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Maine's  
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UNIVERSITY OF MAINE SYSTEM



UNIVERSITY OF MAINE SYSTEM  
**MAINE'S MOST VALUABLE PUBLIC ASSET**  
*The catalyst for Maine's future*

A successful partnership between the University of Maine System, government, and the private sector.

**MAINE ECONOMIC IMPROVEMENT FUND ANNUAL REPORT**

DECEMBER 2006

## STATE FUNDED RESEARCH ANNUAL REPORT

DECEMBER 2006

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\* The narratives provided demonstrate the breadth and diversity of research conducted at UMaine and USM in FY 2006. While there are many stories to tell, these narratives highlight the significant ways that R&D activity spurs innovation, job creation and economic development in Maine.



## 2006 STATE-FUNDED RESEARCH REPORT

December 2006

**T**he Maine Economic Improvement Fund—MEIF—has proved to be one of the most successful public investments in recent decades. In less than 10 years, MEIF has dramatically increased federal and private investment in university-based research in Maine. The result: new jobs, products, patents, businesses, technology and millions of dollars of added economic activity.

In fact, the economic activity generated by MEIF has more than offset the state's appropriation. Maine's sales and income tax revenues have increased as a result of the direct and indirect purchase of goods and services, and the jobs created through MEIF-related enterprises.

MEIF demonstrates the benefits of public and private partnerships. It involves brainpower and innovation provided by faculty and students at the University of Maine and the University of Southern Maine, combined with working capital from the private sector, and the federal and state levels of government.

In 2006, MEIF continued its value and utility to university researchers as they sought and acquired funds to support their research and economic development initiatives. This report summarizes the results.

### MEIF: How It Works

Established by the Maine Legislature in 1997, MEIF supports projects related to seven areas of strategic economic importance and potential:

- Aquaculture and Marine Sciences
- Biotechnology
- Composites and Advanced Materials Technologies
- Environmental Technologies
- Information Technologies
- Advanced Technologies for Forestry and Agriculture
- Precision Manufacturing

As directed by Maine law, state policymakers appropriate MEIF funds to the University of Maine System to support university-based research in the seven strategic areas. The University System allocates those funds to the two universities it has designated to conduct basic and applied research in some or all of those areas: the University of Maine (UMaine) and the University of Southern Maine (USM).

Both universities use the funds to provide faculty, staff and students with the resources they need to pursue research projects. Often the funds are used to match or leverage federal grants and contracts. Other times, MEIF funds help purchase equipment or renovate facilities so that the universities become eligible or competitive for federal or private funding. The combination of funding sources also makes it possible to hire and retain the personnel needed to conduct the research itself.

While both UMaine and USM have been designated as the universities to conduct MEIF-related research, their roles as research institutions differ. For UMaine, MEIF funding helps expand its long-standing role as the state's designated research university. Since its founding in 1865, UMaine has been heavily involved in basic and applied research. It features an extensive array of facilities and resources to support research-related teaching and outreach. Because of its significant research infrastructure, UMaine is well positioned to pursue research grants and contracts.

Meanwhile, MEIF funds are used at USM to help build the infrastructure necessary for it to compete successfully for government and private research funds. USM's role as a research institution is relatively young. As a result, the size and nature of its research infrastructure is less extensive than what's found in Orono. For that reason, MEIF allocations to USM have been primarily focused on building and expanding its research capacity and potential. This strategy is designed to build up USM's ability to attract grants and contracts in specific scientific fields relevant to its region's economic interests.

Though MEIF-related research is concentrated at the University System's two institutions with graduate programs, all seven of Maine's public universities engage in teaching, research and public service outreach related to economic growth and the state's quality of life. Virtually every academic discipline contributes in some way to those two interrelated purposes. This document focuses specifically on MEIF-funded research; other university reports address the much broader scope of scholarly activity taking place annually within the institutions of the University of Maine System.

## MEIF and 2006

**SUCCESS**—By leveraging MEIF funds, UMaine and USM attracted a combined \$42.7 million in federal and private-sector grants and contracts related to the seven strategic research areas.

**RETURN ON INVESTMENT**—Using its long-established research capacity, UMaine used \$12 million in MEIF funds to attract \$38.8 million in federal and private-sector research funds. USM continued to build its research capacity, using \$2.5 million in MEIF funds to leverage an additional \$3.9 million in federal and private-sector grants and contracts.

**STRATEGIC IMPACT**—In 2006, \$57.2 million was invested in university-based research and development related to the MEIF-targeted areas. The amount represents the combined total of grants and contracts received and the MEIF funds drawn down to leverage them.

**CREATING JOBS**—In 2006, 717 full-time equivalent (FTE) positions were funded in Maine through the funds leveraged and expended related to MEIF.

TABLE 1

	UMaine Funds	USM Funds	Total Funds
MEIF Funds	\$12,009,372	\$2,492,617	\$14,501,989
Grants & Contracts Received	38,848,716	3,874,889	42,723,605
<b>Total Funds</b>	<b>50,858,088</b>	<b>6,367,506</b>	<b>57,225,594</b>

## 2006 UNIVERSITY OF MAINE HIGHLIGHTS

### GRANTS AND CONTRACTS:

#### The Return on Investment in University-based Research

New dollars available for R&D expenditures were \$65 million in FY06. Of that amount, MEIF funds accounted for \$50 million. UMaine used \$8 million of its \$10 million in MEIF funds to leverage \$39.9 million in external grants in the seven targeted sectors. The remaining \$2 million in MEIF funds were used for building infrastructure capacity.

The increase in R&D infrastructure and activity has enhanced UMaine's capacity to spur industrial growth, with industry contracts for FY06 totaling \$3.7 million. UMaine submitted a total of 571 proposals during FY06 involving 336 faculty and professional staff from 60 departments or units as principal investigators or co-investigators. A total of \$152 million was requested from external sponsors, up from \$141.3 million requested in FY05. In addition, UMaine faculty and staff produced more than 2,500 publications in FY06, including papers, books, book chapters and technical reports.

### POSITIONS LEVERAGED

In FY06, 626 job positions at UMaine were created and/or supported as a result of MEIF funds, and external grants and contracts. This includes positions directly supported by MEIF funds, and people paid through R&D grants and contracts leveraged from MEIF funds.

### FACILITIES AND EQUIPMENT

UMaine continues to expand and develop state-of-the-art research facilities to support the targeted technologies.

#### Blueberry Hill Farm Laboratory Facility Jonesboro, Maine

The Maine Agricultural and Forest Experiment Station completed a new laboratory facility at Blueberry Hill Farm, Jonesboro. Funding for the building came from \$600,000 in a jobs bond approved by Maine voters in summer 2003, as well as two federal grants totaling another \$330,000.

The new 4,000-square-foot building is in the heart of the Washington County blueberry industry. The facility houses two new labs. One will enable researchers to examine plant specimens for diseases and growth characteristics; the other will house insect and fungi research activities.

### University of Maine Small Animal Facility

The Small Animal Facility (SAF) was constructed on the Orono campus in 1940 as part of the UMaine dairy. In 1977, it was renovated for housing small animals, such as mice, rats and rabbits. The 3,000-square-foot facility has been used exclusively for laboratory animal research for the last 11 years. Current research projects include studies on the effects of blueberries on hypertension, the use of metal foams in human joint and tendon repair, the effect of weightlessness on bone density, and the effect of maternal hypothyroidism on development of the fetal nervous system as a model for human diseases, such as cerebral palsy and Alzheimer's. The latest renovations include the installation of an in-house autoclave; upgrades to the HVAC system; installation of a laboratory animal surgery suite, with dedicated prep and recovery areas; upgrades to the animal rooms; and several modifications to increase building biosecurity. These improvements will allow the university to meet AAALAC and USDA accreditation, which will increase researchers' competitiveness for NIH, NSF and private funding.



Doug Hall, a 1981 UMaine graduate, pledged to mentor those UMaine student entrepreneurs who have innovative ideas under development.

### Student Innovation Center Dedicated

The creative energy that fuels the entrepreneurial spirit is flowing freely at the University of Maine's new Student Innovation Center. Completed in summer 2006 and dedicated in October, the 5,000-square-foot, state-of-the-art facility is designed to facilitate group learning and interaction among student entrepreneurs, faculty members and successful innovators. It was built with 2004 R&D bond funding, which leveraged several private donations.



The Student Innovation Center will serve as home to UMaine's Innovation Engineering Program, an interdisciplinary minor that provides student entrepreneurs with practical education related to innovation, along with the dynamic support that can help them move from idea to reality. UMaine has a strong track record in developing students and others who have become successful entrepreneurs, creating the kind of spin-off business opportunities that can lead to significant economic development.

"The facility and related programs will allow us to capitalize on the initiative and creative thinking that are characteristic of UMaine's students, staff and faculty," UMaine President Robert Kennedy said at the dedication event. Renowned inventor Doug Hall, a 1981 UMaine graduate, has committed to continuing support for the center and the Innovation Engineering Program. Hall pledged to mentor those UMaine student entrepreneurs who have innovative ideas under development.

## **National Cold Water Marine Aquaculture Center – Franklin, Maine**

The University of Maine partnership with the U.S. Department of Agriculture-Agriculture Research Service continues to expand in Franklin. USDA has nearly completed its more than 40,000-square-foot research building, which will focus on salmon breeding. The shared facilities at Franklin now make it the *largest and most flexible marine aquaculture center in North America*. The UMaine/USDA partnership is

continuing to pursue federal funding for a complementary research building on the Orono campus.

## **New Equipment Increases Research Capacity**

More than \$2.3 million in new equipment was procured to support UMaine R&D activity in FY06. Major purchases (greater than \$50,000) through various grants included 28 pieces of scientific equipment, outfitting labs throughout the university.

## **INCREASED STUDENT INVOLVEMENT IN RESEARCH**

### **Ph.D. Students Involved in Interdisciplinary Training and Research**

Building on existing research strength and state-of-the-art infrastructure, the University of Maine is involved in a five-year, \$3.16 million National Science Foundation (NSF) project establishing interdisciplinary graduate education in sensor science, engineering and informatics. Funded through NSF's Integrative Graduate Education and Research Traineeship (IGERT) Program, designed to train Ph.D. scientists through interdisciplinary programs that address global needs, the UMaine initiative features 19 faculty members from departments campuswide. The program's students, known as IGERT fellows, are studying in areas ranging from the science and engineering of new materials and sensing mechanisms to the interpretation of sensor data.



Ph.D. students in the IGERT Sensor Foundation's course working collaboratively on programming sensor nodes.

## 2006 UNIVERSITY OF MAINE HIGHLIGHTS

Each fellow's interdisciplinary research draws on the the connections among two or three of the program's focus areas.

UMaine is one of a small number of institutions with more than one IGERT grant, having launched a similar initiative in functional genomics in 2003. Like UMaine's Graduate School of Biomedical Sciences, established in early 2006, the Functional Genomics IGERT Program is built on connections with other Maine research institutions, specifically The Jackson Laboratory and Maine Medical Center Research Institute.

In each of these programs, the highly skilled and experienced scientists at UMaine and the other institutions serve as mentors for the participating UMaine Ph.D. students, drawing those students into ongoing research projects, and creating opportunities for the science and research leaders of the future to participate in the development of new knowledge while learning the skills and approaches they will need in their own research.

