12-31-2007

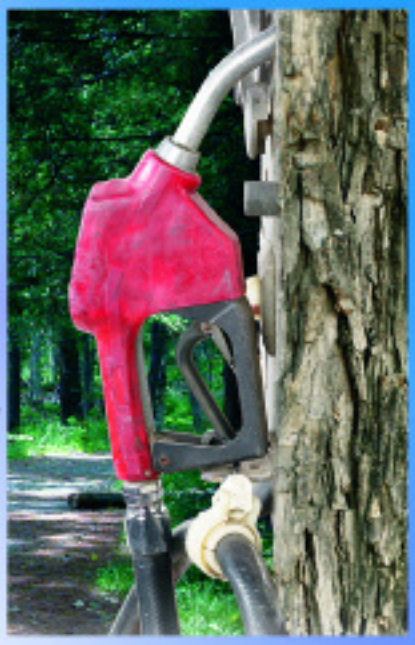
Maine Economic Improvement Fund Annual Report, FY2007

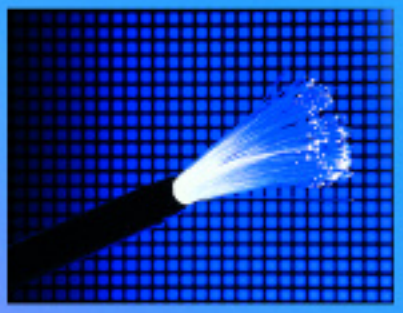
University of Maine System

Building Maine's Economy Through Research, Development & Jobs

10 years of the Maine Economic Improvement Fund

Information Technologies • Precision Manufacturing • Biotechnology • Composites • Aquaculture & Marine Science • Environmental Technologies • Advanced Technologies for Forestry & Agriculture





Maine's Public Universities

UNIVERSITY OF MAINE SYSTEM

Annual Report 2007

Maine's Public Universities

UNIVERSITY OF MAINE SYSTEM

STATE-FUNDED RESEARCH ANNUAL REPORT

DECEMBER 2007

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* The narratives provided demonstrate the breadth and diversity of research conducted at UMaine and USM in FY07. 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.

Maine's Public Universities
UNIVERSITY OF MAINE SYSTEM

STATE-FUNDED RESEARCH ANNUAL REPORT

December 2007

The year 2007 marked the tenth anniversary of the Maine Economic Improvement Fund (MEIF). Established in 1997 by the Maine Legislature, MEIF is Maine's R&D investment fund. Funded through an annual state appropriation, it provides the necessary capital to leverage federal and private-sector research grants and contracts, which in turn create and sustain job growth and economic development.

MEIF is widely recognized as one of Maine's most successful public investment initiatives. According to the State Science and Technology Institute, a national nonprofit organization that assists and monitors technology-based economic development efforts, Maine experienced the nation's largest percentage growth in academic-based federal R&D funding over the past 15 years: 547%. The increase, from about $9 million to approximately $58 million, is almost totally attributable to the availability of MEIF funds and helped turn ideas and innovation into federal grants.

As stipulated in Maine law, the University of Maine System operates MEIF as a vehicle to support university-based research in seven designated strategic research areas:

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

The University System allocates MEIF funds to support two universities—the University of Maine (UMaine) and the University of Southern Maine (USM)—with graduate programs in some or all of those seven targeted research areas. UMaine and USM use MEIF funds to support the personnel and facilities they need to successfully pursue research projects. In some instances, the funds provide required matching funds; in other instances, the funds are used to purchase equipment or renovate facilities to make the universities eligible or competitive for federal or private-sector funding.

Though both universities are engaged in MEIF-related research, their roles as research universities differ:

- UMaine uses MEIF funding to expand its longstanding role as Maine's designated research university. UMaine is heavily involved in basic and applied research, with a wide array of research facilities and resources on its Orono campus, as well as at off-campus research sites located throughout the state. UMaine's extensive research infrastructure, accumulated over many decades, has enabled it to successfully pursue federal and private grants and contracts.

- USM primarily uses MEIF funds to help build an infrastructure sufficient to compete successfully for research grants and contracts. Though it has several areas of distinction, USM's role as a research institution is relatively young and has not developed the assortment of research facilities that has been developed over decades at UMaine. Through MEIF, the University System is attempting to enhance USM's research capacity to better serve the needs and opportunities of southern Maine. For that reason, MEIF allocations to USM have been focused on improving and expanding its research infrastructure.

