyster industry, and we appreciate it."

Dick Clime

well as those that inhabit near-shore areas.

For reasons that are not clear, JOD was in retreat last year, complicating Boettcher's efforts to test a potential treatment. It wasn't until October that she received a shipment of sick oysters. Opening

a plastic bag with a few dozen animals, Boettcher held up a young oyster whose shell was less than an inch wide. "It looks as though it has an overbite," she says.

The mismatch between the two halves of the shell is a signature of JOD infection.

The oyster inside was dead. In its last days, it had built up a small dark internal ring of shell material around itself, as though trying to erect a defense. "JOD kills quickly. In a short period of time, it can kill half of a farmer's crop," Boettcher says.

With those samples, Boettcher and research assistant Aaron Maloy confirmed that *Roseimarina* was again present in overwhelming numbers on the sick animals. In addition, they worked with Clime to test an inexpensive probiotic oyster treatment to protect the young from JOD. Their approach uses a species of harmless, naturally occurring bacteria identified in oysters that had survived previous JOD outbreaks. By dipping the oysters in an enriched solution of the bacteria, the scientists hope to confer a protective coating that will keep *Roseimarina* at bay.

The low JOD incidence in 2003 made it difficult to determine if, in fact, the probiotic treatment worked. It's also possible that by selecting survivors of earlier outbreaks, growers produced animals with innate resistance.

With funding from MAIC, the U.S. Department of Agriculture and Maine Sea Grant, Boettcher and Maloy are focusing on methods to detect the troublesome bacteria. They also are looking at the strategy employed by *Roseimarina* to infect cultured oysters. Already they know that the species has the ability to swim freely, attach to tissues and create a colony that, in effect, smothers the animal inside its shell. Yet to be understood is the complex chemistry of that process.

Better understanding of how *Roseimarina* behaves could help to explain reports of oyster disease in other parts of the world, such as France and California, Boettcher notes. In addition, there is evidence that *Roseimarina* may be a factor in diseases of other organisms, notably some corals, but to date it has only been successfully cultured from American oysters affected by JOD.

Nick Houtman

A microscopic view of the previously unknown bacterium, now tentatively named *Roseimarina crassostreae*. Image courtesy of Kathy Boettcher



THE PRINCIPAL'S OFFICE

With the threat of a vacuum looming in Maine's K-12 educational leadership in the next decade, a new survey finds it's time to rewrite the job description

THE PRINCIPAL'S OFFICE

WHEN EDUCATION EXPERTS look out over Maine's K-12 leadership landscape, they see an aging population of principals, more than half of whom will retire in the next decade from their increasingly complex jobs.

When those same experts teach graduate students in educational leadership at the University of Maine, they find classes brimming with talented people who have what it takes to fill the impending principalship vacuum, but who balk at leaving teaching and going into "management" with its long hours, low pay and high stress.

The answer to the impending crisis lies with local school districts, communities and the state.

"The main threat is the age of the current population of practicing principals," says Professor of Education Gordon Donaldson. "In the next 10 years, we'll see a large turnover. The challenge to school districts is how to entice people to take those

vacant positions. School boards and superintendents have to look at the hours, support and pay. They have to help principals move beyond managing buildings to having a real hand in the improvement of educational programs."

According to the recently released findings of *The Maine Principal Study: Stability and Change Among Maine Principals, 1997-2001*, conducted by the UMaine College of Education and Human Development, replacing retiring K-12 principals with outstanding educators is paramount to school effectiveness and improvement. The research shows that better work conditions and incentives are necessary to boost the number of qualified candidates seeking and succeeding in the job.

In particular, state policymakers and school boards need to take steps toward supporting principals' efforts to lead the instructional program and school improvement. At a time when many districts are financially strapped, this could mean protecting funds for leaders' salaries and professional development.

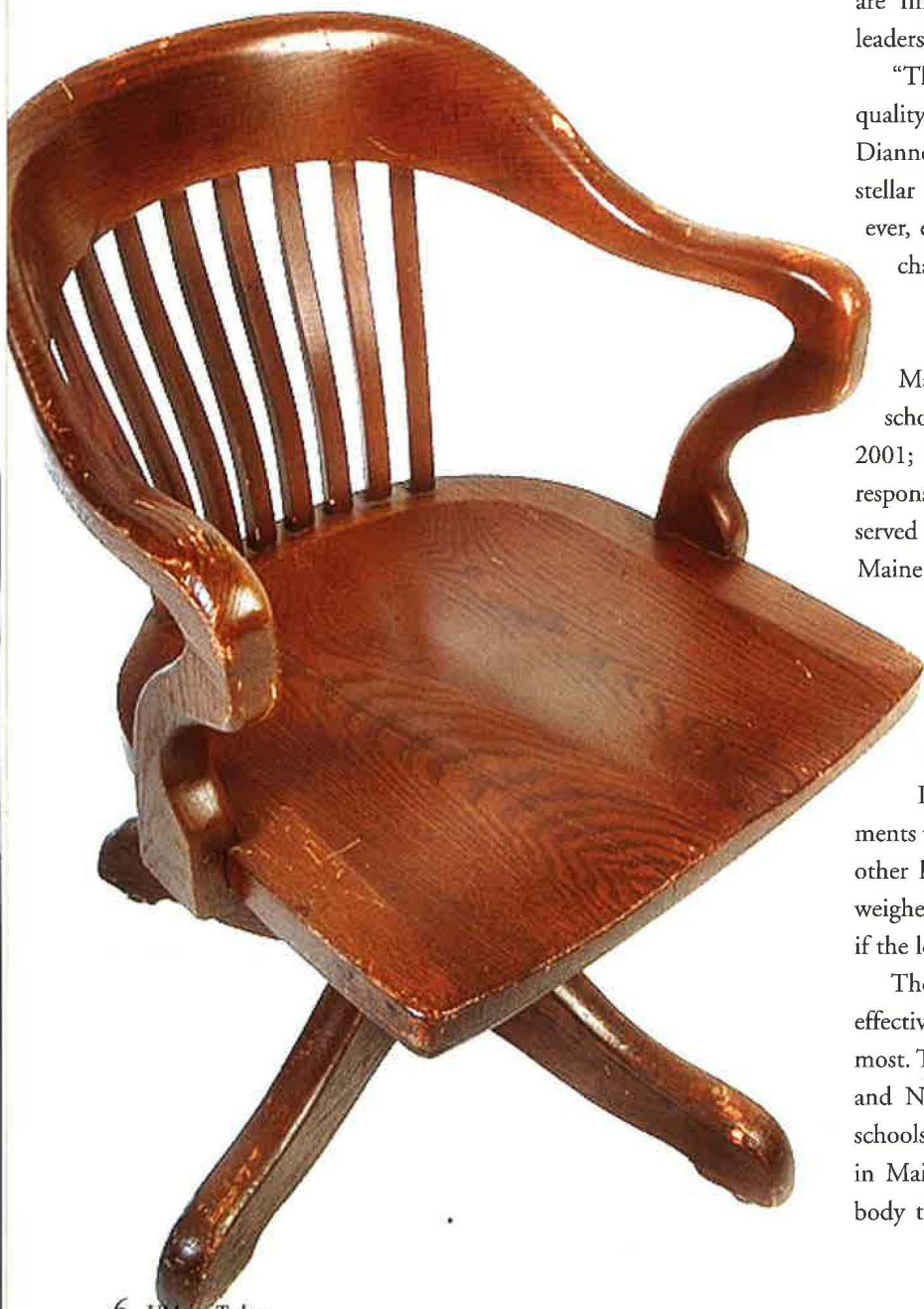
"The strength of the leadership has a direct impact on the quality of the school," says UMaine Assistant Professor of Education Dianne Hoff. "If we can't attract leaders from the ranks of our most stellar teachers, we're not facing a bright future. Now, more than ever, education needs top-quality leaders who can tackle complex challenges with intelligence, enthusiasm and commitment."

THE SURVEY IS THE SECOND in a longitudinal study of Maine K-12 principals and the issues influencing their ability as school leaders. The first survey was done in 1997, the second in 2001; others will follow in 2005 and 2009. With a 53 percent response rate, the most recent findings focus on 363 principals who served as the only administrator or the supervising administrator of a Maine school in 2001.

Two-thirds of the principals responding to the most recent survey have been in their current positions for seven years or less, and one-third for less than two years. More than 50 percent of responding principals were older than age 50, up from 39 percent in 1997; 11 percent were under age 40.

In 2001, as in 1997, most principals expressed positive sentiments toward their work, finding it energizing and fulfilling. On the other hand, the work can be draining and stressful. These costs, weighed against the benefits, left half of the respondents wondering if the long hours, stress and intrusion on personal life are worth it.

The data raise serious concerns about the continuity and effectiveness of leadership in Maine schools, just when it's needed most. Today, state and federal mandates like Maine Learning Results and No Child Left Behind ratchet up the pressure to improve schools for all students and close performance gaps. Nationwide and in Maine, K-12 schools enroll a more culturally diverse student body than ever before. And just as our society has become more



litigious, schools are facing lawsuits on everything from student disciplinary actions to accidents on the playground, notes Hoff.

Central to stress are the extraordinary supervisory responsibilities, the time and energy commitment, and policy and resource uncertainties. The 2001 data show the average Maine principal is supervising 37 percent more staff than in 1997, including an increase from 18 to 33 professional staff and 11 to 17 support staff. As in 1997, the supervisory responsibilities of the principal far surpass those typically expected of a private sector supervisor, where 15 to 20 staff are considered optimum, according to the report.