### TECHNOLOGY TRANSFER AND COMMERCIALIZATION

UMaine continues its vibrant technology transfer and commercialization program. The university's total patent portfolio now contains more than 60 patents, patent applications and international patents.

In FY06, UMaine filed 10 new patent applications. Three new patents were issued and published by the U.S. Patent and Trademark Office:

#### US Applications—Issued

U.S. 7,075,216 Lateral field excited acoustic wave sensor

U.S. 7,053,522 Surface acoustic wave sensor

U.S. 7,031,877 Spectroscopy instrument using broadband modulation and statistical estimation techniques to account for component artifacts

#### Tech-based Start-up Companies

**Atlantic Defense Group** is commercializing ballistic panels developed at the Advanced Engineered Wood Composites Lab. The company in the Target Technology Center is investigating manufacturing options in the Bangor area.

**Gudmuse** is a company started by Professor Stuart Marrs involving the commercial production/sales of instructional DVDs for classical music using advanced new media techniques. The start-up was aided by a student innovation team, working with Target Technology Center staff. New media and business students also assisted with the project.

#### UMaine Student Start-ups

**RE Consulting LLC** was formed by MBA student Rory Eckardt in FY06. He worked on the Innovation Center project at Target Technology Center. RE Consulting, which provides modeling and software solutions for the forest industry, has received Maine Technology Institute and Libra Future Fund competitive grants.

**Consumer Energy Research Corp.** was formed by business student William Sulinski in FY06 in partnership with UMaine engineering graduate Matt Rodrigue. The company has a technology solution that allows oil companies to remotely monitor customer tank levels to more efficiently schedule deliveries. The entrepreneurs have worked closely with the Target Technology Center. The company, located in the innovation space at Target, has received Maine Technology Institute and Libra Future Fund competitive grants.

### INCUBATOR TENANT UPDATE

UMaine's Target Technology Incubator is one of seven statewide Advanced Technology Development Centers, providing both physical space and business counseling services to technology companies. The center is beginning its fifth year. At the end of FY06, it had nine tenant companies.

#### Stillwater Scientific Instruments

Stillwater Scientific Instruments (SSI) is developing a device that dramatically decreases the time it takes to analyze chemical compounds in the laboratory. The device, a component of mass spectrometers, will be sold to laboratory equipment manufacturers. Mass spectrometers are used primarily in the biomedical and pharmaceutical industries, as well as environmental fields in which complex chemical mixtures must be accurately identified. Stillwater Scientific successfully raised \$1.15 million in venture capital in FY06. It is using the funding for further product development, management recruitment and securing OEM manufacturing partners.





Intelligent Spatial Technology (iST) founder Chris Frank was named Maine's 2006 Young Entrepreneur of the Year by the Small Business Administration for his work with the iPointer.

### **iST (Intelligent Spatial Technologies)**

iST is a UMaine spin-off company formed to commercialize the technology developed at UMaine. iST has developed technology that provides users with information about their surroundings.

UMaine is iST's first customer. Its Admissions Office is using the technology to enhance campus tours, allowing prospective students and visitors to point the device at a building and learn about its function and history. Its handheld iPointer provides information about nearby geographic objects based on spatial information about the user's location.

iST has added an experienced executive in the GIS industry, Jerry King, to its management team. His primary roles are fundraising and business development.

### **Angel Secure Networks**

Affiliated with the Advanced Engineered Wood Composites (AEWC) Center, Angel Secure Networks provides software and process engineering services for protecting high-value data

against the risk of compromise. The company, which focuses on national security, is located in Massachusetts and at Target. It partners with UMaine's supercomputer program to further development and commercialization activities.

### **Strategic Dataworks Inc.—Finasys**

Finasys is developing Web-based financial applications. Its principals have more than six years of experience providing custom database design and development services to large corporations, such as Lucent Technologies and Fairchild Semiconductor. Currently, it is looking to transition from custom development and contract development to marketing law practice management solutions.

### **Maine Secure Composites**

Maine Secure Composites, also affiliated with AEWC, researches and develops secure composite materials for use in homeland security and the U.S. military. It focuses on secure shipping containers with embedded sensors that will detect tampering. The company has attracted more than \$1 million from the Department of Homeland Security.

### **Milcord ME**

Milcord ME is developing geospatial solutions through government-funded, advanced technology development programs. Its products are based on research conducted through UMaine's Department of Spatial Information Science and Engineering. The company was successful in obtaining SBIR and STTR funding in FY06.

### **Knife Edge Productions**

A digital video company founded by two former UMaine students, Nathan Hankla and Sheridan Kelley, Knife Edge combines the latest video hardware and software with creative talent and innovative vision. In the past year, the company has completed a number of projects for the Advanced Engineered Wood Composites Center.

### **versionZero**

Nathan Hankla started versionZero, a new media development company, when he was a graduate student at UMaine. He now has clients in New York City and throughout Maine. He was recently selected to redesign the Web site for the Bangor Region Chamber of Commerce.

### **Atlantic Defense Group**

This new company is an AEWC spin-off, working to commercialize ballistic panel tent inserts for the U.S. Department of Defense. The company hopes to secure a manufacturing contract for the panels.

## AFFILIATES PROGRAM

Target's Affiliates Program allows new and emerging companies the opportunity to benefit from the services of the Target Incubator without being physically located in the building. Affiliate members are potential future tenants.

### Current Affiliates

**Buck & Associates**—IT company  
**Christian Gagnon**—IT entrepreneur  
**Com-Jet Papers**—Paper products  
**Direct Web Properties**—Web advertising  
**Good Leads**—Technology company consultant  
**Gudmuse**—UMaine spin-off of Professor Stuart Marrs  
**JMAC Multimedia**—Multimedia company  
**Mainely Sensors**—LASST spin-off company involving faculty, staff and students  
**One U.S. Brand**—Intellectual property consultants  
**Orono Spectral Solutions**—LASST spin-off company involving faculty and recent graduates  
**Spill Free Oil Drainage Products**—Industrial products company  
**Tirranna**—UMaine faculty/staff/student company developing Web-based education tools  
**Waelender Law Offices**—Legal services  
**Zeomatrix**—UMaine spin-off developing environmental remediation technologies

Target continues to offer its award-winning Lunch and Learn series of seminars. The seminars, sponsored by Eaton Peabody, a law firm in Bangor, cover topics such as patent basics, market research, commercialization, business development and human resource issues.

- 19 seminars were offered in 2005–06, with more than 200 attending.
- Attendees include university researchers, students, professors, entrepreneurs and private-sector companies, such as Target Tenants and Affiliate members.

## OPPORTUNITIES FOR UMAINE STUDENTS

The Target Technology Incubator provides employment opportunities for UMaine work-study students and graduate assistants. Students assist with the operation of the center and provide tenant companies with the information and resources necessary to move their businesses forward. Students benefit from real-world experience with companies and exposure to entrepreneurship as a career option.

The Target Technology Center continues to partner with the University of Maine Law School, hosting a patent attorney from the Maine Patent Program. The Patent Program also held five inventors' forums at Target in FY06.

UMaine also partners with the Maine Aquaculture Innovation Center to manage an aquaculture incubator, another of the state's Advanced Technology Development Centers. The incubator has locations in Franklin, at the Center for Cooperative Aquaculture Research (CCAR) and in Walpole, at the Darling Marine Center. CCAR incubator has three tenants: Seabait of Maine LLC, Sea Vegetable Solutions and Maine Halibut Farms. All of these companies are moving toward full-scale commercialization and have received Maine Technology Institute grants to further their development.

UMaine also works with several economic development organizations and municipalities to package real estate, programs and services necessary to support incubator graduate companies and spin-off companies that do not need incubator space. Specific projects are in the planning stages with the Bangor Regional Development Alliance, the Coastal Acadia Development Corp., the Piscataquis Economic Development Corp., the Millinocket Area Growth and Investment Council, the towns of Franklin and Greenville, and the cities of Brewer and Bangor. These projects support business development, attraction and recruitment.

## RESEARCH LEADS TO ECONOMIC DEVELOPMENT

### North Star Alliance

The University of Maine is a key partner in the new North Star Alliance initiative to grow Maine's boatbuilding, composites and marine trades industries. The initiative is funded by a \$15 million grant to the state from the U.S. Department of Labor's Workforce Innovations for Regional Economic Development (WIRED) program. A group of representatives from industry, economic development agencies, workforce development and education organizations developed the initiative. The group identified four "pillars" on which the future of these industries hinges: research and development; market development; workforce development; and capitalization.

UMaine is the lead organization on the R&D pillar, forming an industry advisory group to determine which technologies and market opportunities should be emphasized in research. Graduate and undergraduate students will work on industry-led projects, intended to leverage additional grant opportunities. UMaine also will play a role in linking partner companies with the available economic development resources.

Renee Kelly from UMaine and Robert Lindyberg from AEWC, who are on the North Star Alliance steering committee, have represented the North Star Alliance and UMaine at several national meetings. Kelly represents UMaine on the workforce development and capitalization pillars; Lindyberg represents UMaine on the marketing pillar.



## **UNIVERSITY OF MAINE FY06 HIGHLIGHTS**

UMaine R&D activity achieved significant milestones in FY06:

Total expenditures reached \$65 million. Of that amount, MEIF funds accounted for \$50 million. A large portion of the \$10.4 million from the state was leveraged to bring in an additional \$38.8 million in external grants exclusively in the seven MEIF target sectors.

- 571 proposals were submitted involving 336 researchers and 60 departments, with \$151.9 million requested from external sponsors.
- More than 2,500 publications were produced by faculty and staff.
- UMaine leveraged \$38.8 million in external grants and contracts in the seven MEIF technology sectors.
- 626 job positions were created and/or supported through MEIF funds, and external grants and contracts.
- Nearly \$4 million from grants and contracts supported students' tuition and salaries to work in all technology sectors.
- Construction and renovations were completed on three research facilities.
- More than \$2.3 million in major equipment was secured to outfit labs throughout the university.
- 10 new patent applications were filed and three new patents issued.
- UMaine helped start or spin off two new companies based on UMaine-developed technologies.
- The Target Technology Incubator housed nine tenants, supported 14 affiliate companies and provided referrals or counseling to more than 200 walk-in companies and individuals.
- UMaine-affiliated aquaculture incubators in Franklin and Walpole supported three tenants moving toward full-scale commercialization.

## 2006 UNIVERSITY OF SOUTHERN MAINE HIGHLIGHTS

**GRANTS AND CONTRACTS: The Return on Investment in University-based Research**

**T**HE UNIVERSITY OF SOUTHERN MAINE invested \$2.5 million in state funding to leverage \$3.9 million in federal and private-sector funding for MEIF-related contracts. Proposal submissions totaled nearly \$20 million in the MEIF areas for targeted technologies.

In FY06 as a whole, grants and contract activity at the University of Southern Maine continued at a significant pace with awards at \$48 million, which is just below the peak level in FY04. Actual expenditures during the year also were strong, with the past year as the second highest at \$41.4 million.

USM faculty and staff have worked to develop programs and projects that will augment the experiences of students, enhance the welfare of residents in the state and leave a mark nationally. Collaborative efforts have increased, with more USM projects involving Maine-based organizations and institutions.

**POSITIONS LEVERAGED**

**I**n FY06, MEIF dollars and the R&D grants and contracts those funds generated supported 194 full- and part-time job positions (equaling 90 full-time equivalent job positions). This includes complete/partial support for 35 university faculty; 50 professional, technical and research staff; and 109 student workers.