It is important to note that all seven of Maine's public universities—not just UMaine and USM—are involved in research. All of those universities feature faculty, students and staff engaged in activities related to research, economic growth and matters pertaining to Maine's quality of life. This document focuses specifically on MEIF-funded research taking place at UMaine and USM. Other University System reports, notably its annual report on sponsored research, address the much broader scholarly activity taking place each year across all seven institutions of the University of Maine System.

INTRODUCTION

MEIF and 2007

— **SUCCESS:** By leveraging MEIF funds, UMaine and USM have attracted a combined $46.4 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 $10.1 million in MEIF funds to attract $42.2 million in federal and private-sector research funds. USM continued to build its research capacity, using $3 million in MEIF funds to leverage an additional $4.2 million in federal and private-sector grants and contracts.

— **STRATEGIC IMPACT:** In 2007, $59.5 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 2007, 600 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 Used	$10,134,438	$3,005,996	$13,140,434
Grants & Contracts Received	42,185,379	4,187,757	46,373,136
Total Funds	**$52,319,817**	**$7,193,753**	**$59,513,570**

2007 UNIVERSITY OF MAINE *HIGHLIGHTS*

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

Total new dollars available for R&D expenditures were more than $64.5 million in FY07. UMaine used $10.1 million of its $10.3 million in MEIF funds to leverage more than $42.1 million in external grants and contracts in the state's seven targeted sectors (see table below).

TABLE 2

MEIF-Leveraged New FY07 External R&D Grants and Contracts in the Seven Sectors

State Technology Sectors	Amount
Forestry and Agriculture	$10,785,559
Aquaculture & Marine	8,342,107
Biotechnology	3,128,218
Composite Materials	6,179,841
Environmental Technologies	7,472,495
Information Technologies	3,170,619
Precision Manufacturing	1,432,078
Cross Sectors	1,674,462
Total Leveraged in Grants/Contracts/Gifts	**$42,185,379**

The increase in R&D infrastructure and activity has enhanced UMaine's capacity to spur industrial growth, with industry contracts for FY06, totaling $3.5 million.

UMaine submitted a total of 535 proposals during FY07, involving 362 faculty and professional staff from 60 departments or units as principal or co-investigators. A total of $137.7 million was requested from external sponsors. In addition, UMaine faculty and staff produced more than 3,500 publications in FY07, including papers, books, book chapters and technical reports.

POSITIONS LEVERAGED

- In FY07, 500 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 the MEIF funds.

FACILITIES AND EQUIPMENT

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

- The University of Maine System, in partnership with the Jackson Laboratory, completed a large expansion to the Maine fiber-optic broadband Internet system. Among other connections, the system puts both the Orono campus and the Target Technology Incubator on the highest bandwidth capacity in the state. The UMaine supercomputing facility located in the Target Technology Center received nearly $2 million in new NSF funding to expand capacity, including adding visualization and extending research modeling capabilities. Additional NSF funding extends the supercomputing modeling to Maine middle school students through the laptop program.

- Renovations were completed on Camden Hall on the Bangor Campus of the University of Maine at Augusta. UMaine shares the building with UMA. The renovations, supported by a 2005 bond, support the University of Maine Graduate School of Biomedical Sciences and other allied health programs.

- More than $3 million in new equipment was procured to support UMaine R&D activity. Major purchases (greater than $50,000) through various FY07 grants included 20+ pieces of scientific equipment. This equipment outfits labs throughout the university.

INCREASED STUDENT INVOLVEMENT IN RESEARCH

UMAINE graduate and undergraduate students are critically important to UMaine's research efforts. More than $42.1 million from grants and contracts was used to support students in all sectors. Undergraduate students receive an hourly wage to work on research projects, while graduate students are paid stipends.

At Floods Pond in Otis, Maine, UMaine junior Ben Wasserman participates in research led by evolutionary biologist Michael Kinnison on Arctic charr living in a dozen freshwater bodies statewide. The fish are caught by net and brought on shore, where Wasserman takes measurements and digital photos to analyze their body shape. He also scans for passive integrated responder (PIT) tags, indicating previously caught charr, and inserts tags in new fish. The fish are then released. The mark-recapture techniques are used to estimate population size, which is important in managing rare species.