The comparative data between 1997 and 2001 also reflect that the average Maine principal is serving a slightly larger school; working more hours (half reported spending more than 60 hours per week on the job); and working in a school district described as rural (67 percent).

The study finds Maine principals believe that "responding to people" and leading the instructional program lie at the heart of what they should be doing. Yet the range of activities and demands erodes their capacity to give full attention to this leadership.

In 2001, principals reported that most of their time was devoted to personnel management, followed by public relations and student management. In 1997, the top three agenda activities were student management, personnel management and interactions with the education hierarchy.

DESPITE THE PRESSURES today, a majority of principals continue to find a lot of meaning in their work. That's good news, says Richard Ackerman, associate professor of educational leadership.

"It's a complicated picture, but not as negative as it looks," he says. "The tensions today are creating healthy debates that, hopefully, will bring about positive changes in leadership and schools."

The results of the Maine survey mirror the national picture, says Ackerman. "Traditional leadership structures in almost every school are being questioned. The current climate is sparking great questions and that's a victory.

"American schools and administrators are increasingly being asked to engage in various forms of accountability and part of the tension here is healthy," Ackerman says. "It is causing us to think about leadership differently, in a way that creates a different kind of accountability in schools, so that responsibility and authority for the guidance and direction of teaching and learning flow from many different sources.

"There are many qualified people under the schoolhouse roof who want and need to be involved in leadership work. Schools and districts must be actively involved in helping to grow their own leaders to do that work. Conditions are right for school leaders to talk to one another in real and authentic ways about these matters."

Margaret Nagle

LEARNING ABOUT LEADERSHIP

DESPITE PERCEPTIONS TO THE CONTRARY, school principals don't know it all. And if they had their way, lessons in how to effectively handle their multifaceted leadership responsibilities would be ongoing. If only they could find the time.

Doctoral research completed in November at the University of Maine by former elementary school teacher, counselor and principal Anita Campbell found that principals are so engaged in increasingly complex day-to-day responsibilities — from student and staff supervision to budget management, academic reform compliance and community involvement — they often haven't the time or the energy to learn about how to lead more effectively.

"Given the consuming nature of the principalship, principals face many and very diverse learning needs," says Campbell, an educator since 1969 who wrote *Through Their Eyes: Maine Principals Explore Their Learning About Leadership*. "The purpose of this research was to explore principals' learning needs and experiences from the inside out . . . to understand more fully what forms of learning are most meaningful to practicing principals."

Campbell's research involving five female middle school principals in Maine found a distinct tension between principals' expressed learning needs and the persistent difficulty in pursuing them. The principals voiced the particular need for ongoing learning in technology, assessment, building projects, school safety and relationships.

"Principals expressed a preference for learning opportunities that could immediately inform their work in their schools," says Campbell, who is currently the outreach coordinator for an alternative certification program at the University of Maine at Farmington. "However, several obstacles stood in the way: little time for learning, a lack of understanding of their needs from their districts, and dissatisfaction with one- or two-day conferences that took them away from their schools."

On the other hand, the principals found that the learning that occurred in the school with staff was often the most productive.

"This research suggests that principals (should) take charge of their learning by reflecting on what their work is teaching them, and being honest and open with stakeholders about what it would take to make the learning more meaningful," Campbell says. "To be effective leaders, principals must be willing to advocate for their own learning needs instead of being sucked into the maelstrom of reactive leadership."

"The creative economy is a catalyst for the creation of new jobs in Maine communities. People who create jobs want to live in places that have a diverse cultural mix and an innovative, educated workforce. Maine will be competitive economically if we continue to capitalize on the synergies between entrepreneurship, education, the arts and quality of life."

Gov. John Baldacci in a statement promoting a Blaine House Conference on the Creative Economy, set for May 2004

3D

A new digital filmmaking research laboratory at UMaine is expected to be a tripartite drawing card for students, businesses and the movie industry

"HOLLYWOOD IS AT A turning point," asserts Raphael Di Luzio. Moviemakers are pivoting away from shooting on celluloid and toward filming digitally on videotape.

It's a pivotal moment that gives the University of Maine and the state the opportunity to propel themselves to the forefront of digital filmmaking, says the artist with an eye for what the mechanical can do for the artistic.

Standing at the intersection of the technical and the creative elements of filmmaking, the University of Maine assistant professor of



"I'm trying to engage in an entrepreneurial model that brings resources back into the program and into the state."

Raphael Di Luzio

new media has proposed a practical application that could boost both the state's economy and its artistry. Di Luzio is establishing a digital filmmaking program at UMaine with a lab equipped with cutting-edge hardware and software that could be used by both students and, for a fee, filmmakers in the state.

The lab will allow students to learn the latest ways to use digital equipment for film, audio, animation, three-dimensional computer effects and compositing, which is the process of using computers to superimpose one image onto another to create a single image. Compositing is the way much of the most recent *Star Wars* movies were melded.

The lab will allow students to learn the latest ways to use digital equipment for film, audio, animation, three-dimensional computer effects and compositing.



But Di Luzio is not just looking to build an educational program; he hopes to directly link students and the lab with filmmakers who come to Maine. This connection — plus the potential for helping nourish the state's "creative economy," creating jobs, and generating revenues by teaching industry-approved software certification programs — led the Maine Technology Institute (MTI) to provide a \$201,000 grant to get the endeavor up and running.

"I'm trying to engage in an entrepreneurial model that brings resources back into the program and into the state," Di Luzio says.

He does not want to simply create a corps of adept technicians, or only to produce key grips, best boys and camera operators for the film industry. It also is about "gearing up people to be the creators and the visionaries," he says. The idea is to "produce a healthy base of digital content developers" who make Maine their home.

The hope is to put the state on the leading edge of a changing film industry. "Hollywood goes anywhere to shoot. But we don't have enough individuals out there (in Maine) who can work in the industry."

THE PROPOSAL IS AN EXCELLENT example of adapting new technology to an existing industry that will increase Maine's competitiveness, says Janet Yancey-Wrona, director of MTI, a state agency charged with encouraging and supporting technology-intensive endeavors that help multiple industries and lead to job creation.

Jake Ward, executive director for research and economic development in UMaine's Department of Industrial Cooperation, says that the "crossover ground" between the artistic and the technological will prove

fertile. Already, two Maine firms that model how bodies move through fluids (i.e., how missiles fly through air and yachts slice through water) are interested in taking advantage of the three-dimensional computer modeling that will be available in the lab.

A bonus is that it will be the only lab of its kind in New England, according to Yancey-Wrona. Filmmakers will be able to use the lab, along with students, thus helping to train the local workforce and strengthen state efforts to boost its "cultural economy," she added.

Lea Girardin, director of the Maine Film Office, says simply, "We need to have a film crew base. We do have one but it's small. We'd love to expand it and this should do it."

If film production companies can hire crew members locally rather than importing them from Boston, it saves them money and makes Maine a more attractive place to shoot a movie, commercial or documentary, Girardin says.

The film office, also a state agency, on average helps bring upward of \$17 million worth of film productions into the state each year. For example, the office was involved in the successful effort to bring the movie production of the novel *Empire Falls* to Maine.

AT UMAINE, THE DIGITAL filmmaking program and the lab will help to flesh out the New Media Program, Di Luzio says. The interdisciplinary program studies the systems, technologies, history, design, and theory of information artifacts and networks. It began in 1991 as a minor in multimedia. In 1998, the name was changed to new media; the program first offered undergraduate degrees in 2000.

3D

While on one hand, the 43-year-old Di Luzio says,

"I'm certifiably a cine-holic; I love movies," on the other, he says he is "an anomaly" in the New Media Program because he was trained as a painter. Still, along with his painting degrees, he holds a professional certificate in computer graphics.

It is the use of digitized information to create art that intrigues Di Luzio. As a painter, Di Luzio says he began to look at his own work and found that "the narrative was not moving or it was sluggish."

A few years ago, the concept of "time-based media" grabbed him. This involves turn-

ing music or film into a digital signal, then "digitally sampling" the piece (taking a segment, such as the refrain of a song, out of the original). Most importantly, the duration of these digital samples can then be altered and manipulated, Di Luzio explained.

One of Di Luzio's artistic projects involving time-based media is called *Seasonal Fugue Disorder*. Di Luzio set up a digital video camera in the Maine woods that was filming the changing seasons. It videotaped each day from sunrise to sunset, compressing the daylight hours into roughly 1.5 minutes. These segments were then digitally fused to create four films — one for each season — roughly 2.75 hours long. Originally done as

part of a British online exhibition of digital and time-based art, the fugue will eventually become a video installation.

HARDWARE AND SOFTWARE are needed for the new program, and they don't come cheap. That is why Di Luzio incorporated revenue-generating elements into his digital filmmaking plan and sought in-kind contributions from industry.

Di Luzio is bringing in new digital cameras, one of which, the Panasonic SDX 900, costs roughly \$60,000 and was funded by the MTI grant. The SDX 900 allows students to digitally film to Hollywood standards and later transfer their work onto film without losing quality. While the camera videotapes footage that can be downloaded to a computer hard drive, FireWire technology allows the camera to be plugged into a digital video drive that can be connected directly into a computer. The shift from film to videotape and video drives should save film programs money, Di Luzio says, because raw film stock is expensive.

However, the digital equipment and computer programs also are costly. Investing in new hardware and software, Di Luzio says, can be akin to hauling wheelbarrows of cash to the lip of "a fiery pit" and dumping it in year after year. Without a constant stream of funds to invest in new or updated software, technology becomes a "non-renewable resource," he says.