Further evidence of the growth in research strength at USM is the increase in the number of doctoral students enrolled in the cooperative Ph.D. program in biochemistry and molecular biology. Seven USM students now participate in the program; four years ago, there was only one. These advanced students provide vital research expertise to USM's bioscience labs, contribute to the publication productivity of faculty, and offer valuable mentoring and guidance for undergraduate and master's students.

**FACILITIES & EQUIPMENT**

**T**he University of Southern Maine enhanced facilities and equipment in several key areas:

**High-tech Microscope Added**

USM acquired a special piece of instrumentation in FY06 with a \$400,000 award from the National Science Foundation to

purchase a Transmission Electron Microscope (TEM) with tomography capabilities. When completed, the facility with its microscope and high-performance computing cluster will enable USM researchers to perform new types of analysis, such as investigation of the morphology of the newly discovered bacteriophages. TEM will serve as a resource for the bioscience research community in southern Maine. It represents an important step in the development of USM's research infrastructure.

**Research Computing Goes to the Next Level**

USM's Research Computing Group (RCG) includes several faculty members from computer science and technology; and full-time professional staff, contractors, consultants, three graduate students and 15–20 students from various departments and disciplines. Much of the work of RCG in FY06 continued to build USM's capacity and information technology infrastructure to collaborate with and support a growing number of research and development projects, and complex instrumentation requirements in the biosciences. In addition, RCG has continued its key role as collaborator in the ongoing efforts around Thinking Matters, USM's two-day showcase of scholarly research (see related story in the "Increased Student Involvement in Research" section).

In FY06, the research computing group initiated its part of the NSF-funded project, "Acquisition of Integrated Electron Microscopy, Tomography, and Computational Resources Supporting Interdisciplinary Collaboration in Research and Education at USM," led by principal investigator Monroe Duboise and co-principal investigators Glenn Wilson and Ak-Kau Ng. This project applies a high-performance parallel computing cluster (HPC) to support tomographic image acquisition, three-dimensional reconstruction, data storage and systems modeling applications. The technology also provides advanced bioinformatics support for research and education projects in an interdisciplinary community of scientists. Computer science and technology students, under the direction of Dr. Bruce MacLeod, have been working on open-source, three-dimensional modeling applications, and have begun rendering complex images from a variety of sources.

The HPC also is used by researchers in statistics. Cheng Peng and his graduate students are able to run simulations that would normally take weeks to complete with standard desktop computers. HPC promises to significantly reduce computational time for a number of research projects across disciplines, and contributes to USM's overall research infrastructure.



## INCREASED STUDENT INVOLVEMENT IN RESEARCH

### Thinking Matters

In April, USM hosted its fifth annual Thinking Matters conference on the Portland campus, the signature event for student researchers.

The purpose of the event is to provide a public forum for students to share the results of their research, encourage student initiative and celebrate the results. It featured 20 oral presentations, as well as research poster authors discussing their works.

Conference keynote speaker Alan Lishness, chief innovation officer for the Gulf of Maine Research Institute, described the design and operation of the Cohen Center for Interactive Learning, along with the numerous disciplines involved. He also provided a perspective on innovative interface technologies that enable learners to interact more directly with information and concepts.

Other panels and presentations focused on:

- Ethics at risk—a combination of theory and application.
- Altruism or self-interest—driving shoppers to the thrift store; nonprofit retailing.
- Hurricanes Katrina and Rita—the Distant Hands Network, a Web-based initiative to connect Maine groups with those in need.

Examples of the research posters presented:

- Papermaking by horticulture students using locally collected fibers.
- Contamination in soils in and around Portland, and ways of removing it using plants.
- A re-examination—a poster and a video presentation of The Unicorn Tapestries.

Support for the Thinking Matters conference comes from MEIF, as well as institutional resources at USM.

### Partnering with Rural High School Students

The Maine Science Corps completed its fifth year of highly successful partnership: connecting science teachers and students at rural high schools with the USM biosciences research community and the Education Division of the Foundation for Blood Research (FBR).

Since 2001, grant support from the National Science Foundation (NSF), along with significant USM contributions,

have allowed the Maine Science Corps to address critical needs for laboratory-based active learning in science classrooms of rural high schools across Maine. During the first five years, Science Corps provided NSF- and USM-sponsored fellowships for 29 biosciences graduate students. It also established a strong connection between the USM scientific community and schools, impacting about 5,000 high school students. The interactions typically involve graduate fellows bringing into the schools activities aligned with Maine's science education standards (Maine Learning Results), along with needed equipment and materials as part of eight to 10 classroom laboratory sessions throughout the school year.

During the first four years, the graduate fellows were from USM's Department of Applied Medical Sciences. The program emphasized molecular biology, immunology, microbiology, epidemiology and biotechnology. Currently, the project is increasingly interdisciplinary with the recruitment of fellows from the Department of Biological Sciences. Through increased collaboration of fellows and faculty with diverse interests, a more interdisciplinary graduate experience is provided.

While rural high school students and teachers benefit from enhanced laboratory-based learning opportunities and strong links to the USM scientific community, the graduate student experience is enriched through development of effective teaching and communication skills, along with understanding of the positive impact that involved scientists can have in K-12 science education.

## TECHNOLOGY TRANSFER AND COMMERCIALIZATION

### Law & Innovation Center a Hub for Maine's Innovators

The Center for Law & Innovation at USM supports Maine's investments in science and technology by bridging the gap between scientific research and commercialization. The center, part of the University of Maine School of Law, assists innovators in Maine's high-technology sectors, as well as in traditional industries reliant on the forests or the sea. It provides education, research and extraordinary public service in intellectual property law and science policy.

The recent final evaluation of Maine's public investments in research and development by the UNC Center for Competitive Economics praises the center's service unit, the Maine Patent Program, as a valuable R&D tool, ranking it among the top three public programs (with the Maine Technology Institute and the University of Maine System campuses) for client satisfaction.

## 2006 UNIVERSITY OF SOUTHERN MAINE HIGHLIGHTS

Since its inception in 2000, the Maine Patent Program has exploded in its outreach efforts and the number of clients seeking and receiving intellectual property services annually. In FY06, the program offered intellectual property counseling on 189 matters. In addition to patent advice, Maine's innovation community also sought assistance with trademark and copyright questions, and the program's technology transfer outreach expanded.

### FY06 Intellectual Property (IP) Projects

Patent	142
Trademark	26
Technology transfer	9
Copyright	5
Other	7

The Maine Patent Program has grown steadily and consistently in its service outreach each year. FY06 intellectual property projects represent a 19 percent increase over the previous year.

IP projects in FY05	159
IP projects in FY06	189

**Total projects completed since 2001: 702**

The center also provides educational seminars on patent, copyright and trademark law, and on technology transfer to numerous audiences statewide. In FY06, the center and its staff held or participated in more than 20 workshops on intellectual property law and hosted the Maine Inventors Forum in Portland and Orono. Educational programs reached more than 600 people, from Gorham to Rockland, Strong, Machias, Fort Kent and several places in between.

The center also has developed a critical technology transfer component to serve the state's academic and nonprofit research community with patent screening and commercialization assistance. In October 2005, the center hired Leonard Agneta as director of the Maine Patent Program. Agneta is a patent attorney and technology transfer professional formerly with the University of Nebraska Medical Center. Through a grant from the Maine Technology Institute, technology transfer consultant Todd Keiller was hired. Keiller and Agneta offer the state's nonprofit research laboratories, campuses of the University of Maine System and the University of New England innovation screening, licensing and commercialization assistance. The center raised funds from five research institutions to retain Keiller through FY07.

With offices in Portland and Orono, the center and program serve the entire state. The staff includes three attorneys (two of whom are registered to practice with the U.S. Patent Office), one patent agent, a professional administrative manager and two administrative assistants. The center also has leveraged the state's funding by developing an intellectual property law clinic at the School of Law that involves enrolled law students in providing client services, significantly helping to meet the growing demand for IP advice and technology transfer.

Looking ahead, the center will continue to serve as the technology transfer hub for the state, offering expertise to the Foundation for Blood Research, The Jackson Laboratory, Mt. Desert Island Biological Laboratory, University of New England, University of Maine and University of Southern Maine. It will continue to bring together the state's research community with industry and potential investors. And the center will work to even better serve the state's innovative entrepreneurs and existing industry with patent and commercialization assistance.

### Business Incubator Moves to USM's Portland Campus

Maine's first business incubator, the Maine Center for Enterprise Development (MCED) has moved to the University of Southern Maine.

MCED, considered one of the most successful business incubators in northern New England, is housed in USM's Bioscience Research Wing on the Portland campus. MCED will help link USM's research activities and the entrepreneurial energy in the School of Business to increase business spin-offs that contribute to regional economic growth.

Students have become part of the MCED client base, bringing research innovations and entrepreneurship together. Part of the incubator is being used for students participating in USM's annual business plan competition. The winner and finalists will be given residency in the incubator.

The incubator also plans to strengthen ties with several other USM programs, among them the Maine Patent Program, and the USM School of Applied Science, Engineering and Technology, as well as programs housed in the Bioscience Research Wing. Those include the Maine Center for Toxicology and Environmental Health, and the Research Computing Group. The business incubator's presence at USM





USM's Bioscience Research Wing in Portland is home to the Maine Center for Toxicology and Environmental Health, and the Maine Center for Enterprise Development, one of New England's most successful incubators for start up technology companies.

will give researchers access to needed business development services.

MCED, created nine years ago by the Portland-area business community, ranks well nationally in technology transfer. A study by the National Business Incubation Association for similar programs indicated that MCED is performing in the top 20 percent as measured by the patents held by client companies. It also ranks in the top third nationwide as measured by federal or state research grant support of client companies.

## **THE UNIVERSITY OF SOUTHERN MAINE FY06 HIGHLIGHTS**

USM R&D activity marked significant milestones in FY06:

- USM generated 177 awards topping \$44.9 million in external funding.
- Total grant and contract activities at USM reached \$41.4 million in FY06.
- 236 proposals were submitted, with more than \$64 million requested from external sponsors in FY06.
- \$2.5 million in MEIF funds were leveraged to bring in 28 awards totaling \$3.9 million.
- 194 full- and part-time (90 FTEs) job positions were created and/or supported through R&D dollars (MEIF funds, and external grants and contracts) in FY06.
- Maine's most successful business incubator, the Maine Center for Enterprise Development, moved to USM in fall 2006.
- A new microscope facility was installed in the Biosciences Wing on the Portland campus, serving the research community of southern Maine.

## 2006 AQUACULTURE AND MARINE SCIENCES

## Effects of Trawling in the Gulf of Maine

The nonprofit Gulf of Maine Research Institute developed a proposal that resulted in a \$195,000 grant from Northeast Consortium that brought together sixth-generation draggerman Cameron McLellan, UMaine marine science professor Les Watling and UMaine graduate student Emily Knight for a groundbreaking study in seafloor ecology—and scientist-fisherman relations.

Knight conducted research aboard McLellan's 72-foot steel-sterned trawler. Using a robotic diver, she collected samples of the ocean floor and underwater video in the Western Gulf of Maine Closure, a marine-protected area closed to dragging. The organisms found in each sample were identified and compared to those found in areas frequently fished. Knight found that distinct patterns emerged.