TECHNOLOGY TRANSFER AND COMMERCIALIZATION

UMAINE continues its technology transfer and commercialization program. The university's total patent portfolio now contains more than 80 patents, patent applications and international patents.

In FY07, UMaine filed nine new patent applications. Three new U.S. patents were issued and five were published by the U.S. Patent and Trademark Office (USPTO).

U.S. Applications issued in FY07

- U.S. 7,075,216 Lateral field excited acoustic wave sensor (precision manufacturing)
- U.S. 7,120,998 Fabrication of chopper for particle beam instrument (precision manufacturing)
- U.S. 7,141,137 Method of making laminated wood beams with varying lamination thickness throughout the thickness of the beam (advanced technologies for forestry and agriculture)

U.S. Patent Applications published by USPTO during FY07

- Rapidly deployable lightweight load-resisting arch system (Application #20060174549)
- Multifunctional reinforcement system for wood composite panels (Application #20060263618)
- Composite anti-tamper container with embedded devices (Application #20060285440)
- Thermoplastic composites containing lignocellulosic materials and methods of making the same (Application #20070066722)
- Process for treating a cellulose-lignin pulp (Application #20070131364)

New Patent Applications filed by UMaine during FY07

- Inflatable composite structural member infused with polymer
- Portable housing with folding capabilities
- Ballistic panels for protective armor
- Fire retardant treatment for wood fiber insulation products
- Collector modules for bio-aerosol particles
- Procedure to improve adhesive bonding between resin and wood plastics
- Monolithic spiral coil acoustic transduction sensor
- Ship-to-ship ramp for military tanks
- Method of producing carbon nanotubes using natural fiber as a starting substrate

■ Tech-based Start-up Companies

GreyMaple Software LLC

GreyMaple is a startup company that provides Web-based services for technology resellers to automate their supply chain and purchasing functions through aggregated supplier databases and XML communication. This project was developed at UMaine's Computer Connection store as it realized that the technologies it built to support its services would have commercial value to other technology resellers.

■ UMaine Student Start-ups

The first year of operation of the University of Maine Student Innovation Center (SIC) saw the realization of pent up demand for commercialization support for student entrepreneurs. The SIC features incubator-like space and programming designated for UMaine students and faculty who are serious about starting businesses. Participants benefit

Sea and Reef Aquaculture

Søren Hansen is a UMaine Ph.D. student specializing in captive raised marine ornamental fish for the retail market. UMaine is providing the lab space for the research and the Target Incubator is providing the business development assistance necessary to commercialize Sea and Reef Aquaculture.

from the business development and facility services offered at the SIC. These companies or projects have assigned space in the Student Innovation Center:

Farmers' Bio-Energy Group

Farmers' Bio-Energy Group was the winner of our National Science Foundation-funded "Bioproducts Commercialization Contest." It is in the beginning stages of exploring the development of an ethanol production facility in Aroostook County that would use cull potatoes. In the future, it would look at additional sources of agricultural waste for biofuel production.

New England Web Solutions

This company is developing new tools for online course delivery and digital media storage. It is piloting the program with selected UMaine faculty and is working on funding sources to facilitate scaling up the project. This group includes a computer science, business and new media student. Its funding includes grants from the Maine Technology Institute and the Libra Foundation Future Fund.

SymBio

This company has developed techniques for culturing a novel marine organism, *Elysia chlorotica,* in a laboratory setting. It plans on utilizing this development to sell the sea slugs in the marine ornamental aquaculture market. At the same time, it plans to develop an education based module to distribute to high school and college educational sites for integration into current curriculum in general biology, developmental biology, genetics and molecular biology.

Yo Bon LLC

A company that evolved from an award-winning University of Maine Food Science and Human Nutrition product development class, Yo Bon is embarking on the commercialization of "the health savvy indulgence"—a delicious pairing of luscious dark chocolate and creamy wild Maine blueberry yogurt in Yo Bon Blueberry Bites. While delivering a decadent, luxurious taste, Yo Bons also provide a powerful punch of antioxidants and calcium as well as probiotics and fiber. Three on-site production workers are employed on a temporary basis.