So, Di Luzio approached computer software companies, Apple in particular, and broached the idea of having UMaine offer professional certification programs for various types of filmmaking and music software, such as Final Cut Pro, Maya 3D Modeling, DVD Studio Pro and Shake Compositing. The fees should provide a revenue stream for buying the latest software.

The certification programs are to be initially offered at UMaine's Hutchinson Center in Belfast, Maine, where the computer lab has been upgraded with new Apple G5 computers, made possible through the support of MBNA.



The strong support of local companies, the in-kind contributions and the money-making aspects were pluses in the eyes of the Maine Technology Institute, which provided a grant for the digital filmmaking initiative.

The lab in Orono also could be a money-maker. The university could let multimedia and technology companies use the facilities on a contractual or project basis, Ward says.

The certification programs, along with generating income, would also create a corps of professionals skilled in using the newest top-end software, according to Di Luzio, who was able to snare an array of software as in-kind contributions to the nascent program.

The strong support of local companies, the in-kind contributions and the money-making aspects were pluses in MTT's eyes. Yancey-Wrona explained, "Our purpose is to develop capacity for industry."

The "real crazy" part of the whole idea, Di Luzio says, is that by coupling those who earn the certificates with the students in the filmmaking program, "we could set up a model of a post-production (film) company."

Eventually, "I would like to spin off a real company of students who become entrepreneurs, who can do this stuff on their own after they graduate," Di Luzio says. However, "before you can begin to ask for the sun and the stars, you should be able to produce the moon first. We want to see what our students produce and use that as a foil."

Gordon Bonin



Photo by Kenton Williams

The Creative Economy

WHEN ED AND SHANNON MARTIN moved to central Maine in 2001, they wanted to live in "the biggest city in the area." That was Bangor.

They wanted to live downtown "in the middle of something," so they bought a place on Main Street. A four-story building in need of renovation.

Shannon started her job as a journalism professor at the University of Maine while Ed opened his first photographic studio, called Lumiere.

The two faculty members from Rutgers University are among a growing number of professionals contributing to the creative economy of Maine's third-largest city.

"We looked for a building where we could have a studio and could live, and in doing that, I think we contributed to the revitalization of downtown," says Ed Martin of his home in the former Smiley's clothing store. "Ours is just one building out of a great many, but other people are doing similar things. I've been told there are more people living downtown than there were 10 years ago, and I hope there will be even more."

Lumiere Photographic Studio is in the same block as the Maine Discovery Museum for children, and within easy walking distance of a handful of independent bookstores and art galleries, the recently relocated UMaine Museum of Art, the expanded Bangor Public Library, the Penobscot Theatre and the new Bangor Museum and Center for History. The facilities are considered cultural anchors that draw patrons and keep the downtown alive — typical mainstays of a creative economy.

Bangor also is in its third year of hosting the National Folk Festival.

"The creative economy refers to a newly defined economic cluster that has always been a part of our overall economy, but has only recently been identified as a discrete economic sector," says Kathryn Hunt, a research associate at UMaine's Margaret Chase Smith Center for Public Policy. In its 2000 report, *The Creative Economy Initiative: The Role of Arts and Culture in New England's Economic Competitiveness*, the New England Council reported that \$6.6 billion in cultural tourism dollars were generated in the region from 1993-97.

In 2000, 14,000 Maine workers were employed in the economy's creative sector; in the next decade, that workforce is expected to grow by 18 percent.

The creative economy has intellectual capital at its core, Hunt says. The model includes artists, software developers, filmmakers, actors, designers, photographers, musicians, architects, museum curators, authors and many others who are self-employed, or working for nonprofit organizations or small businesses.

As part of economic development, a critical mass of artistic and cultural creativity can help to revitalize communities, create jobs to retain young people, be a drawing card for workers coming to the state, attract tourist dollars and contribute to a region's quality of life. It is already happening in Maine communities like Portland, Lewiston/Auburn, Augusta, Dover-Foxcroft, Rockland and Stonington.

"It has to do with helping communities stop the fantasy that one large company will come in and take away their economic woes," Hunt says. "It's forcing communities and regions to admit that they have to support a diversified economy and encourage creative synergies that lead to new companies based on ideas and technology."

Last year, Hunt, a community and economic development expert, helped to formalize a new partnership between Bangor and the University of Maine. The partnership addresses UMaine's commitment to be engaged with the state and its communities, and the city's need for downtown revitalization, including meeting the growing needs of its elderly and low-income populations.

"We hope," Hunt says, "to create a model that we can then take to other communities."

Aquaculture

Two Ph.D. students are studying ways to more successfully reproduce tropical fish in captivity as a way to save natural habitat

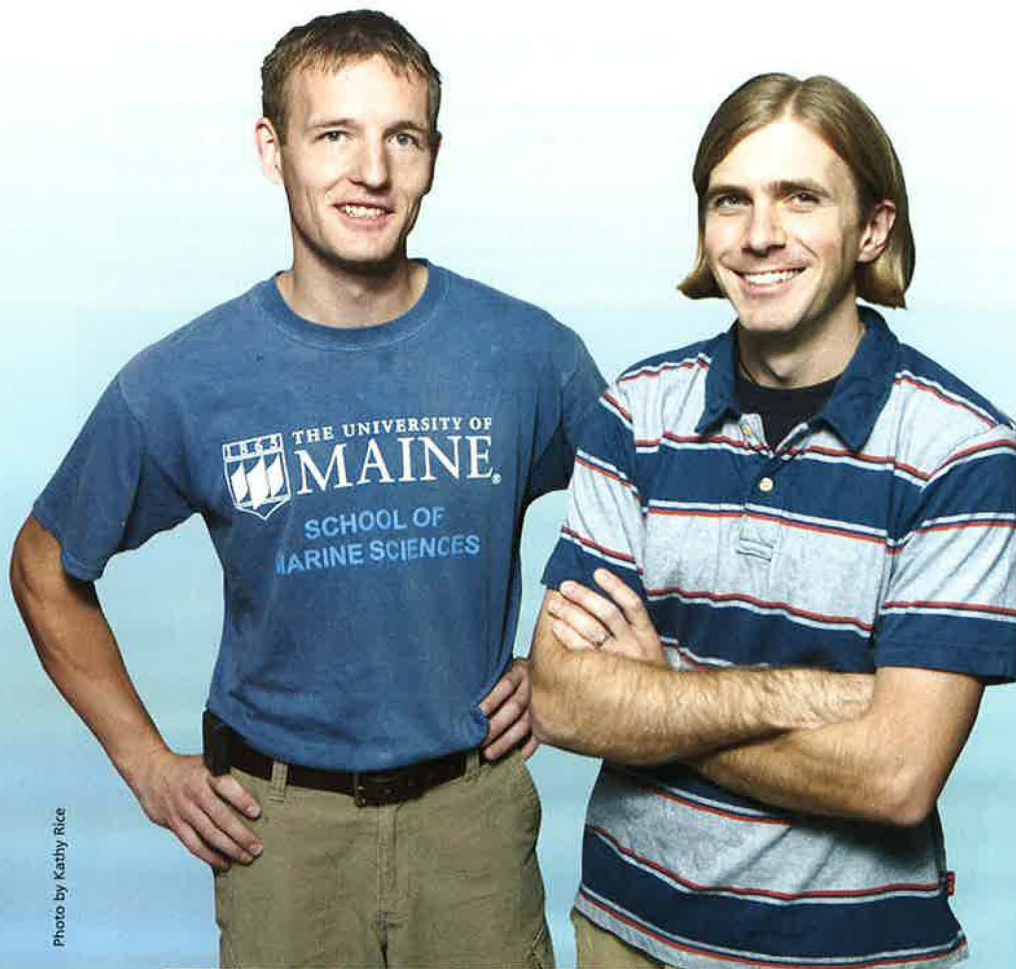


Photo by Kathy Rice



Researchers Søren Hansen and Chad Callan (top photo) hope to raise mandarin fish in their UMaine laboratory.

Photo by Carlos Villoch

YOU WON'T FIND TROPICAL FISH in the cold waters of the Gulf of Maine. In fact, Maine would be low on most people's list as a place to raise colorful clown fish, dottybacks and other coral reef dwellers. Two University of Maine graduate students are challenging that logic by delving into the details of tropical fish aquaculture. Their goal is to raise fish for the home aquarium industry, a market they estimate to have about \$250 million in annual sales in the U.S.

In addition to pursuing their Ph.D. degrees in the School of Marine Sciences (SMS), Søren Hansen and Chad Callan have founded a company, Sea & Reef Aquaculture, LLC. With help from a \$10,000 Maine Technology Institute seed grant, and from business development services at UMaine's Target Technology Incubator and the Maine Aquaculture Innovation Center, they intend to develop new methods and lower costs for raising salt-water aquarium fish.

"When I worked for a tropical fish importer, I got to see the dark side of the aquarium industry, as far as how many fish come in and how many die. The sheer volume of turnover (is enormous), and I didn't like it," says Callan, who grew up in New Jersey. "About 95 percent of the stock to supply those aquariums now comes from coral reefs. Less than 5 percent is raised in captivity. I wanted to get the industry more ecologically focused and supply this trade with cultured fish."

The methods used to capture tropical reef fish can harm the reef itself, Hansen explains.

to save the coral reefs

Since their quarry often hide inside the coral, divers sometimes use sodium cyanide solutions to stun the fish. In the process, they damage the reef environment and can kill the coral as well. In many cases, though the fish will survive this collection method, they usually succumb to the effects a short time later. Their lives in home aquariums tend to be short.