The success of the first season of research led to additional funding from the National Marine Fisheries Service, allowing Knight to collect additional data that strengthened the significance of her initial findings. Results of the study were critical in two important ways: They offered the first reliable estimates of recovery times for seafloor habitats disturbed by trawling, and they were achieved through a collaborative effort that promises to satisfy the skeptics—both in the lab and on the docks.

Watling estimates that it would take roughly a decade for the surface-dwelling organisms to reestablish themselves, but cautioned that a full recovery of the habitat would take much longer. Recently protected habitats are recovering. While anything resembling a "natural" condition would certainly be far in the future, Knight found that significant gains had been made in the short term.

## Marine Worm Aquaculture Operation

A unique aquaculture pilot project at the University of Maine's Center for Cooperative Aquaculture Research (CCAR) in Franklin has developed the first commercial sea worm aquaculture operation in the United States.

Today, Seabait Maine LLC, the company that owns the worms and is developing its technological know-how with UMaine, sells out of its sandworm stocks in advance. The Maine branch of Seabait Ltd., in the United Kingdom, is planning a facility that will eventually increase production 20-fold and give worldwide attention to the UMaine research.

The Maine Aquaculture Innovation Center, Maine Technology Institute and UMaine invested in the innovation to create a fully commercial worm farm.



"Everyone we've encountered in Maine has been willing to lend us a helping hand to bring in new investment, create new jobs and develop new technologies that don't exist anywhere else," says Seabait Maine LLC Managing Director Peter Cowin.

Managing director Peter Cowin and his team scientifically scrutinize the worms at every stage of life—from eggs through adulthood. Among their findings: the worms self-clean their tanks, leading the researchers to hypothesize that perhaps they could clean tanks of other species, lowering both the cost of worm food and tank cleaning; the worms are high in omega-3 fatty acids, making them a healthy food source; and sea worms might one day join their distant cousins, leeches, in medical applications, because elements in their blood compare favorably with the blood of humans.

The current facility incubating at the CCAR produces 5 tons of worms a year. The new facility initially will produce about 65 tons; then, ultimately, 100 tons or more.



## Fighting Viruses with Physics

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

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

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

Specifically, Hess is looking at hemagglutinin, the protein from influenza virus that opens a fusion pore in membranes of host cells to allow in the infection. Removal of cholesterol from membranes appears to have inhibitory effects on hemagglutinin. The researchers are using lasers and spectroscopy to see what's going on in a virus. For example, they may find out why influenza needs cholesterol, and it may be the same reason HIV, or some other virus, needs cholesterol, possibly providing new answers for medical science.

## Zebrafish May Provide Clues to Early Muscle Development

The formation of muscle cells in developing zebrafish embryos will be the focus of a one-year study conducted by UMaine biological sciences professor Clarissa Henry.

The Muscular Dystrophy Association has provided Henry with a \$72,000 grant to carry out the research, which promises to shed new light on the role played by early muscle development processes in the formation of diseases.

Henry's three-pronged approach will look at the molecular mechanisms for the initial elongation of muscle cells, the role of cell adhesion molecules in fast muscle fiber formation, and the potential causes of cell death found in several types of muscular dystrophies. By concentrating her efforts on the early differentiation between embryonic muscle cells, Henry hopes to discover what guides the process of muscle cell development—and where it can go wrong.

Since the development of muscular dystrophy follows similar genetic and developmental patterns in zebrafish, mice and humans, Henry's work promises to provide both a new direction for the treatment of human diseases and a better understanding of the cell's capacity for repair and regeneration.

UMaine's zebrafish facility is a hub of activity, facilitating the initiatives of multiple campus scientists in such areas as microbiology, toxicology, immunology, developmental biology and genetics.





Michael Mason, assistant professor of chemical and biological engineering, is developing an improved screening technique in which nanometer size metal particles are used to "tag" cancer cells, allowing surgeons to identify cancerous tissue more quickly and efficiently.

## Tagging Cancer Cells

Extremely small tumors are notoriously difficult to detect and pose a potentially lethal threat to cancer patients, even after surgery. But by using an amazingly tiny technology being perfected by University of Maine researchers, doctors may soon be able to pinpoint even the most minuscule cancerous cells while the patient is still on the operating table.

UMaine Chemical and Biological Engineering Assistant Professor Michael Mason is developing an improved screening technique in which nanometer-size metal particles are used to "tag" cancer cells, allowing surgeons to identify cancerous tissue more quickly and efficiently. Metallic nanoparticles are guided by attached biomolecules that are attracted to specific molecules on the surface of cancer cells. The technique is sensitive enough to reveal even a single cancer cell.

Michael Mason and his team will provide the foundation for cellular and tissue trials conducted by Dr. Peter Allen at Memorial Sloan-Kettering Cancer Center in New York, which funded the UMaine research.

## Researchers Probe Link Between High Blood Pressure and Thinking Skills

Psychology professors Merrill Elias, Michael Robbins and Penelope Elias are continuing their study of the relationship between high blood pressure and cognitive skills with a \$680,619 grant from the U.S. Department of Health and Human Services. The project's latest manifestation will utilize groundbreaking new technologies to achieve a more accurate measure of blood pressure.

The new technique, recently developed by researchers in Australia, uses ultrasound to measure blood pressure closer to the brain. UMaine psychologists will be working with Australian scientists to reassess their previous findings regarding the adverse affects of high blood pressure on cognitive performance.

The project also will focus on the relationship between arterial stiffness and cognitive ability in people with long-term high blood pressure.

Previous collaborative work with investigators in England will continue in the project's latest phase, examining the relationship between high blood pressure and other cardiovascular risk factors ranging from diabetes to obesity. The interaction between blood pressure levels and factors that promote improved cognition also will be examined.

Ultimately, researchers hope that the study will lead to more accurate methods for measuring blood pressure and improvements in treatment.



### Creating Advanced Materials to Protect U.S. Navy SEALs

UMaine, the Office of Naval Research and Hodgdon Yachts in East Boothbay have teamed up to design new materials for the U.S. Navy SEAL's Mark V special operations craft. The project brings together cutting-edge composites technologies spearheaded by UMaine's Advanced Engineered Wood Composite (AEWC) Center and the long tradition of quality boatbuilding at Hodgdon Yachts. Its success could mean hundreds of millions of dollars in boatbuilding contracts in the state.

A primary goal is to use specialized composite materials in the hull and elsewhere that can absorb the shock created by high-speed travel.

UMaine mechanical engineering graduate student Kate Stephens, working with her adviser, AEWc technical services manager Bob Lindyberg, has developed and refined an innovative impact test that was used to select the composite material with the greatest shock-absorbent properties.

By combining the facilities and expertise at Hodgdon Yachts with the technological advances being made at UMaine, the project has the potential to open a new market for the state. The project has already resulted in the creation of a new company: Maine Marine Manufacturing LLC. Maine Marine is the prime contractor for the construction of the full-scale technology demonstrator called the Mark V.1. The company is in line to compete for a \$200 million contract to build the new vessels.

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



### Building Military Strength



In a \$6.2 million U.S. Army research program, the University of Maine Advanced Engineered Wood Composites (AEWC) Center will conduct research on high-strength structures for military applications.

Among the projects under development: tent protective structures, high-performance air beams, rigidified inflatable structures, rapidly deployable bridges and ballistic modular building components.

AEWC researchers will work with the U.S. Army Natick Soldier Center and the U.S. Army Corps of Engineers. The research will take advantage of a new, \$4.5 million expansion of laboratory space that was financed with a voter-approved bond in 2003.

The new facilities expand AEWc's capacities to develop thick composites technologies, resin-infusion processes and polymer extrusion. The space accommodates an anticipated 35 additional research personnel, including engineers, scientists and support staff who will be funded through the new research program.

### Composites Improve Maine-built Canoes

UMaine's Advanced Engineered Wood Composites (AEWC) Center has partnered with Old Town Canoe and the Maine Technology Institute to develop and test a new line of Old Town composite canoes and kayaks.

With Maine Technology Institute seed grant funding and AEWc expertise, Old Town Canoe will develop, refine and test new composite materials designs for a line of high-performance canoes and kayaks. Through this partnership with UMaine, Old Town Canoe will be better able to sustain and increase its workforce by adding several composite manufacturing jobs.

The collaborative effort between AEWc and Old Town Canoe is aimed at developing new manufacturing processes for composite canoes and kayaks that are often favored by enthusiasts for their structural stiffness and light weight.

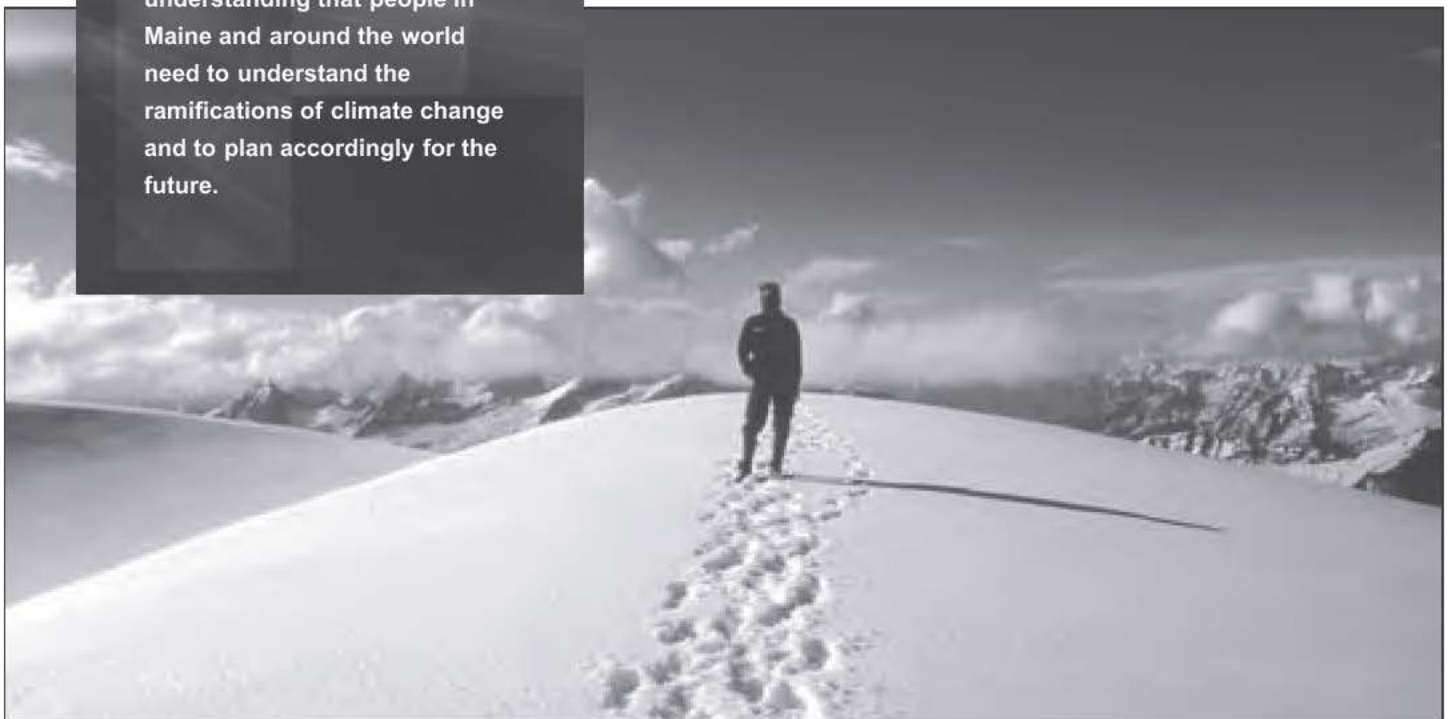
### Paul Mayewski Award

Professor Paul Mayewski, director of the Climate Change Institute at the University of Maine, was recognized in 2006 for a long and distinguished record of international leadership in the scientific study of global climate change. Mayewski, who was interviewed for a climate change segment on "60 Minutes," received the first Scientific Committee on Antarctic Research Medal for Excellence in Antarctic Research at an international meeting in July. Mayewski leads the renowned UMaine interdisciplinary Climate Change Institute, which works in a variety of scientific fields, developing the knowledge and understanding that people in Maine and around the world need to understand the ramifications of climate change and to plan accordingly for the future.