BUSINESS INCUBATION

The University of Maine is a partner in the operation of two of the state's Advanced Technology Development Centers or "business incubators." The Target Technology Incubator in Orono, one of seven such incubators among the statewide Advanced Technology Development Centers, provides both

physical space and business counseling services to technology companies. The center is beginning its sixth year.

In addition, the Maine Aquaculture Innovation Center operates aquaculture and marine science incubators at both the UMaine Center for Cooperative Aquaculture Research in Franklin, Maine, and at the UMaine Darling Marine Center in Walpole, Maine.

■ The Target Technology Incubator

The Target Technology Incubator currently has seven tenant companies with three new companies pending admission in the fall/winter 2007. Combined, tenant companies raised more than $3 million in investment capital and research grants this year.

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. This device, a component of mass spectrometers, will be sold to laboratory equipment manufacturers. Mass spectrometers are sold primarily in the biomedical and pharmaceutical industries, as well as environmental fields in which complex chemical mixtures must be accurately identified.

Knife Edge Productions

A digital video company founded by two UMaine graduates: Nathan Hankla and Sheridan Kelley, Knife Edge combines the latest video hardware and software with artistic talents and innovative visions.

Intelligent Spatial Technologies (IST)

IST is a University of Maine spin-off company formed to commercialize the technology developed by the NCGIA. IST has developed technology that provides users with information about their surroundings. By knowing where someone is and what direction he or she is facing, a handheld device instantly provides relevant information about nearby geographic objects.

Angel Secure Networks

Angel Secure Networks provides software and process engineering services for protecting very high-value data against the risk of compromise by trusted insiders as well as outside pirates. Its focus is national security. It also partners with UMaine's supercomputer program to further its development and commercialization activities. This year, the company relocated from Massachusetts to Maine.

Maine Secure Composites

Maine Secure Composites, affiliated with AEWC, researches and develops secure composite materials for use in homeland security and the U.S. military. Funded by the Department of Homeland Security, it is currently focusing on secure shipping containers with embedded sensors that will detect tampering.

Milcord ME

Milcord ME is developing geospatial solutions through government-funded advanced technology development programs based on research conducted through UMaine's Department of Spatial Information Science and Engineering.

versionZero

Nathan Hankla started versionZero, a new media development company, when he was a graduate student at the University of Maine. He now has clients in New York City and throughout Maine. He was recently hired to redesign the Web site for the Bangor Region Chamber of Commerce and has worked with UMaine departments and with the Forest Bioproducts Research Initiative to develop marketing and trade show materials.

■ New Tenants Moving in Fall/Winter 2007

Zeomatrix LLC

Current affiliate company Zeomatrix is a UMaine spin-off engaged in designing, testing and producing catalysts for environmental remediation of animal waste odor and decontamination of toxic chemical agents. It is commercializing UMaine patent-pending technology and will move into Target in January 2008.

Orono Spectral Solutions

OSS is a UMaine spin-off company commercializing patented and patent-pending liquid sensor technology developed in LASST. The company recently secured over $2 million in development funding and moved into the Target Center in fall 2007.

■ Tenants of Innovation Center Plus

The Target Technology Incubator offers the Student Innovation Center Plus, which features cubicle space and programming designed for recent UMaine and Student Innovation Center graduates who are in transition to full-time businesses.

RE Consulting—Provides consulting services to the forestry and forest product manufacturing industries to improve efficiencies and processes.

Ryan Beaumont—Offers engineering design automation solutions by developing custom add-ons and third-party applications for CAD, CAM, Finite Element and Computational Fluid Dynamics software.

■ Graduating Companies

This year, Target successfully "graduated" one company:

Strategic Dataworks Inc.—Finasys

Finasys is developing a Web-based law practice management solution for lawyers and law firms. Finasys is now located in Portland, Maine.

TARGET'S AFFILIATES PROGRAM

Target's Affiliates Program allows companies that are not tenants to benefit from many of the services and resources available at the center. Affiliates include existing technology companies, start-up companies, and university researchers who are commercializing new technologies.