"We're hoping to bring a lot more attention to marine ornamental aquaculture as a whole, and make people aware that tank-raised fish are becoming more available and are an environmentally sound alternative to buying fish collected from the reefs."

Chad Callan

"It does seem a little crazy that we're growing tropical fish in Maine," Callan adds. "When people ask, we explain the environmental situation. There is a lot of aquaculture going on in Maine, and it's a natural transition to include this end as well."

CALLAN AND HANSEN CREDIT David Townsend, biological oceanographer and SMS director, with facilitating their project. It all started in fall 2001 at UMaine when Hansen, a native of Denmark, was a teaching assistant for Townsend. Hansen was finishing his master's degree in fish physiology when he talked with Townsend about his interest in tropical fish aquaculture and his plans to start a business with Callan in Hawaii after gradua-

tion. At that time, Hansen was raising and selling clown fish, like the colorful star of the Disney movie *Finding Nemo*. However, he knew that extensive research and development were still necessary before a business venture could succeed.

Townsend's interest grew during a visit with Callan, who had received his marine biology master's degree from UMaine in 2000 and was working at a tropical fish aquaculture company in Hawaii. During a tour of the company's grounds, Townsend commented on the close proximity of the facility to the ocean. Since the fish being cultured at the facility were not native to Hawaii, he wondered about the ecological effects of potentially introducing exotic species to island waters.

Introduction of non-native species is a

concern with aquaculture. "It occurred to me that if we were in Orono, Maine, that wouldn't be a problem. A tropical saltwater fish won't survive in the Penobscot River, let alone the Gulf of Maine," Townsend says.

Both Callan and Hansen applied to the UMaine marine biology Ph.D. program. They had conducted their master's research at the Aquaculture Research Center (ARC) in Orono and knew what it took to coax fish through their earliest life stages. Moreover, they knew that for most tropical reef fish, practically nothing is known about feeding preferences and reproduction. Although clown fish are raised successfully in captivity, techniques have not been developed for raising most of the more than 1,200 species of reef fish that are commercially traded.



Clown fish are among the tropical species successfully bred in captivity.

Photo by Carlos Villoch



Splendid dottybacks are raised at Sea & Reef Aquaculture.

Photo by Carlos Villoch

IN THEIR RESEARCH, Callan and Hansen are tackling those basic questions for clown fish, dottybacks, angelfish, wrasses and a few other selected species. Callan is focusing on the nutritional requirements of broodstock — what they need to eat to continue spawning and maximizing the quality of the eggs and larvae produced.

“These fish spawn in some cases every day, and at least once a week, year-round. They must spend a tremendous amount of energy producing those eggs, and they require a lot of nutrients to sustain that need on a continual basis,” says Callan, who previously worked with nutritionist Linda Kling on techniques for raising cod.

“Commercial aquarium diets are geared toward just keeping the fish alive and may not be best suited for prolonged spawning. I’m going to produce a diet that will increase their spawning and larval survival potential. The big bottleneck is that larval stage and getting them past that first feeding hurdle,” he adds.

That stage will be the focus of Hansen’s

work. He plans to use a high-speed video system to see exactly how fish larvae interact with their tiny zooplankton prey. Some zooplankton have anti-predator defenses that allow them to escape. Hansen will analyze the feeding process in split-second detail to determine how larval fish select their prey. “We’ll get a better idea of what kind of prey we need to raise for these fish larvae and what prey concentration is optimal,” he says.

Jacqueline Hunter, a technician at ARC, will help with raising the zooplankton prey for their studies. Hunter has extensive experience in raising rotifers and brine shrimp — live feed organisms that are commonly used for aquaculture research purposes.

Researchers elsewhere are working on similar questions, but much of that is being done in places where the water stays warm year-round.

“What we’re trying to show is that, because these fish are so small and you can have large numbers in a small area, there’s potential to have this type of business in a

non-tropical location,” says Hansen. You can have such an operation totally indoors so it doesn’t affect coastal resources, Callan says. “It’s a clean, indoor aquaculture setting. And potentially, it has a high value — a higher value per fish than any food fish species.”

Simultaneously starting a business and pursuing a Ph.D. program are not for the fainthearted. “Neither one of us could do this alone,” says Hansen. He and Callan are always on call in case their aquarium research system should malfunction. Day in, day out, they share a pager that is triggered by sensors monitoring water quality and other aspects of the fish-rearing system.

Nevertheless, they are committed to both the science and the business. “We’re hoping to bring a lot more attention to marine ornamental aquaculture as a whole, and make people aware that tank-raised fish are becoming more available and are an environmentally sound alternative to buying fish collected from the reefs,” Callan says.

Nick Houtman

The Next Big Thing: tiny technology

Two new scientists expand MEMS research capabilities at UMaine



Photo by Kathy Rice

Bioengineer Rosemary Smith and biochemist Scott Collins have a combined 50 years of experience in MEMS, working in government, academic and industrial labs. Both recently came to UMaine from the University of California – Davis.

Think small. Smaller. Smaller still. Microscopic, nano (one-billionth) scale. Complex machines no bigger than a grain of sand. Research instruments that can manipulate molecules.

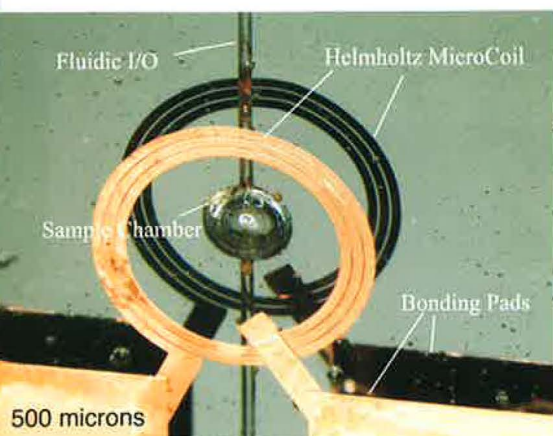
It's tiny technology that's set to have a big impact on our macro world within 10 years.

"This is a new chapter in microelectronics," says bioengineer Rosemary Smith, a leading researcher in the field for the past 20 years. "More and more, traditional microelectronics manufacturing in this country is going overseas because of the excessive costs of facilities and personnel (here). That happens when manufacturing like this has matured, reached its limit. What's new is nanotechnology and MEMS (microelectromechanical systems). They are the next big design and manufacturing fields in this country."

MEMS technology, which has evolved out of the microelectronics industry in the past 30 years, essentially shrinks a machine or instrument onto a silicon chip, often adding "smart" capabilities. These micromachines combine electrical and mechanical components, enabling them to gather and communicate information, and, as the processed information warrants, take action. In addition, their size makes them inexpensive and easy to mass-produce. Microsystems can be utilized individually or in an array for micro or macro applications.

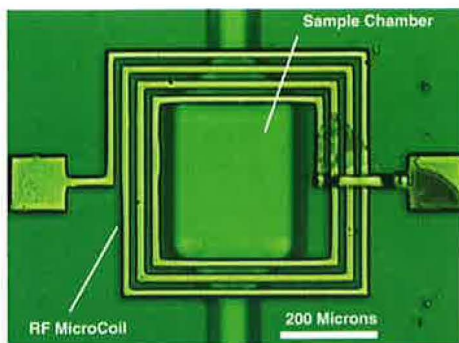
A commercially successful example of MEMS technology is found in vehicle air bags, where microsensors, called accelerometers, detect a collision and send an electrical signal to the inflation device. In inkjet printers, miniature devices act as actuators by responding to electronic signals to regulate ink flow. Digital light processing technology in high-density televisions and projectors provides sharp, bright images using a DMD (digital micromirror device) chip with more than 1 million mirrors, each a fraction of the width of a human hair.

NMR Microcoils



A Helmholtz microcoil

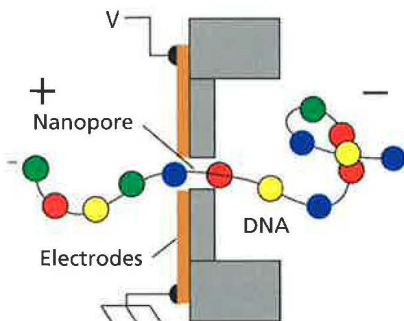
A series of radio frequency (RF) microcoils for nuclear magnetic resonance (NMR) spectroscopy provide unique chemical identification of microliter to nanoliter samples for biological studies.



Microcoil surface (top image) and a scanning electron microscope view of the microcoil interconnect.

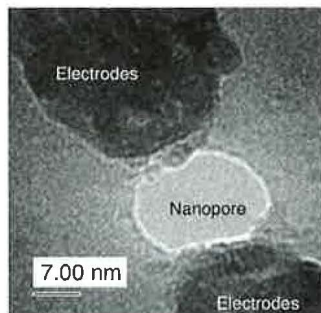
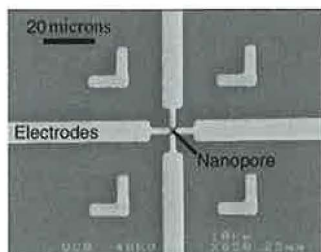
Images courtesy of Scott Collins and Rosemary Smith

Tunneling Current Detection Electrodes



Cross section and operation of a nanopore. Funding for this project was provided in part by the National Science Foundation.