### Maine Students Will Benefit from Supercomputer Visualization

The usefulness and widespread applicability of environmental modeling data from various sources will be greatly enhanced by the addition of a visualization system funded by an \$480,000 grant from National Science Foundation. The system will allow for the storing, rendering and display of large multidimensional data sets on a wall-sized display.

UMaine scientists are currently among the leaders in developing these data through modeling of polar ice, land masses, and the flow of ocean and atmospheric currents. Enhanced visualization will positively affect both the scientific usefulness of the data and the ability to communicate the information with others. This can be particularly important in Maine, where the Maine Learning Technology Initiative has placed laptop computers, networked through high-speed wireless connections, in middle schools across Maine. Those young computer users stand to benefit from access to learning opportunities created by the availability of visual models related to the UMaine scientists' data.







### Agent-based Lobster Fishery Model

Understanding the complex relationships between marine organisms, ocean habitats and human activities is critical to protecting Maine's delicate marine ecosystems and developing a productive and sustainable relationship with the sea.

UMaine researchers are pioneering a new method of studying those interactions known as Complex Adaptive Systems (CAS) theory. The technique uses cutting-edge computer technology and advanced computational tools to unravel the intricacies of complex systems, allowing researchers to develop reliable models that will improve both our

understanding of marine ecosystems and our management of marine resources.

From applying advanced algorithms that can identify the conditions leading to successful stewardship in the lobster industry to manipulating complex environmental data in ways that can locate ideal migration routes for humpback whales, UMaine scientists and mathematicians are poised to make the university a world leader in applied CAS theory while helping to manage marine resources, inform policy and uphold commercial fisheries as one of the foundations of the Maine economy.

## 2006 PRECISION MANUFACTURING

## New Thinking

A new handheld sensing device designed to detect hazardous materials has the potential to be a real boon to firefighters and other first responders on the scene of an emergency. University of Maine professor of chemistry Carl Tripp from the Laboratory for Surface Science and Technology, and engineers from Orono Spectral Solutions have nearly completed a prototype, with business assistance from Bret Golann of the Maine Business School. A product survey of fire chiefs yields enthusiasm for the new invention.

Golann and other UMaine professors teach entrepreneurship courses as part of the undergraduate business curriculum at UMaine. He also offers a new course in technology commercialization that builds on the entrepreneurship courses by helping seniors and graduate students in any field learn how to launch and grow technology-based businesses.

Golann's philosophy is that whether they join an entrepreneurial company or go out on their own, he wants them to be able to take even the most poorly defined ideas and figure out if they can be viable and grown into sustainable businesses.

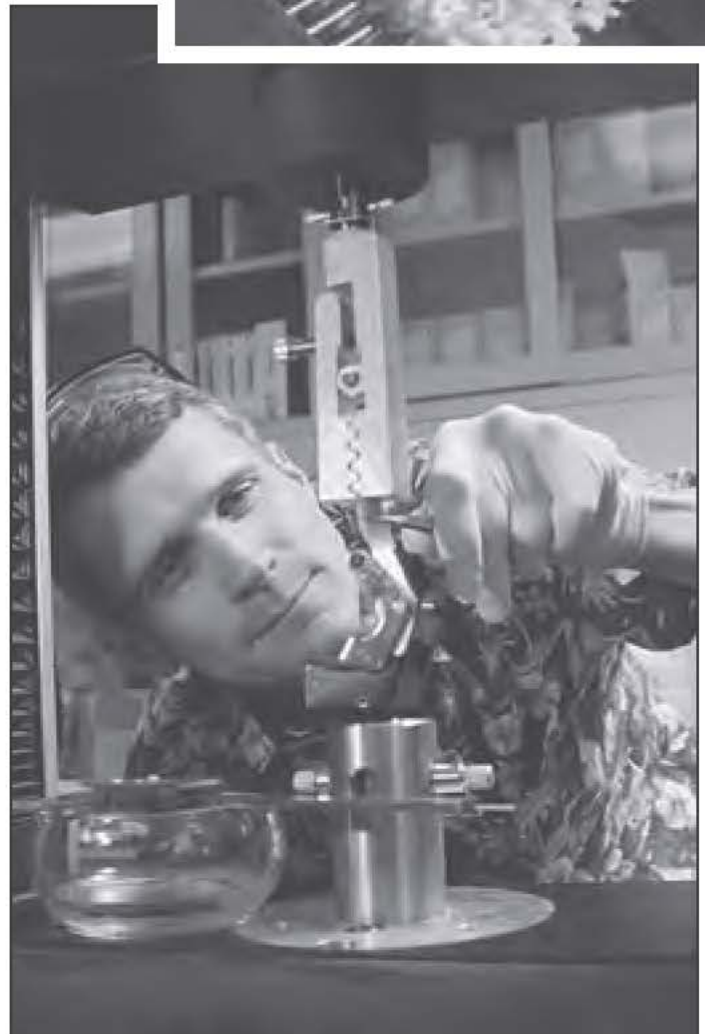
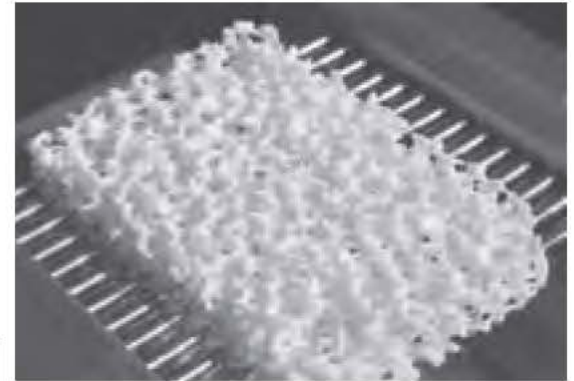
## Using Foam Metal to Repair Bones

Working with professor of chemical and biological engineering Darrell Donahue and a team of other University of Maine researchers, reconstructive surgeon Dr. Ian Dickey is testing the potential of lightweight foam metals as implants for bone repair.

As their research into medical uses for foam metals continued, Donahue and Dickey tapped into additional resources at UMaine, recruiting Scott Collins of the Laboratory for Surface Science and Technology, Anja Nohe and Michael Mason of the Department of Chemical and Biological Engineering, and Andre Khalil of the Department of Mathematics and Statistics. Their ultimate goal is not only to prove that foam metal implants work, but to find out why.

Together, the researchers are developing a high-tech tool kit for the study of foam metals in an effort to better understand what makes the material so effective as a medical implant. Their discoveries will help foam metal manufacturers to develop a new line of products that will improve patients' lives.

The team is pursuing public and private funding that could expand their research efforts. Foam metal projects also are being considered for UMaine internal R&D funding as an area of new and emerging research benefiting the state.



UMaine engineer Darrell Donahue will use specialized equipment to measure the strength and efficacy of foam metal implants.





## Refining Oil from the Forest

UMaine received a \$6.9 million award from the National Science Foundation's Experimental Program to Stimulate Competitive Research, which required a 50 percent (\$3.45 million) match by the university through the Maine Economic Improvement Fund. The grant, called "Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts," is funding new research that could develop an entirely new spectrum of products created from wood oils

and build the research infrastructure to create a biorefinery in Maine.

Like oil, chemicals from trees could be used to make a variety of products: plastics for containers or manufactured parts, coatings, adhesives and resins. One project in the Advanced Engineered Composites Center is a car fender made using a wood-derived resin.

These niche chemicals could bring twice or triple the price of pulp, according to UMaine professor of chemical engineering Adriaan van Heiningen. Deriving ethanol alone could add 20 percent to 30 percent in revenue.

If biorefining processes reach their full potential, and measures to sustain the forests and the industries are successful, the creation of these new revenue streams will go a long way to reclaiming—and creating—a lot of jobs in Maine.

## Portable Detectors for Potato Wart Pathogens

An interdisciplinary UMaine research team has received \$800,000 in U.S. Department of Agriculture funding to develop new methods to detect microbial pathogens in food.

The project involves advanced sensor technologies to develop portable, rapid-detection methods for identifying the fungal pathogen responsible for potato wart, a particularly onerous food-based fungus that can be spread by various means, leading to long-term quarantine of infected agricultural areas. The researchers, led by professors Laurie Connell and Rosemary Smith, hope that successful development of a potato wart-based model will have distinct benefits in protecting the nation's food supply.

## New Computer Program Aids Forest Industry

A new decision-support tool developed at the University of Maine helps forest managers evaluate a complex set of variables when trying to determine how and when to best thin the spruce-fir stands of northern Maine.

ThinME is a computer program created by Department of Forest Ecosystem Science researchers Robert Seymour and Robert Wagner, and Cooperative Forestry Research Unit and U.S. Forest Service colleague KaDonna Randolph.

The computer program graphically illustrates a range of thinning options that meet specific criteria determined by the user, allowing forest managers to consider factors as diverse as annual growth rate, tree size and financial value when developing overall management plans.

Results from ThinME are being evaluated on a dozen study sites across Maine in what is called the Maine Commercial Thinning Research Network. Various thinning prescriptions have been applied to test plots that include the annual measurement of more than 12,000 trees.

Measurements from these plots are being used to test the predictions of ThinME and to improve the model over time.

## Creating Improved Potato Varieties

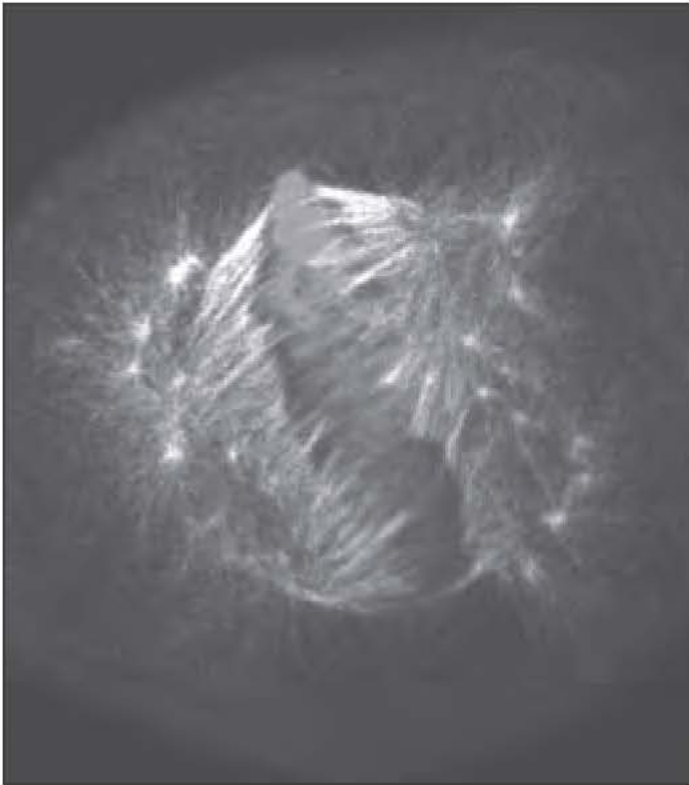
UMaine agronomy researcher Gregory Porter was recently awarded more than \$250,000 in funding from the U.S. Department of Agriculture for an ongoing eight-state potato breeding project aimed at creating improved potato varieties for cultivation in the eastern United States. Maine's potato industry generated nearly \$300 million in direct sales in 2003.