Mainely Sensors (UMaine patents in Precision Manufacturing)

Christian Gagnon, Engineering (IT)

Com-Jet Papers (Advanced Technologies for Forestry and Agriculture)

Entwood (UMaine Patents in Composites)

One U.S. Brand (OUSB) (IT)

Spill Free Oil Drainage Products LLC (Precision Manufacturing)

Sea Vegetable Solutions (Aquaculture)

Sea & Reef Aquaculture (Aquaculture)

Grey Maple Software LLC (UMaine Software in IT)

THE CENTER FOR COOPERATIVE AQUACULTURE RESEARCH AT FRANKLIN

The Franklin Center provides space on site for start-up aquaculture businesses. FY07 has seen the beginning of significant incubator space expansion and fit-out through grants from the 2005 Maine Marine Research Fund. In addition, the Maine Aquaculture Innovation Center has expanded incubator resources at the Darling Marine Center in Walpole through grants from the Maine Marine Research Fund.

Aquaculture Business Incubation Clients in FY07:

BioEdge Fishing Products

Maine Halibut

Seabait Maine LLC

Sea Vegetable Solutions Inc.

Friendship International

Great Bay Aquaculture

ECONOMIC DEVELOPMENT PARTNERSHIPS

Moving R&D into Maine's Economy

UMAINE 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 Corporation, the Piscataquis Economic Development Corporation, the Millinocket Area Growth and Investment Council, the Town of Franklin, the City of Brewer, the Town of Greenville, and the City of Bangor. These projects also support business development, attraction and recruitment.

In addition, the University of Maine had R&D contracts with hundreds of companies throughout the state. UMaine often supports companies on their Maine Technology Institute-funded grants. UMaine researchers support the Maine Technology Institute by serving on its Board of Directors, and Technology Boards, and on proposal review committees.

The U.S. Department of Labor WIRED grant, which created the North Star Alliance for Boat Building, Composites and Marine Trades, continues to be a major project for the

economic development in the state. UMaine researchers lead the R&D pillar and supported the Southern Maine Community College's development of the Advanced Technology Center for composites recently opened in Brunswick, further demonstrating the need to integrate R&D and work force development.

Finally, collaborative work continues on the Corea, Maine aquaculture and marine business park at the former U.S. Navy base. UMaine assisted Acadia Capital Corporation to obtain over $700,000 in funding to install a seawater intake/discharge system for land-based aquaculture applications. Two companies are awaiting the completion of this system to begin construction of new production facilities.

THE UNIVERSITY OF MAINE FY07 HIGHLIGHTS

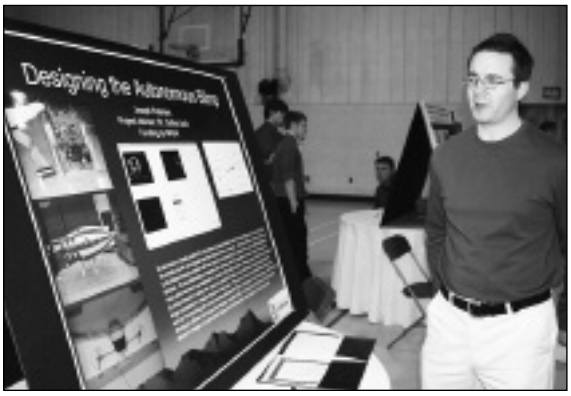
Total new R&D funding in FY07 was $64 million. Of that amount, MEIF funds accounted for $10.3 million, which was leveraged to bring in an additional $42 million in external grants in the seven target sectors.

- 535 proposals were submitted involving 362 researchers and 60 departments, with $137.7 million requested from external sponsors.
- More than 3,500 publications, papers and presentations were produced by faculty and staff.
- UMaine leveraged $10.3 million in MEIF funds to bring in $42 million in external grants and contracts, specifically for the seven technology sectors.
- Over 500 job positions were created and/or supported through external grants and contracts.
- Nearly $4 million from grants and contracts was used to support students' tuitions and salaries to work in all technology sectors.
- Over $3 million in major equipment was secured to outfit labs throughout the university.
- Nine new patent applications were filed and three new U.S. patents were issued.
- UMaine helped start or spin-off one new company based on UMaine-developed technologies and three new student start-up companies through the Student Innovation Center.
- The Target Technology Incubator housed seven tenants, supported nine 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 five companies moving toward full-scale commercialization.

2007 UNIVERSITY OF SOUTHERN MAINE *HIGHLIGHTS*

THE UNIVERSITY OF SOUTHERN MAINE invested $3.0 million in state funding to leverage $4.2 million in federal and private-sector funding for MEIF-related contracts.