In a nanopore device for the high-speed sequencing of DNA, the pore is approximately 30 atoms in diameter. DNA is drawn through a nanopore while electrodes located on the edge of the pore register a unique current signature for each DNA nucleotide that passes. When fully developed, a nanopore sequencer will sequence a complete human genome in less than one hour, allowing physicians to diagnose pathologies at a genomic level.



Plain view of a quadrapole (top image) and a scanning electron microscope view of a nanopore.

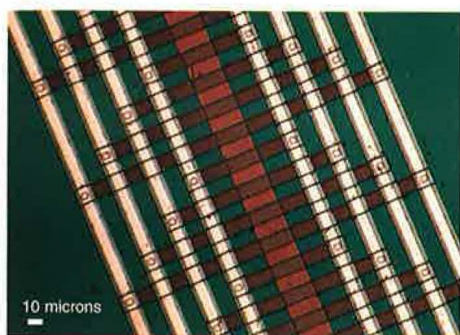
"The field has gone through cycles," says Smith. "Initially, the idea was to build microscopic intelligent sensors by merging integrated circuit technology with materials that provide sensing capability. In the biomedical arena, the focus was on implanted devices that were small and intelligent. But after five years of academic and industrial efforts, there still were many problems, both with biocompatibility, and because the integration of materials and technologies was too complicated. Consequently, there was a big shift in focus from doing smart sensors to the more basic science on material interfaces. That's where research facilities like LASST (the University of Maine's Laboratory for Surface Science and Technology) picked up.

"On the silicon end," Smith says, "the shift was made to hybrid instruments, with sensors and integrated circuitry on separate chips. Then, with the genomics revolution, bench-top instruments and microfluidics came in. New materials have developed in the past 10 years that are now sparking a return to implantable and biomedical systems."

In the world of medicine, MEMS is already found in some minimally invasive blood glucose testing devices using biosensor technology. Now in development are prototypes of the artificial pancreas and artificial retina, both involving "machines" and electronics that coexist on silicon chips. One of the biggest feats ahead for nanotechnology: personal, high-speed gene sequencing.

Smith and biochemist Scott Collins, who met while doing research on chemical sensors at the University of Utah, have a combined 50 years of experience in MEMS technology, working in government, academic and industrial laboratories. Both came to UMaine from the University of California – Davis, where they directed the Microinstruments and Systems Laboratory. Their research focused on chemical and physical biomedical microsensors, and technology development for analytical microinstruments — tools that allow scientists to work "at the same scale as the biology," says Collins.

Microneedle Array for ISF/Blood Extraction and Drug Delivery



Electrode array

"Everybody wants something to help their research, and we hope to build those instruments. We'll be designing research prototypes at low volume and cost," says Collins. "Micro-technology development is our niche."

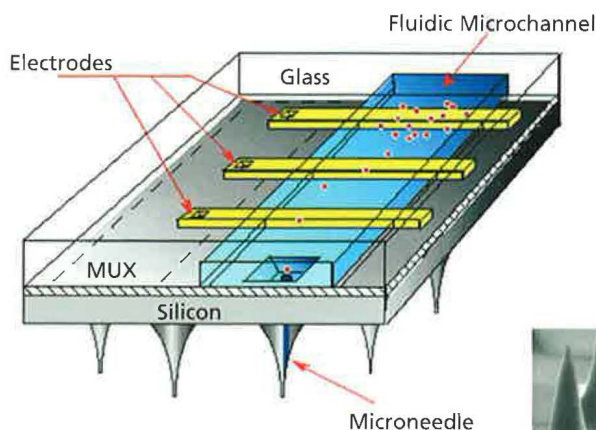
In some ways, says Collins, "it's like taking existing instruments and shrinking them as small as possible."

Smith and Collins were attracted to Maine by the possibility of doing research and development to address the needs of scientists at Jackson Laboratory in Bar Harbor. In addition, Fairchild Semiconductor International, headquartered in South Portland, announced in 2001 that it is licensed to offer the SUMMiT micromachining process. SUMMiT is a multi-level MEMS technology created by Sandia National Laboratories, funded primarily by the U.S. Department of Defense.

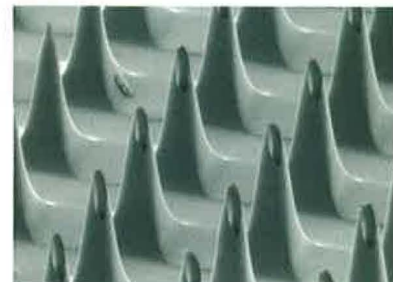
The focus by Smith and Collins on silicon-based microelectronic technology complements the material science research of UMaine's Laboratory for Surface Science and Technology. For more than two decades, UMaine researchers have conducted research in high-tech areas related to surfaces, interfaces and thin film materials. Their work in advanced materials ranges from basic science to applied technology in such areas as microelectronics and chemical sensors.

"It's unusual to find this broad scope of technology in one place," Smith says. "That means we have a large toolbox for any instrument we want to build."

LASST, housed in the Sawyer Environmental Research Center on campus, will have a new home in the \$18 million Engineering



Cross section and operation of a microneedle array. Funding for this project was provided by the BioFLIPS Program at DARPA.



One kind of microinstrument is a skin-piercing microneedle array, about the size of a penny, that can be used to painlessly draw interstitial fluid (ISF) or blood, and to administer drugs. The array includes 400 sharp microneedles, each 200 micrometers (.001 millimeter) tall with an opening along one side, that readily pierce the epidermis. The array is self-adhesive due to the large number of needles and the elastic nature of skin. Electrode arrays are being used to collect and detect biosensing particles when they react to a specific target molecule.

and Science Research Building now under construction. As part of the new facility, Smith and Collins are designing a research laboratory customized for the development of microinstrumentation. Construction is expected to be completed this spring. Smith and Collins will spend a year preparing it for occupancy.

"The facility is being designed to accommodate a wide range of micromachining and materials. That will be unusual," says Smith. "Usually, universities have facilities modeled after technologies on either end of the spectrum — integrated circuit or a non-silicon material. We're designing a lab to keep the small scale with high flexibility."

The researchers will be supervising graduate students in the lab. The hope is to ultimately develop labs and courses for undergraduates in a feeder program for this field of research.

"There's a lot of talent at UMaine and in the vicinity," Smith says. "Given the facility we envision, we hope our research will be a

resource for small start-up and spin-off companies. This will be an incubator for them; there's no other facility with this technology within 200 miles."

Today, the trend in microinstrumentation is the same as it was with computers, Smith points out. At one time, they were relegated to scientific research institutions; now they're in everyone's home. In the near future, analysis tools found in clinical labs or big, expensive facilities will find their way into the home so people can analyze their environment on a routine basis. Microinstruments will provide more capability to the individual than he or she ever thought possible. It's like 20 years ago; how could most people have known what it's like to have a laptop?

"The hope is that it ultimately means an improved quality of life and better health because of new, improved and widely available technology. It's what we're striving for," Smith says.

Margaret Nagle



THE MORNING NEWSPAPERS ARE JUST SHOWING UP on doorsteps when Peter Bosse walks into the University of Maine Advanced Manufacturing Center (AMC) in Orono. He greets the custodian, chats with Brian Barker, AMC engineer/machinist, and then gets to work on his latest project, programming software that controls an automated saw.

For Bosse, a UMaine engineering graduate student from Frenchville, Maine, AMC provides an opportunity to participate in the creation of a new enterprise, a process that is at the root of economic development. While his own research focuses on fuel cell technology for the U.S. Navy, he has helped to buy equipment, hire personnel and start a program that serves as an innovation resource for Maine manufacturers and research laboratories.

The result of more than 90 meetings between UMaine and Maine manufacturing companies, AMC is at the dawn of its own growth. "In 2000 and 2001, we traveled the state and asked companies how the university could help them. Their answer was a one-stop shop from concept to something that can be manufactured," says Scott Dunning, AMC executive director. "We are not here to compete with the private sector. We are a unique niche resource for the state, a rapid-response center for new product development."

Machine shops "can't make money making one of anything," adds Steve Adam, UMaine engineering advancement officer. "And when clients come to us with a request that we make multiples of the same product, we hand them a list of shops that do that work."

Financial support for AMC has come from UMaine's College of Engineering and the Department for Industrial Cooperation, the Maine Economic Improvement Fund, and a June 2003 public bond referen-

dum. The advisory board includes representatives of wood, metal and plastics products manufacturers statewide.

DUNNING SERVES ON THE BOARD of the Maine Metal Products Association and during the 1990s, managed UMaine's Industrial Assessment Center, a federally funded program to increase energy efficiency in small and medium-sized manufacturing companies. He and Tom Christensen, associate professor of bioresource engineering and AMC operations manager, knew that manufacturers could benefit from research support, but when AMC opened its doors in January 2003, they were in for a surprise. The new venture was overwhelmed with demand for its services. A fledgling staff of eight students led day to day by Christensen, Barker and Bosse scrambled to keep up.

AMC undertook design challenges from companies such as Fisher Engineering in Rockland, Shape Global Technology in Sanford and Hilltop Log Homes in Bowdoinham. It also began to serve research labs on the Orono campus and at UMaine's Darling Marine Center in Walpole.

For the time being, AMC shares crowded quarters with the Mitchell Center for Environmental and Watershed Research in Norman Smith Hall. Lack of space, says Christensen, means little capacity to accept new projects. That will change next fall. Across campus, construction has begun on a new 30,000-square-foot building that will enable AMC to triple its student workforce and add machinery.