Together with fellow UMaine researchers Alfred Bushway, David Lambert, Gary Sewell and Zenaida Ganga, Porter will collaborate with a number of other potato development researchers to produce insect- and disease-resistant potato varieties that maintain high yields in diverse growing conditions.

Desired characteristics for the project's new line of special spuds include excellent adaptability, attractive appearance, high dry matter content, excellent fry color, freedom from internal defects and excellent nutritional qualities. The project's comprehensive approach will take the new varieties from seed to store by not only developing new stock, but by following through with commercial trials and industry support.

Researchers hope that the multidisciplinary project will result in new potato varieties that will enhance both farm sustainability and grower profits.

## 2006 AQUACULTURE AND MARINE SCIENCES



At USM, one area of focus of the Maine Center for Toxicology and Environmental Health is how chemicals in the environment transform normal cells into tumor cells and cause cancer. The picture shows a cell that is attempting to divide. Under normal circumstances, a cell will have two centrosomes, but the Wise Laboratory recently discovered that when cells are exposed to hexavalent chromium, the number of centrosomes increases dramatically, which may be how chromium causes lung cancer.

## Nation's Largest Repository of Marine Cell Lines

The nation's most extensive Marine Cell Line Library, a vital tool for understanding and protecting endangered whales and other marine mammals, is right here in Maine.

Researchers at the University of Southern Maine are building the living cell repository, which will allow scientists worldwide to do research on endangered marine mammals without harming or interfering with living animals.

This information is critical if scientists are to discover the cause of major die-offs and strandings among some whale species. It also may lead to comparative studies between marine mammals and humans.

Leading the initiative is USM toxicologist John Wise, director of the Wise Laboratory of Environmental and Genetic Toxicology at USM's Biosciences Research Institute. The research labs were supported through MEIF.

USM scientists receive tissue samples from a network of collaborators, including Mystic Aquarium and the Marine Mammal Center in Sausalito, Calif. In addition, tissue samples are supplied by Natives in Barrow, Alaska, who are federally authorized to hunt a limited number of bowhead whales annually. The harvested tissues are maintained and reproduced through genetic manipulation at USM labs.

Cell lines from the bowhead whale population may hold clues of importance to human toxicological research, Wise notes.

USM's National Marine Cell Line Library is supported in part by grants from the National Oceanic and Atmospheric Administration, and the National Institutes of Health.

## 3,317 and Counting

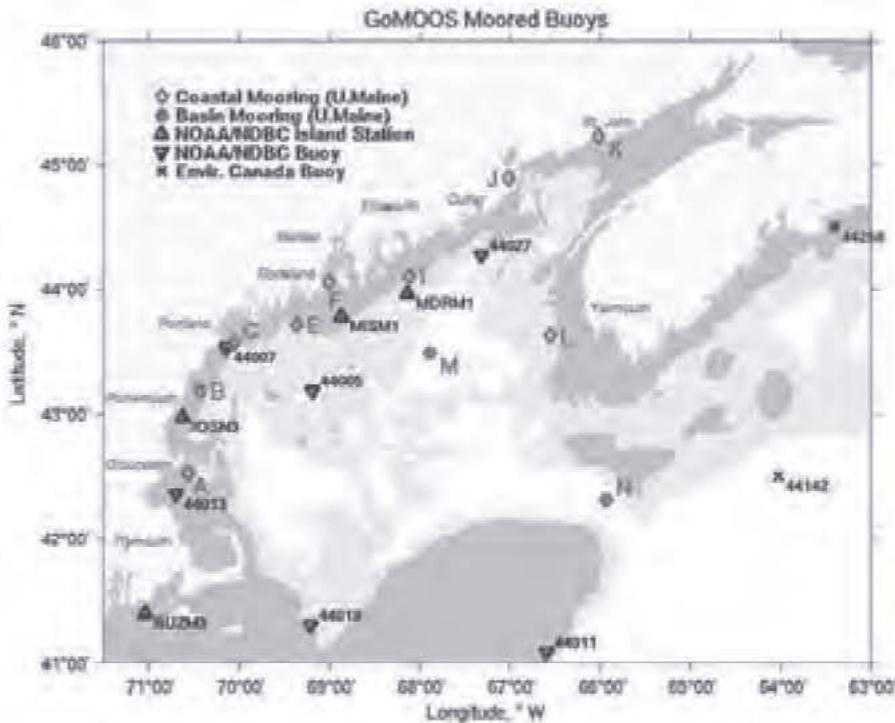
Lew Incze, USM senior research scientist and aquatic systems group director, Nick Wolff, aquatic systems group research associate, and their colleagues have received international recognition for their USM-based Gulf of Maine Census of Marine Life. In the group's first count of known marine species, 3,317 were identified—over 50 percent more species than previous estimates. The team's findings could prove a vital tool for better management of the Gulf of Maine ecosystem.

The collaborative project is one of just seven that are part of the international Census of Marine Life, and the only ecosystem-based field project.

Scientists have produced a searchable register for the Gulf of Maine and neighboring waters. It is expected to provide a baseline for scientists to monitor future losses or introductions of species resulting from climate change or other influences.

Incze, a chief scientist for USM's Bioscience Research Institute, is funded in part by MEIF.





## The Gulf of Maine Ocean Observing System Mobile Interface

The Computer Science Department at USM recently became engaged in collaborative projects with the Gulf of Maine Ocean Observing System (GoMOOS), a national, nonprofit pilot program designed to bring hourly oceanographic data from the Gulf of Maine to fishermen, scientists, environmentalists and other interested groups.

In addition to buoy information, such as wave height and period, water temperature and a host of other data, the GoMOOS Web site presents data about a number of special projects, including fisheries information and ocean circulation forecasts.

While GoMOOS provides data to all desktop computer users via the Internet, it had not yet provided an interface for users of handheld devices. Interested in broadening their capability, staff from GoMOOS and USM designed a project to create a mobile data interface that would be optimized for viewing on personal digital assistants (PDAs) and "smart" mobile phones, as well as broad-based functional computing systems.

The project faced numerous constraints and design challenges to bring a platform-independent mobile interface to all users, including those in the Gulf of Maine.

Graduate student Joe Duchesneau, working with his adviser, professor Bruce MacLeod, systematically overcame the numerous challenges of adapting a high-end desktop application to a device that has a fraction of the computing power of its desktop counterpart.

After a series of iterations and pilot testing, the results were compiled in a master's project, "Providing a Mobile Interface to a Desktop Oriented Web site."

Philip Bogden, director of GoMOOS, feels confident that a production version will soon be ready for distribution.



## 2006 BIOTECHNOLOGY

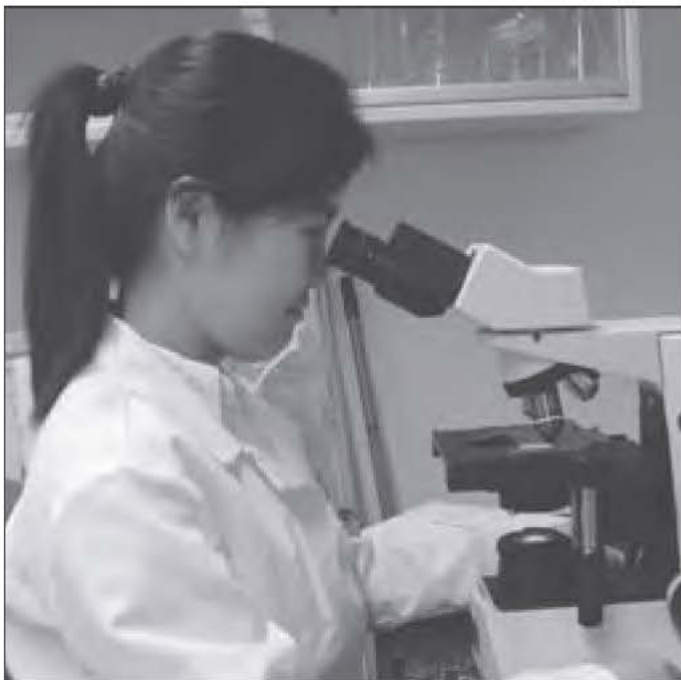
## Lab Gains National Recognition Discussing Effects of Chromium on Human Health

At a time when Maine suffers from substantial public health issues related to exposure to environmental contaminants, a University of Southern Maine lab is generating attention in national scientific circles for its research on chromium and its effects on humans.

John Wise, USM associate professor of biosciences and applied medical sciences, is principal investigator for the Wise Environmental and Genetic Toxicology Laboratory. Wise, a Maine native, left a position as a founder and director of Yale's Laboratory of Environmental and Genetic Toxicology to establish a similar lab in USM's Bioscience Research Wing in Portland. The research center itself was made possible through MEIF funding.

Much of the research has focused on hexavalent chromium (Cr(VI)), which is known to cause lung cancer in humans. Lung cancer exhibits chromosome instability, which is characterized by changes in both chromosome structure and number. Research at Wise's lab is the first to demonstrate that hexavalent chromium causes chromosome instability in human lung cells. Wise and his team now are investigating how it causes these effects.

A graduate student is at work on a confocal microscope in Wise's lab at USM, part of the Maine Center for Toxicology and Environmental Health.



The research was reported in the April 2006 edition of the noted journal, *Cancer Research*. This work, which also provides hands-on experience for graduate students, is supported by the National Institute of Environmental Health Sciences, the U.S. Environmental Protection Agency under the STAR Graduate Fellowship, and by USM's Maine Center for Toxicology and Environmental Health. The center contributes to national and statewide efforts to study environmental contaminants and reduce their effects by promoting interactions among scientists, regulators and commercial enterprise working on environmental problems that may affect human health.

## USM Takes Biotech to Rural Maine High Schools

High school students in rural Maine are learning the latest in molecular biology research techniques through the Science Corps Program, a biology outreach initiative from the University of Southern Maine.

With grants from the National Science Foundation and the National Institutes of Health, USM professor of molecular biology Monroe Duboise and a team of graduate students not only are advancing genetic research on diseases, they also are enhancing science programs in rural high schools in Maine.

In addition to demonstrating cutting-edge science, the graduate students also serve as mentors to the high school students, with the goal of raising educational aspirations. Among topics investigated since the program's inception: DNA fingerprinting, Lyme disease and a diagnostic technique for identification of proteins.

The university and high school researchers are exploring such questions as how environmental conditions affect the population of a bacteriophage, a virus that infects bacteria and their host bacteria.

Students participating in this research project gain basic experience in hands-on research and research methods.

USM's recent acquisition of a transmission electron microscope—made possible in part through MEIF—provides an unusual opportunity for Science Corps graduate fellows and the high school students they work with to observe the morphology of the newly discovered bacteriophages.





USM undergraduate students Jasmin Rocray, left, and Steven MacWhinnie, right, research various stages of caterpillar development. Behind them is USM biological sciences professor David Champlin. MacWhinnie is one of the coauthors of an article on their research in *Science*, an international scientific journal.

### USM Research on the Identification of a New Growth Hormone Published in *Science*

*Science*, a widely respected, international scientific journal of the American Association for the Advancement of Science, published an article describing research done, in part, at USM on insect hormones. The hormones may help in our understanding of human and animal growth, and help battle agricultural pests, as well as insect-borne diseases.

The findings also are relevant in helping the medical community toward a better understanding of the role of hormones in normal development, stem cell research, cancer and other diseases.

The authors were USM Assistant Professor of Biological Sciences David Champlin; two of his students, Paul Allee and Steven MacWhinnie; and three colleagues from the University of Washington and Hiroasaki University in Japan. The research done at USM was funded by the National Science Foundation and the Bioscience Research Institute of Southern Maine. MEIF-funded student fellowships also were a key part of the project.

The researchers have identified a previously unknown starter hormone responsible for initiating metamorphosis in caterpillars. The hormone is regulated by nutritional cues in the caterpillar's food.

The USM researchers found that by manipulating what the caterpillar eats, they could create strange chimeras that were part caterpillar, part pupa. This will lead to a better understanding of how hormones control growth in animals, including humans. This also is related to stem cell research and regenerative medicine—how to coax cells to change their fates.

### USM Grad Student Wins EPA Fellowship

Laura Savery of Topsham was selected as an Environmental Protection Agency Science to Achieve Results (STAR) graduate fellow at the University of Southern Maine. She received this honor at an awards reception in Washington, D.C. The prestigious EPA STAR Graduate Fellowships are awarded to master's and Ph.D. students in environmental fields of study.

Savery's project examines the toxic interactions between chromium and arsenic, and their impacts on human lung cells.

## 2006 BIOTECHNOLOGY

## Researchers Study Health Effects of Nanoparticles

Applied medical science faculty members John Wise and Ah-Kau Ng, director and member, respectively, of the Maine Center for Toxicology and Environmental Health at USM, have launched a new research program to address issues of nanotoxicology.

Professors Wise and Ng are conducting research on nanoparticles. Their initial investigations focus on the toxic and carcinogenic potential of nanoparticles on human cells of lung tissues, considered to be prime targets of environmental toxicants. Wise's research is focused on how gold nanoparticles damage DNA and transform normal human lung cells into tumorigenic lung cells—those capable of causing tumors.

Nanotechnology is considered to be the next industrial revolution and to become a \$1 trillion industry within the next 10 years. The federal government is already investing \$1 billion in nanotechnology development.

Outcomes of the nanotoxicology research have twofold significance. The findings will help regulatory agencies like the EPA define safety guidelines for nanotechnology application. They also will provide useful information needed to create better nanoparticles that pose minimal or no health hazard to consumers.

## Tracking Public Health

The National Centers for Disease Control and Prevention (CDC) has launched a major initiative known as Environmental Public Health Tracking to assist states and municipalities in improving and integrating their systems of environmental and health information.

To provide scientific support to the states and cities in this effort, the CDC has recently funded a partnership led by Daniel Wartenberg of the University of Medicine and Dentistry of New Jersey (UMDNJ) and W. Douglas Thompson of the University of Southern Maine.

The goal of the UMDNJ/USM partnership is to assist state and city health departments in developing the infrastructure to collect environmentally relevant health outcome data, and to support them in assessing if the outcomes are associated with specific environmental hazards.

The UMDNJ/USM project researchers will review the major data monitoring systems run by state and city health departments to determine if collection of additional types of environmentally related data would increase the likelihood of detecting a problem if, indeed, one exists.

Researchers also will develop and refine the statistical methodology used to identify associations between environmental hazards and disease occurrence.

Finally, the researchers will work with state and city health departments in the Northeast to conduct epidemiologic studies between environmental hazards and disease occurrence.

The collaboration between Thompson and Wartenberg was facilitated by the Libra Foundation, which funded Wartenberg's 2005 sabbatical residency at USM. Their CDC-funded grant runs through 2010.



## New USM Research Computing Group Successful Nationally and Internationally

USM's best and brightest students with an interest in computers and research have joined forces with faculty and staff to form a new research computing group. The group has access to state-of-the-art computing equipment, technologies and methodologies. And they are making their mark in Maine and around the nation, providing services on campus and off.

Through hands-on learning and a multidisciplinary approach, these students are contributing to the economic development of Maine using research and science at USM and beyond. They assist faculty with research, develop software applications, solve computer problems and set up scientific equipment.

The group is directed by Glenn Wilson, associate research professor in USM's Department of Technology. In it are up to 25 undergraduate and graduate students from diverse academic disciplines who are supported through federal work-study, grants and departmental funds.

## Transmission Electron Microscope

A major addition to the University of Southern Maine's research infrastructure was recently made possible when Monroe Duboise, Ah-kau Ng and Glen Wilson received a National Science Foundation grant to acquire a transmission electron microscope (TEM).

The \$400,000 project, "Acquisition of Integrated Electron Microscopy, Tomography, and Computational Resources Supporting Interdisciplinary Collaboration in Research and Education at USM," is in the new research wing of the science building.

Professor Duboise serves as the principal investigator; Professors Ng and Wilson are co-investigators.

When completed, the facility will support a core transmission electron microscopy and scientific computing resources for USM, as well as the southern Maine research and science education communities.



Lab manager Karen Moulton shows off USM's new transmission electron microscope.

## 2006 PRECISION MANUFACTURING

## Product Development and Support

Familiar sights when driving near any highway construction project are large concrete structures called Jersey barriers, some of which weigh more than 6,000 pounds. A new product designed to lift the barriers into position is now under development by USM and UMaine faculty and staff.

UMaine's Advanced Manufacturing Center provided design and fabrication assistance; prototype testing was done at USM's Manufacturing Applications Center.

Both centers were designed to help Maine companies by providing support services to improve their manufacturing processes and to aid in the development of new products.

USM's Manufacturing Applications Center is testing the prototype of a new product designed to lift Jersey barriers into place.





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## LEGISLATIVE HISTORY OF STATE RESEARCH APPROPRIATION FOR OPERATIONS

The following is a summary of the actions of the 118th–122nd Maine Legislatures with regard to appropriating research funds to the University of Maine System for operations:

### **118th LEGISLATURE**

**March 26, 1997:** Governor signed into law the Economic Improvement Strategy (Chapter 24) that appropriated \$500,000 to UMS for research.

**April 1, 1998:** Governor signed into law the Economic Improvement Strategy (Chapter 643, Part LL, Section S-3) that appropriated \$4 million to UMS for research. These funds were allocated from the FY98 year-end state surplus for use in FY99.

### **119th LEGISLATURE**

**March 15, 1999:** Governor signed into law the Part I Current Services budget (Chapter 16) that appropriated \$4 million in 1999–2000 and 2000–01 to UMS on a “base budget” basis for research. This extends the one-time FY99 \$4 million research appropriation that was funded from the FY98 year-end state surplus.

**June 4, 1999:** Governor signed into law the Part II Supplemental Appropriation budget (Chapter 401) that appropriated an additional \$5.55 million in 1999–00 and an additional \$50,000 in 2000–01 to UMS on a “base budget” basis for research.

**April 25, 2000:** Governor signed into law the Part II Supplemental Appropriation budget (Chapter 731) that appropriated \$300,000 in 2000–01 to UMS on a “base budget” basis for the Maine Patent Program.

### **120th LEGISLATURE**

**June 21, 2001:** Governor signed into law the Part II Supplemental Appropriation budget (Chapter 439) that appropriated an additional \$2 million in 2002–03 to UMS on a “base budget” basis for research.

**March 25, 2002:** Governor signed into law a deappropriation (Chapter 559) that reduced the FY03 \$2 million Supplemental Appropriation by \$1 million.

**July 1, 2002:** Governor signed a Financial Order that curtailed the FY03 \$2 million Supplemental Appropriation by an additional \$1 million. This eliminated the FY03 increase of \$2 million for research, bringing the FY03 research and development appropriation back to the FY02 level of \$10.1 million.

**November 18, 2002:** Governor signed into law a Supplemental Appropriation budget (Chapter 714) that deappropriated the \$1 million curtailment that was signed July 1, 2002.

### **121st LEGISLATURE**

**March 27, 2003:** Governor signed into law the Part I Current Services budget (Chapter 20, Part RR) that appropriated \$100,000 in 2003–04 and 2004–05 on a “base budget” basis for research.

**January 30, 2004:** Governor signed into law a Supplemental Appropriation budget (Chapter 513, Part P, Sec. P-2) that includes a provision to transfer to MEIF up to \$2 million of any unbudgeted state revenue remaining at the close of FY04. The full amount was subsequently transferred to UMS. This same Chapter 513, Part P, Sec. P-3 made the \$2 million part of the MEIF FY05 base appropriation.

### **122nd LEGISLATURE**

**March 29, 2006:** Governor signed into law a Supplemental Appropriations budget (Chapter 519, Part A, Sec. A-1) that includes providing one-time funding of \$600,000 in FY07 for the commercialization of research and development activity, and for the Gulf of Maine Ocean Observing System.



## LEGISLATIVE HISTORY OF STATE RESEARCH APPROPRIATION FOR OPERATIONS

## NEW APPROPRIATION

## 118th LEGISLATURE

	FY98	FY99	Total 2-Year
UMaine	\$400,000	\$3,200,000	\$3,600,000
USM	100,000	800,000	900,000
Total	\$500,000	\$4,000,000	\$4,500,000

## 119th LEGISLATURE

	FY00	FY01	Total 2-Year
UMaine	\$4,440,000	\$40,000	\$4,480,000
USM	1,110,000	10,000	1,120,000
Total	\$5,550,000	\$50,000	\$5,600,000

## 120th LEGISLATURE

	FY02	FY03	Total 2-Year
UMaine	\$0	\$0	\$0
USM	0	0	0
Total	\$0	\$0	\$0

## 121st LEGISLATURE

	FY04	FY05	Total 2-Year
UMaine	\$80,000	\$1,600,000	\$1,680,000
USM	20,000	400,000	420,000
Total	\$100,000	\$2,000,000	\$2,100,000

## 122nd LEGISLATURE

	FY06	FY07	Total 2-Year
UMaine	\$0	\$540,000	\$540,000
USM	0	60,000	60,000
Total	\$0	\$600,000*	\$600,000

\*One time funding

Total Yearly Research Appropriation for FY06

	FY2006 Appropriation
UMaine	\$9,760,000
USM	2,440,000
Total	\$12,200,000

## UMS STATE-FUNDED RESEARCH

**November 3, 1998:** Maine voters approved a \$20 million bond issue to improve the Maine economy by supporting innovative research and development. UMS received \$13.5 million from this bond for capital improvements and equipment purchases to support research and development. The bond proceeds were distributed between UMaine (\$10.8 million) and USM (\$2.7 million).

**June 4, 1999:** Governor signed into law the Part II Supplemental Appropriation budget (Chapter 401) that appropriated \$2.5 million in 2000–01 to UMS on a “base budget” basis to pay the debt service on a \$25 million university R&D revenue bond. The university issued the revenue bond August 15, 2000. It provides \$20 million for the UMaine Engineering Science Research Building and \$5 million for the USM Portland Science Building Lab Renovation.