While looking forward to the future, Christensen points with pride to the existing critical mass of industrial-grade metal machining equipment, computers running design software and systems devoted to the rapid development of prototypes. For a manufacturer, says Christensen, that means fast product development at a relatively low cost.

Photos, left to right: a vacuum chamber component for sensor research; graduate student Peter Bosse in an Advanced Manufacturing Center lab; the cutting process for an electric bike motor cooling fin; the manufacture of a vacuum chamber component; senior Nicole Chasse working as AMC's safety coordinator; a melting head for the Climate Change Institute's ice core analyses.
Photo, lower right: a Faro coordinate measuring machine.

Photos by Kathy Rice and courtesy of the Advanced Manufacturing Center

AD



As an example, he points to a project for Shape Global, manufacturer of molded plastic components. In collaboration with Spirometrics of Gray, Maine, the company recently needed to come up with a new part for a breathing apparatus for people with asthma.

The typical development process would mean making a metal die and using it to create parts for testing purposes. As changes are made, new dies have to follow. At \$10,000 per die, the process quickly gets expensive. At AMC, test parts can be made for as little as \$150 on a rapid prototyping machine, one of two in the state. The device uses fused deposition technology to create intricate products out of ABS plastic, some with moving parts. It allows design engineers to refine specifications before investing in production machinery.

The benefits of such a service are clear to Dean of Engineering Larryl Matthews. "In order for manufacturers to engage in innovation, they have to divert part of their resources away from production. That raises barriers to their ability to enter new markets. AMC is all about lowering those barriers and enabling manufacturers to solve problems and become more competitive," says Matthews.

IN ADDITION TO ESTABLISHED COMPANIES, individual inventors and entrepreneurs have brought new product ideas to AMC, some literally on the back of a napkin. That's the first step, says Bosse, in creating a new product. "People don't realize how much work goes into a new product. They have to go through proof of concept, testing and making changes. They need to consider marketing."

Projects conducted at AMC during the past year range from devices for controlling traffic and stacking boards to ball bearings for a rock crusher and precision laboratory hardware for research. In addition to

working with the private sector, AMC has taken on machine shop duties for the Advanced Engineered Wood Composites Center and the Climate Change Institute on the UMaine campus.

Students involved in these projects receive more than a paycheck, says Dunning. "We want to graduate students who have an entrepreneurial vision. They may start by fabricating parts under supervision, but by the time they're seniors, they may be running projects on their own. Plus, they'll have experience on industrial-grade equipment. They'll have practical experience with project management, teamwork and business, in addition to technical skills."

Bosse expects to receive his master's degree in biological engineering in 2004, and then will consider his employment options. Knowing how difficult it can be to start a new company, he has his eye on the developing fuel cell industry.

It can be tough to know whose technology and which company will succeed, he adds, but working closely with manufacturers through AMC will help him learn to ask the right questions.

Nick Houtman

VANCING Manufacturing



Students at the center of innovation

A new facility will link young entrepreneurs with experts

JACOB PELLETIER DECIDED to pursue a career in mechanical engineering so he could explore his wide range of interests — mathematics, physics, chemistry, design, alternative energy. His undergraduate research involved the development and commercialization of low-cost solar energy, and he spent two years as the student design and construction coordinator for the University of Maine Solar Vehicle Team.

All of the activities were “stepping stones toward entrepreneurship,” says Pelletier, now a UMaine graduate student and president of Pell Innovations Inc., his newly created company, located in the Target Technology Center in Orono, Maine. Pell Innovations is dedicated to the commercialization of new ideas and innovations in transportation, health, structural information, agriculture and energy technology.

Last year, Pell Innovations received a seed grant from the Maine Technology Institute to pursue one of Pelletier’s inventions. He hopes to have patent pending status in March.

While he appears to be on the entrepreneurial fast track, Pelletier now looks back at the last couple years and says that he could have benefitted from more hands-on interaction among the business, engineering and manufacturing disciplines at UMaine. With such coordination, a student engineer like Pelletier could design a product, work with business experts to locate project resources and then find the manufacturing know-how to fabricate a prototype.

It’s the very kind of coordinated expertise that other young entrepreneurs will find in UMaine’s Technology Innovation Center starting next year.

The state bond referendum last June provided \$1.5 million for the creation of the center, which will help student entrepreneurs develop ideas and access the expertise of engineering, business and marketing, and manufacturing on campus.

The Innovation Center will fulfill one of the key links in the state’s R&D strategy for economic development — namely equipping UMaine’s graduates with the skills to translate the research knowledge that they gained into businesses and jobs that will help grow the state’s economy.

A special facility is expected to be built this spring, and activities will be coordinated by the Provost’s Office in a cross-campus effort to encourage student innovators.

While primarily a resource hub, the facility also will have offices, conference rooms and workspaces where entrepreneurial teams can look and feel like real start-up companies.

“Staff in the center will work with students who want to explore the commercialization of their innovations and new ideas,” says Jake Ward, executive director for research and economic development in UMaine’s Department of Industrial Cooperation. “It will be the student version of Target. Here they can get help with business plans, the patent process, market research, company structure, funding — all the basics for turning an innovative idea into an innovative company or commercial product.”

Providing expertise and academic support for the center will be the College of Engineering and the College of Business, Public Policy and Health, which already feature entrepreneurial components, including courses in technology commercialization.

Prototype fabrication will be available from UMaine’s new Advanced Manufacturing Center on campus.

The center will be a resource for young entrepreneurs in any discipline, Ward says, including students in new media, marine sciences and the liberal arts.

“We’ve had student entrepreneurs all along, but now we’re supporting those who emerge in a more proactive way,” says Ward. “It’s hard to create entrepreneurs, but a center like this will help us uncover and nurture them, and will provide a critical mass attractive to investors.”

Margaret Nagle



Photo by Kathy Rice

A material world

tatorian from Palmyra, Maine, has spent the last two summers as an intern with NASA. At NASA's Glenn Research Center in Cleveland, Ohio, working in the Microgravity Science Division, Page studied combustion under low-gravity conditions.

Last summer, she was at the Los Alamos National Laboratory in New Mexico, where she worked in the Neutron Science Center Division. Page was involved in research exploring the design, performance and integration of nanostructures — materials created on the nanometer (one-billionth of a meter) scale.

"I love the progression of science," says Page. "It's exciting to think about being in a field that's starting up, with so much that can be looked into. I hope that in 10 years, I'll be contributing to the field."

Page became interested in material science working in the lab of UMaine Assistant

Professor of Chemical Engineering William Desisto. In particular, she wanted to study the structure and property of materials.

"Nanostructures made with a few hundred atoms have different properties because of their scale," she says. "We have to understand the building blocks of nanotechnology in order to create new materials that could have applications in such areas as space vehicles, medicine and electronics."

Page will graduate in May after four years at UMaine as a scholar-athlete. As a member of the Women's Track and Field team, Page holds the university record in discus and is serving her second year as captain. She also qualified to compete in USA Weightlifting's American Open Championships in December. She is president of UMaine's Student-Athlete Advisory Board.

Page has been invited to return to the Los Alamos National Laboratory next summer. She is headed to graduate school to pursue a Ph.D. in material science.

FOR KATHARINE PAGE, it's hard to know what's more exciting: sitting at a table exchanging ideas with scientists from throughout the world, including a Nobel Prize winner, or asking "What if?" in the field of nanotechnology and seeing the answer explored in two scientific papers.

Page, a University of Maine senior in chemical engineering and a high school salutatorian

Starting with versionZero



Photo by Kathy Rice

Hankla owns versionZero, a multimedia design company dedicated to "information design" — from Web pages and branding to graphic design for DVDs and brochures. He and five other UMaine undergraduates started talking about such a company two years ago, but only Hankla pursued the idea. Last year, he launched his company with the help of Target Technology Center. Hankla has since designed marketing campaigns for Target and MaineTech 2003.

Hankla, who is from Georgetown, Maine, was among the first UMaine students to graduate with a degree in new media. Now as a graduate student in liberal studies, he also teaches an introductory new media course.

"New media is changing everyday. It's a high-paced field," says Hankla, whose graduate research focuses on time-based media. For his thesis, Hankla is building a "render farm" with 24 G4 Macintosh computers that will make parallel processing possible. When complete, the supercomputer will allow students to do in an hour what now takes eight hours to accomplish in 3-D animation.

While versionZero is still a small business, Hankla, who graduates this year, expects his design company to expand with the hiring of a writer and computer programmer. But he'll never forget how his and so many other small businesses got their start.

"That's why the name, versionZero," Hankla says. "We're targeting small businesses (as customers) and they have to start somewhere."

NATHAN HANKLA OWNS a small business that assists small businesses. He relishes the chance to help start-up companies reach potential customers.

Hankla knows what it's like to have no advertising budget and 10,000 business cards to distribute to anyone you meet.

"Working with small businesses that initially don't have anything (in terms of resources) presents unique challenges," he says, "but it also lets me be a little more creative in how I do their projects."



Mustang super-charger custom manifold. Image courtesy of Foxtech Design.

Setting up shop

THE FIRST COMPANY TO TAKE wing from the University of Maine Target Technology Incubator in Orono, Maine, designs complex parts for the automotive, aerospace and consumer products industries.

After joining the Target Center in March 2003, Foxtech Design Inc., opened an office last fall in Ellsworth, Maine. Four other fledgling companies hope to follow by establishing businesses in the state, says Target Director Debbie Neuman.

The four start-ups now share office space at Target with several established companies. They have received support to write business plans, identify markets, develop their technology and secure financing.