**April 25, 2000:** Governor signed into law a one-time supplemental appropriation (Chapter 731) that appropriated \$9 million for the renovation of teaching laboratories and classrooms in Aubert Hall at UMaine.

**June 11, 2002:** Maine voters approved a \$35 million bond issue to be used in part to stimulate job growth. UMS received \$9 million, with the bond proceeds distributed to UMaine (\$5 million) for the Advanced Manufacturing Center and to USM (\$4 million) for the Mitchell Center.

**June 10, 2003:** Maine voters approved a \$60 million bond issue to be used to stimulate job creation and economic growth. UMaine and USM received a combined \$15 million to support their research efforts, \$3.6 million of which was matching funds for MEIF R&D projects.

**November 8, 2005:** Maine voters approved a \$20 million bond issue to be used to stimulate economic growth and job creation. UMaine received \$3 million for the development of the Laboratory for Surface Science and Technology and renovations associated with the Graduate School of Biomedical Sciences. Maine voters also approved an \$8.9 million bond related to agriculture and the environment. UMaine received \$800,000 for improvements to the Witter Teaching and Research Farm.

### FY2006 SUMMARY OF STATE FUNDING FOR RESEARCH CAPITAL PROJECTS UMAINE/USM COMBINED

	Referendum Bond Portion	Other Funds	Total Project Budget	Expenditures to Date
<b>FY99 State Bond Issue (approved by voters 11/3/1998)</b>				
UMaine	\$10,800,000	\$1,168,622	\$11,968,622	\$11,901,232
USM	2,700,000	155,100	2,855,100	2,855,100
<b>TOTAL</b>	<b>\$13,500,000</b>	<b>\$1,323,722</b>	<b>\$14,823,722</b>	<b>\$14,756,332</b>
<b>FY01 University R&amp;D Revenue Bonds (Debt Service Paid by \$2,500,000 State Appropriation Issued 8/15/2000)</b>				
UMaine	\$20,000,000	\$1,203,296	\$21,203,296	\$20,961,569
USM	5,000,000	4,238,073	9,238,073	9,205,819
<b>TOTAL</b>	<b>\$25,000,000</b>	<b>\$5,441,369</b>	<b>\$30,441,369</b>	<b>\$30,167,388</b>
<b>FY01 One-Time State Appropriation (signed by Governor 4/25/2000)</b>				
UMaine	\$9,000,000	\$3,441,899	\$12,441,899	\$11,968,063
<b>FY02 State Bond Issue (approved by voters 6/11/2002)</b>				
UMaine	\$5,000,000	\$0	\$5,000,000	\$4,502,463
USM	4,000,000	32,529	4,032,529	4,032,529
<b>TOTAL</b>	<b>\$9,000,000</b>	<b>\$32,529</b>	<b>\$9,032,529</b>	<b>\$8,534,992</b>
<b>FY03 State Bond Issue (approved by voters 6/10/2003)</b>				
UMaine	\$7,000,000	\$558,058	\$7,558,058	\$7,103,394
USM	4,400,000	0	4,400,000	4,082,523
<b>TOTAL</b>	<b>\$11,400,000</b>	<b>\$558,058</b>	<b>\$11,958,058</b>	<b>\$11,185,917</b>
<b>FY05 State Bond Issue (approved by voters 11/08/2005)</b>				
UMaine	\$3,800,000	\$0	\$3,800,000	\$3,889



# APPENDIX C

## UNIVERSITY OF MAINE SYSTEM UTILIZATION OF FY2006 OPERATING RESEARCH APPROPRIATION

### UMAINE

Total Research Area	Source of R&D Funds			Utilization of R&D Funds				Unused Funds Carried Forward To FY07 <sup>1</sup>	New Grants & Contract Generated <sup>2</sup>	Total FTE Positions Supported By All R&D Funds <sup>3</sup>
	FY06 R&D Base Budget	Unused R&D Funds from Prior Years	FY06 Total R&D Funds Available	FY06 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts	Total R&D Funds Utilized			
Adv. Technology, Forestry & Agriculture	\$1,650,000	\$1,078,729	\$2,728,729	\$2,402,629	\$9,000	\$0	\$2,411,629	\$317,100	\$6,504,108	168.9
Aquaculture & Marine Science	1,450,000	211,879	1,661,879	1,598,998	509,491	0	2,108,489	(446,610)	8,541,866	77.3
Biotechnology	700,000	356,855	1,056,855	916,003	682,526	(700,000)	898,529	158,326	5,024,248	61.1
Composites	1,775,000	73,052	1,848,052	691,363	71,817	700,000	1,463,180	384,872	5,758,453	78.1
Environmental	887,000	189,858	1,076,858	933,175	85,139	0	1,018,314	58,544	4,892,128	67.4
Information Technology	1,421,000	150,199	1,571,199	2,243,830	158,472	0	2,402,302	(831,103)	3,317,672	136.4
Precision Manufacturing	1,717,000	295,221	2,012,221	1,640,478	7,829	0	1,648,307	363,914	4,810,241	37.4
Unassigned Reallocated by System	160,000	0	160,000	58,622 <sup>5</sup>	0	0	58,622	101,378	0	0.0
<b>Total State Funding</b>	<b>\$9,760,000</b>	<b>\$2,355,793</b>	<b>\$12,115,793</b>	<b>\$10,485,098</b>	<b>\$1,524,274</b>	<b>\$0</b>	<b>\$12,009,372</b>	<b>\$106,421</b>	<b>\$38,848,716</b>	<b>626.6</b>
UMaine Cost Sharing Funding <sup>6</sup>	\$1,637,807	\$0	\$1,637,807	\$0	\$0	\$0	\$203,606	\$1,434,201	\$0	0.0
<b>TOTAL FUNDING</b>	<b>\$11,397,807</b>	<b>\$2,355,793</b>	<b>\$13,753,600</b>	<b>\$10,485,098</b>	<b>\$1,524,274</b>	<b>\$0</b>	<b>\$12,212,978</b>	<b>\$1,540,622</b>	<b>\$38,848,716</b>	<b>626.6</b>
2003 Jobs for Economic Growth Bond <sup>4</sup> MEIF Matching Funds	\$0	\$1,827,421	\$1,827,421	\$0	\$473,000	\$0	\$473,000	\$1,354,421	\$0 <sup>7</sup>	0.0

<sup>1</sup>Include year end equipment carry over funds (equipment ordered, not received and not paid).

<sup>2</sup>Dollar value of new grants and contracts that resulted from FY06 state R&D funds.

<sup>3</sup>One FTE position is equivalent to one full time employee working an entire year on R&D projects.

<sup>4</sup>Original amount was \$2.88 million. Job creation and economic growth bond.

<sup>5</sup>MEIF R&D evaluation.

<sup>6</sup>Salary and benefits from university.

<sup>7</sup>Included in grants and contracts generated figures shown above.

### USM

Total Research Area	Source of R&D Funds			Utilization of R&D Funds				Unused Funds Carried Forward To FY07 <sup>1</sup>	New Grants & Contract Generated <sup>2</sup>	Total FTE Positions Supported By All R&D Funds <sup>3</sup>
	FY06 R&D Base Budget	Unused R&D Funds from Prior Years	FY06 Total R&D Funds Available	FY06 R&D Actual Expenditures	Transferred To Match Grants & Contracts <sup>5</sup>	Transferred Between R&D Accounts	Total R&D Funds Utilized			
Aquatic Systems Group	\$40,578	\$620	\$41,198	\$26,611	\$0	\$0	\$26,611	\$14,587	\$572,460	6.0
Information Science Institute A	124,783	(16)	124,767	121,786	0	0	121,786	2,981	29,172	1.3
Research Development	423,713	79,103	502,816	370,632	0	0	370,632	132,184	0	12.0
Bioscience Institute	665,828	43,341	709,169	492,741	0	0	492,741	216,428	2,205,377	36.0
Operations (plant, facilities, lease)	230,000	0	230,000	480,788	0	0	480,788	(250,788)	0	0.0
Opportunity Programs	41,000	12,612	53,612	4,287	0	0	4,287	49,325	0	0.0
Undergraduate Research	104,128	(5,740)	98,388	64,722	0	0	64,722	33,666	603,848	4.0
Library	95,000	17,150	112,150	95,042	0	0	95,042	17,108	0	0.0
Animal Facility	125,395	(3,538)	121,857	124,794	0	0	124,794	(2,937)	0	3.0
Wise Lab Personnel	367,581	(14,171)	353,410	383,069	0	0	383,069	(29,659)	0	14.5
Research Computing Group	181,994	33,029	215,023	240,602	0	0	240,602	(25,579)	464,032	13.5
GMRI Laboratory Fit Out	0	40,194	40,194	72,887	0	0	72,887	(32,693)	0	0.0
Unassigned Reallocated by System	40,000	0	40,000	14,656 <sup>5</sup>	0	0	14,656	25,344	0	0.0
<b>Total State Funding</b>	<b>\$2,440,000</b>	<b>\$202,584</b>	<b>\$2,642,584</b>	<b>\$2,492,617</b>	<b>\$0</b>	<b>\$0</b>	<b>\$2,492,617</b>	<b>\$149,967</b>	<b>\$3,874,889</b>	<b>90.3</b>
2003 Jobs for Economic Growth Bond <sup>4</sup> MEIF Matching Funds	\$0	\$218,532	\$218,532	\$0	\$218,532	\$0	\$218,532	\$0	\$0	0.0

<sup>1</sup>Include year end equipment carry over funds (equipment ordered, not received and not paid).

<sup>2</sup>Dollar value of new grants and contracts that resulted from FY06 state R&D funds.

<sup>3</sup>One FTE position is equivalent to one full time employee working an entire year on R&D projects.

<sup>4</sup>Original amount was \$720,000. Job creation and economic growth bond.

<sup>5</sup>MEIF R&D evaluation.

<sup>6</sup>FY06 expenditures includes transfers to match grants and contracts.

UNIVERSITY OF MAINE SYSTEM  
**SUMMARY OF UTILIZATION OF FY06 OPERATING RESEARCH APPROPRIATION**

**UMAINE/USM COMBINED**

	Source of R&D Funds			Utilization of R&D Funds			Total R&D Funds Utilized	Unused Funds Carried Forward To FY07 <sup>1</sup>	New Grants & Contract Generated <sup>2</sup>	Total FTE Positions Supported By All R&D Funds <sup>3</sup>
	FY06 R&D Base Budget	Unused R&D Funds from Prior Years	FY06 Total R&D Funds Available	FY06 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts				
UMaine	\$9,760,000	\$2,355,793	\$12,115,793	\$10,485,098	\$1,524,274	\$0	\$12,009,372	\$106,421	\$38,848,716	626.6
USM	2,440,000	202,584	2,642,584	2,492,617	0	0	2,492,617	149,967	3,874,889	90.3
<b>Total State Funding</b>	<b>\$12,200,000</b>	<b>\$2,558,377</b>	<b>\$14,758,377</b>	<b>\$12,977,715</b>	<b>\$1,524,274</b>	<b>\$0</b>	<b>\$14,501,989</b>	<b>\$256,388</b>	<b>\$42,723,605</b>	<b>716.9</b>

<sup>1</sup> Include year end equipment carry over funds (equipment ordered, not received and not paid).

<sup>2</sup> Dollar value of new grants and contracts that resulted from FY06 state R&D funds.

<sup>3</sup> One FTE position is equivalent to one full time employee working an entire year on R&D projects.





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