Foxtech owner Scott Cromwell started his company in Michigan in 1997 and moved to Maine in 2003. A resident of Blue Hill, he specializes in computer-aided design.

At UMaine, he has worked with the Advanced Manufacturing Center and Fogler Library. He also has received business mentoring through the Maine Small Business Development Center, and participated in the MaineTech 2003 show in Augusta and the governor's trade mission to Ireland.

"Scott has exceptional technical skills and has grown into a successful entrepreneur. We will continue to monitor his progress and assist him with the ongoing challenges of operating a business. I am confident years from now, he will be a growing and successful Maine company," says Neuman.

Neuman notes that research-based start-ups take an average of three years to become self-sufficient. "That is what we are working toward with every tenant of the incubator: graduation as businesses in the community, armed with the knowledge, resources and connections they need to be successful."

Digital Delivery

A GOLD MINE OF INFORMATION about Maine's culture and natural history will be available electronically to classrooms throughout the state as a result of a federal grant to Fogler Library at the University of Maine, the Maine State Museum and Maine Public Broadcasting Corp.

The Institute of Museum and Library Services (IMLS) has awarded a more than \$470,000 grant to make digital resources about Maine accessible over the high-speed broadband network that includes the Internet.

The Windows on Maine project will focus on two exemplary educational programs of Maine Public Broadcasting:
***Quest: Investigating Our World* and *HOME: The Story of Maine*.**

The Windows on Maine project will focus on two major educational initiatives produced by Maine Public Broadcasting and partners. *HOME: The Story of Maine* is a series of 13 half-hour television programs about Maine's history; *Quest: Investigating Our World* is a series of 24 hour-long programs about the natural and environmental sciences in New England. Both television series are accompanied by in-depth Web site content and companion classroom material. Windows on Maine will store and make accessible these two exemplary education programs, along with supporting historical and scientific digital media gathered from partner collections.

Materials will be distributed in real time and be accessible on demand to the laptop computers of 7th- and 8th-grade students, personal computers in high school classrooms, and others outside the state via the University of Maine's Internet2 connection.

"By leveraging the delivery power of broadband technology with digital collections from Maine's cultural agencies, this collaborative effort promises to provide sustainable support to Maine's educators in all parts of the state, even the most remote and economically underdeveloped locations, as never before," says Marilyn Lutz, director of library information technology planning at Fogler Library and a principal investigator for the project.

Senior \$ense

SENIORS ACROSS MAINE will benefit from a new University of Maine Center on Aging program funded by a \$1.3 million Corporation for National and Community Service federal grant.

The three-year Senior \$ense program will involve the recruitment, training and placement of 30 full-time AmeriCorps VISTA volunteers in more than 15 community organizations throughout Maine. The volunteers will help to develop financial, employment, and consumer counseling services and resources for seniors living in poverty.

The center is recruiting volunteers to serve for one to two years to help

improve the lives of Maine seniors.

"By providing a way to deliver resources and services that are customized to different regions of the state, we aim to help Maine's elders learn to more effectively deal with money and related issues and, in turn, reduce their risk of becoming victims of unscrupulous businesses," says Lenard Kaye, director of the Center on Aging.

Kaye notes that the program will use technology to expand its reach to all people who might benefit from it. The project will include the construction of a comprehensive, interactive Web site where resources will be available to all

older adults, their families, and health and human services personnel.

Organizational partners in the project, where VISTA members will be assigned, include UMaine Cooperative Extension, Maine's Area Agencies on Aging, many of the state's Community Action Agencies, Penobscot Community Health Center, and the Maine Jobs Council.

Consultation and training support also will be available through the Elder Abuse Institute of Maine, the Senior Community Service Employment Program, the State Bureau of Elder and Adult Services, and AARP of Maine.

A NEW LIST OF 14 CHARACTERISTICS

of successful middle schools speaks to how effective education can be in the lives of young adolescents, says a national authority on middle-level education.

"A strong case is made for the courageous leadership needed by middle grades teachers and administrators," said Ed Brazee, speaking at a November news conference in Washington, D.C., where the National Middle School Association (NMSA) released its research findings.

"Middle schools work when principals, teachers and parents work together to achieve a common vision and place a strong emphasis on student learning and creating a culture of caring and support."

Brazee is a University of Maine professor of education and editor of NMSA publications. He joined other officials of the national organization in calling for policymakers to act now to implement the recommendations, which are part of NMSA's revised position statement, *This We Believe: Successful Schools for Young Adolescents*.

A companion document, *Research and Resources*, supports the effectiveness of the 14 qualities, when all are in place.



Meaning in Middle School

- The National Middle School Association believes successful schools for young adolescents are characterized by a culture that includes:
- ✓ Educators who value working with this age group and are prepared to do so.
 - ✓ Courageous, collaborative leadership.
 - ✓ A shared vision that guides decisions.
 - ✓ An inviting, supportive and safe environment.
 - ✓ High expectations for every member of the learning community.
 - ✓ Students and teachers who are engaged in active learning.
 - ✓ An adult advocate for every student.
 - ✓ School-initiated family and community partnerships.
 - ✓ Curriculum that is relevant, challenging, integrative and exploratory.
 - ✓ Multiple learning and teaching approaches that respond to students' diversity.
 - ✓ Assessment and evaluation programs that promote quality learning.
 - ✓ Organizational structures that support meaningful relationships and learning.
 - ✓ School-wide efforts and policies that foster health, wellness and safety.
 - ✓ Multifaceted guidance and support services.

WHEN DESCENDANTS of Revolutionary War veteran William Crabtree wanted to locate the captain's final resting place, geologist John Nelson helped them find the 19th-century cemetery. Turns out, it was under a house in Falmouth, Maine.

Normally, the Ph.D. candidate in the University of Maine Department of Earth Sciences conducts research on the last ice age in southern Maine, where he lives. He uses an electrical resistivity measurement (ERM) that gathers information about rock and soil layers underground.

He also used ERM to locate that long-forgotten burial site. Last September, his presentation on his efforts received a Best Paper Award in the Division of Environmental Geosciences at the Eastern Section of the American Association of Petroleum Geologists annual meeting.

ERM injects electric current into the ground, then detects the signals reflected to the surface that show the location of water tables, impervious soil layers and bedrock. However, electricity doesn't flow easily through air, including pockets that form where the earth has been disturbed.



Put to the test

STRUCTURAL AND MATERIALS TESTS performed by the Advanced Engineered Wood Composites (AEWC) Center at the University of Maine have received an international stamp of approval that will help companies to develop new products.

The International Accreditation Service (IAS) Inc., has certified AEWC as a laboratory that meets standards for 47 different tests of plastics, wood products, composites, adhesives, and structural panels and assemblies. IAS is a nonprofit subsidiary of the International Code Council that provides the foundation for quality-control functions used by industrial associations and government agencies.

"Businesses in Maine can come to our laboratory not only to develop new products, but to get them tested and approved by building code agencies in the U.S. and around the world. We are pleased that we can now offer this unique service that will help grow Maine industry," says Habib Dagher, AEWC director.

The AEWC Center currently works with more than 100 Maine companies in the wood products, construction and composite materials areas to help them develop better products, including composite ships, bridges, consumer products and building materials.

The UMaine center is one of four university laboratories in the U.S. to receive this type of accreditation, and the only one with such a wide range of certified testing procedures.

Losing Loggers



IN THE FUTURE, who will cut the trees for northern New England's logging industry? The question is more than academic. A steady flow of timber is the foundation of the region's forest products industry, which generated \$9 billion in estimated revenues in 2000.

A recent University of Maine survey of loggers in Maine, New Hampshire, Vermont and Quebec suggests that a continuing shortage of woods workers could drive up prices for wood and increase mechanization trends, ultimately affecting the state's pulp and paper industry.

The survey results are getting attention in Augusta, where legislators are concerned about working conditions and pay scales for loggers. Those who run training programs for woods workers also are using the information to address logging industry issues.

Andy Egan, UMaine associate professor of forest resources, sent eight-page questionnaires to loggers in the four jurisdictions. Of the 1,103 replies, 63 percent came from Maine; 18 percent from Quebec. The rest were split between Vermont and New Hampshire.

The results suggest that the composition of the region's woods workers will change considerably in the next decade. Just over half of the respondents expect to be in business in the next five years, and more than two-thirds say they would not encourage their children to follow in their footsteps. Factors contributing to the potential exodus are low average annual incomes (from \$15,615 in Quebec to \$28,449 in Vermont), lack of health insurance and paid vacation, and a perception that the public views logging as an unskilled profession.

Keeping an adequate labor supply will require increases in wages, benefits and wood prices, says Egan. The lack of social prestige associated with logging remains a barrier for the future workforce.

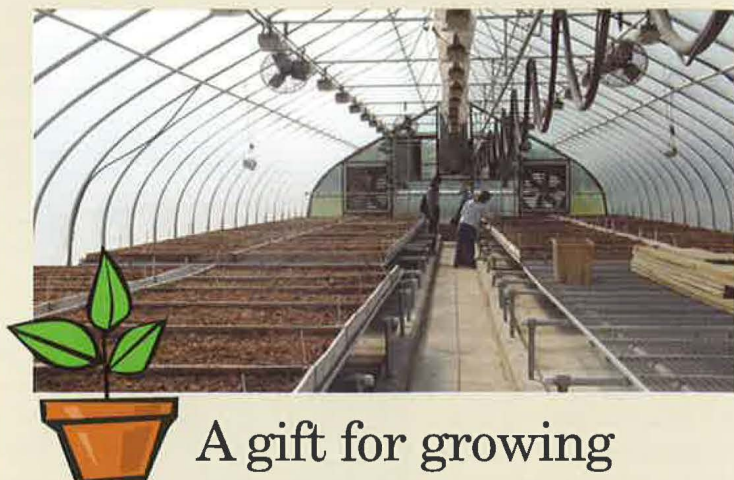


Photo courtesy of Mike Vayda

A gift for growing

THE GIFT OF AN AGRICULTURAL RESEARCH FACILITY in Island Falls, Maine, to the University of Maine will provide a scientific growth spurt for research being done in cooperation with the state's potato and horticultural industries. Island Falls potato grower Arthur Shur donated the facility to UMaine in honor of his father, Jacob. It will be known as the Jacob Shur Research Facility.

The research station includes a building and three greenhouses where scientists will use advanced tissue culture techniques to develop plant varieties for Maine's climate and soil conditions, says Steve Reiling, director of the Maine Agricultural Center at the university.

"The size of this facility enables us to accommodate a much larger research effort in this area than we can do on campus," says Reiling. "When breeders identify a plant with desirable characteristics, the best method to reproduce them in large quantities for research purposes is through tissue culture. The building has room for up to 1 million plants."

Plants propagated through tissue culture rather than seed retain the exact genetic composition of the parent plant.

Prior to the donation to UMaine, the facility was leased to Monsanto Corp., for genetically modified potato research. That effort has been terminated and no research related to genetic modification is being done at the facility. Susan Ballou of Island Falls managed the facility for Monsanto and will continue at the research station, working for UMaine.

University research projects already under way at the facility include horticultural work on garden plants with commercial potential and on disease-resistant white pine trees.

LASERS PERFORM MULTIPLE TASKS. They restore eyesight, scan groceries at the checkout counter and bond metal components in a seamless weld. Expanding on the industrial benefits of the technology, University of Maine engineers are working with the U.S. Navy and two Maine companies — Technology Systems Inc., of Wiscasset and Applied Thermal Systems (ATS) of Sanford — to bring the benefits of laser welding to ship construction.

Laser-welded structural components can be produced faster and with more precision than conventionally hot rolled or welded parts, says Vince Caccese, UMaine associate professor of mechanical engineering. That's because lasers focus intense energy with greater pinpoint accuracy compared to other welding technologies. Since lasers can work with a vari-

ety of metal alloys, they also make possible the use of stronger metals, resulting in lighter structures.

To date, the research has focused on a part used to stiffen bulkheads and other stress-bearing elements of a ship hull. Tests confirm that the laser-welded parts stand up to bending and fatigue more effectively than conventional parts. Non-magnetic steel also has been welded — an achievement of considerable interest to the Navy, says Caccese.

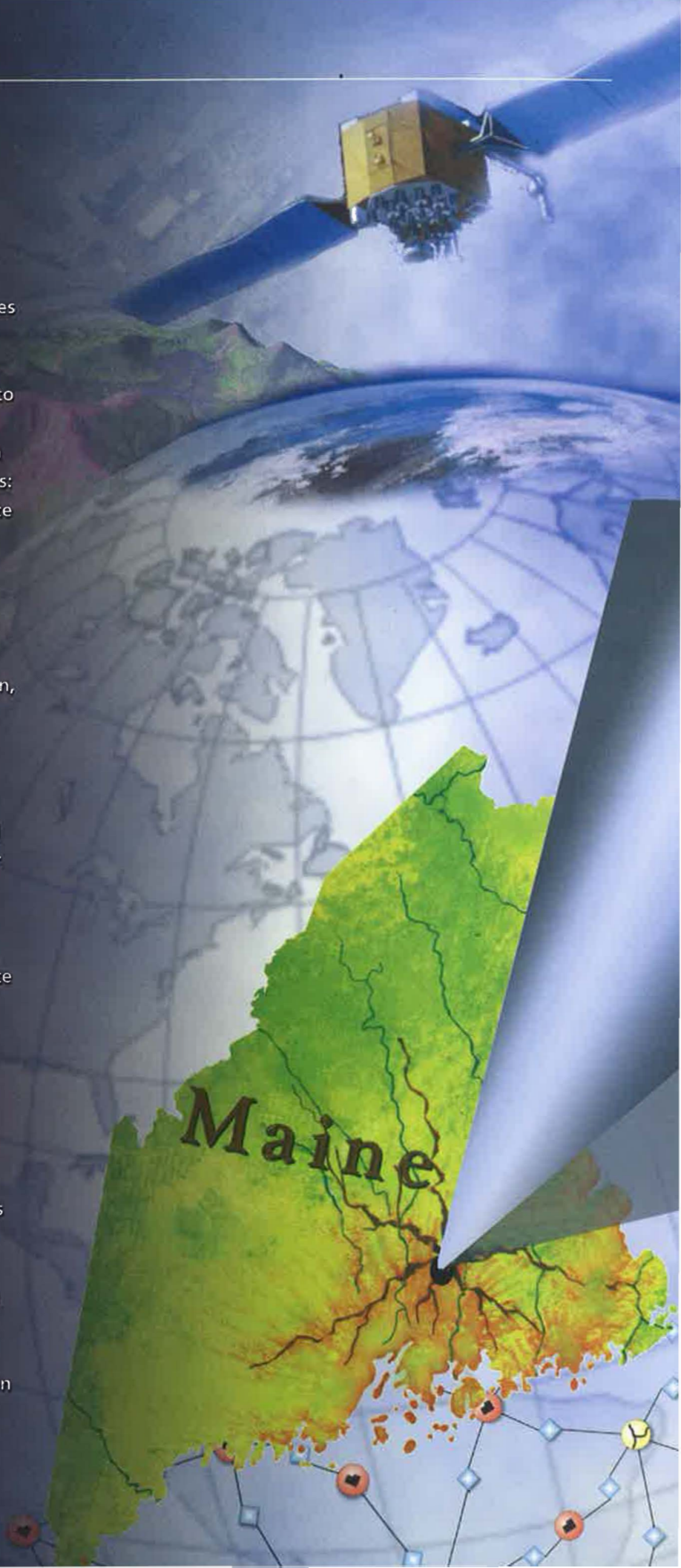


Clean Joints

THE MARRIAGE OF COMPUTERIZED maps and databases has spawned a worldwide geographic information system industry. One of the industry's roots can be traced to a 1988 National Science Foundation grant to fund a center devoted to the study of geographic information science. The recipient of the \$9.8 million grant was a research consortium of three universities: the University of California – Santa Barbara, the State University of New York – Buffalo and the University of Maine.

The goal was to establish a National Center of Geographic Information and Analysis, known as NCGIA, to expand research efforts in collecting, analyzing and understanding geographic information, and to evaluate the social, legal and institutional implications of the ever-increasing use of GIS technology. NCGIA became an international leader through its trademark “specialist meetings” and cutting-edge research. In addition, NCGIA developed educational materials in GIS-sponsored programs for educators at all levels and supported an outreach program. During the period of the award, NCGIA organized several major international conferences; developed a core curriculum in GIS for undergraduate courses worldwide; and published extensively, including 54 books.

Today, NCGIA continues as a research consortium among the three founding universities. The UMaine site has grown to a research operation with approximately \$3 million external annual funding from a variety of federal agencies. Approximately 50 graduate students are currently pursuing master's and doctoral degrees on spatial information science and engineering-related research. Current research activities, focusing on the design of next-generation information systems, include cognitive and ontological foundations, spatio-temporal modeling, mobile computing, image understanding and location privacy.





At the Center

Photo by Kathy Rice

Darling Marine Center Director Kevin Eckelbarger

COME ANY TIME OF YEAR to Wentworth Point on the Damariscotta River and you'll find many of Maine's leading marine scientists at work. In the summer, their research ranks double with visiting scientists and students from throughout the country and the world.

The 170-acre Ira C. Darling Marine Center in Walpole, Maine, is part of the College of Natural Sciences, Forestry, and Agriculture at the University of Maine. Tucked into its forested waterfront are the most modern marine science laboratories and classrooms in northern New England. In addition, built to the contour of Wentworth Point is the Darling Conference Center.

While scientists are dispersed widely throughout the state-of-the-art research facilities, it's at the conference center that they regularly congregate.

The \$1.6 million Darling Conference Center, completed in 1999, was made possible by funding from the National Science Foundation and the Ira C. Darling funds that are held at the University of Maine Foundation. The center's features include a large dining room and meeting area, and housing for almost 70 researchers and students. "The conference center has allowed us to significantly expand our educational and research-related activities, and it has opened the Darling Marine Center to the world at large by attracting leading international marine scientists to our scientific meetings," notes Kevin Eckelbarger, director of the Darling Marine Center.

The Ira C. Darling property was donated to UMaine in 1965. In addition to the property, the University of Maine Foundation holds the operating funds for the facility, which ultimately allowed UMaine to leverage other sources of funding, including the National Science Foundation, to benefit the facility. "This was the ultimate gift," according to Amos Orcutt, president/CEO of the University of Maine Foundation.

Ira C. Darling, a retired Chicago insurance executive, also established two endowment funds at the University of Maine Foundation, the Agatha and Clare Darling professorships in oceanography.

UNIVERSITY of MAINE
FOUNDATION

www.umainefoundation.org

Two Alumni Place
Orono, Maine 04469-5792
207-581-5100 or 800-982-8503

100 Foden Road, Suite 303, W. Building
South Portland, ME 04106
207-253-5172 or 800-449-2629