Overall grants and contract activity at USM continued at a significant pace in FY07, with total grant awards at $45 million. Development activity in the MEIF areas for targeted technologies remains strong, with proposal submissions of just under $20 million and new federal awards of $3 million.



Joseph Petersen, engineering, discusses the use of two cameras used in a 3D vision system as part of his design for an autonomous blimp.

POSITIONS LEVERAGED

In FY06, MEIF dollars and the R&D grants and contracts those funds generated supported a total of 90 full-time equivalency positions comprising faculty, technical staff and students. An increasing number of undergraduate students have joined the pool of graduate students who participate in laboratory and field-based scientific research and development at USM.

The University of Southern Maine has joined the Council for Undergraduate Research (CUR), the leading national organization dedicated to building undergraduate research programs in higher education. Undergraduate research programs have proven to recruit and retain top-quality students and faculty, and are an integral part of USM's R&D strategy.

FACILITIES AND EQUIPMENT

In 2007, USM completed a new laboratory for the Maine Center for Toxicology and Environmental Health with leveraged federal dollars from the U.S. Department of Energy. Situated in the bioscience wing on USM's Portland campus, the $1.5 million construction project expanded laboratory space and provided specialized equipment for toxicology research. With its new lab, the Maine Center for Toxicology and Environmental Health has brought in 30-40 staff and students on funded projects, and has initiated a new partnership with Ocean Alliance, a leading organization studying the effects of pollution in the world's oceans on whales and the potential harm to human health.

Thanks to MEIF funds and the coordinated efforts of UMS librarians, researchers at USM gained a powerful new tool in 2007 with the acquisition of ScienceDirect, a searchable database that provides access to thousands of top scientific articles and journals. The availability of this important resource allows USM scientists to compete more effectively with other institutions nationally in research efforts and scholarly publication.

INCREASED STUDENT INVOLVEMENT IN RESEARCH

Student Symposium: Thinking Matters

The University of Southern Maine's annual Thinking Matters symposium, a public forum for local students to share their research and creativity, was once again a huge success, giving more than 200 students from USM and Southern Maine Community College the chance to present research on topics ranging from cloned food and the future of the European Union to effective mass transit systems and heavy metals-based pollution on Mount Everest.

The event also featured a keynote panel discussing "The Brookings Institute Report: Charting Maine's Future." The panel was moderated by Judith Spross, associate professor of USM's College of Nursing and Health Professions and chair of USM's Research Council. Panelists included Andrew Bossie, 2006-07 USM Student Senate president; Alan Caron, president and founder of GrowSmart Maine; and Charles Colgan, professor of public policy and management in USM's Muskie School of Public Service.

Other panels and student-based presentations included "The Relationship Between Foster Care and Adult Homelessness" and "Diabetes and Heart Disease: Self-Management for Better Health."

ScienceCorps at Five

The ScienceCorps Program is a unique collaboration among USM faculty, graduate students and Maine high school science teachers and their students. With support of graduate fellowships through a grant from the National Science Foundation's Graduate Teaching Fellows in

K-12 Education program, graduate students from USM's Department of Applied Medical Sciences and the Department of Biological Sciences visit rural high schools to bring state-of-the-art scientific tools to the schools and to engage students directly in the process of scientific research.

Classroom activities are built around research issues that are sufficiently broad, including environmental, ecological, molecular biological and health-related dimensions. For example, model aquatic habitats have been used at several high schools as a year-long framework for research studies conducted by students. Students investigate ecological concepts, responses of systems to pollutants, biodiversity and changes in microbial communities, including model habitats created in the classroom laboratory that are subject to experimental manipulation and longterm study.

Graduate student fellows contribute their expertise in genomic analysis and, together with faculty advisers, provide access to university resources, such as transmission electron microscopy. In addition to school visits, the graduate fellows interact with high school students through Web-based interfaces and e-mail. Each summer, the participating high school science teachers join USM faculty and graduate fellows for an intensive workshop to build teacher-fellow teams and to develop content and methods for the coming year.

TECHNOLOGY TRANSFER AND COMMERCIALIZATION

USM and Maine Medical Center entered into a licensing agreement with a Maine-based company for production of a monoclonal antibody that may serve a valuable role in diagnosing human diseases such as cancer. This licensing agreement is the first for USM as a direct result of MEIF investment, and has stimulated ongoing interest in technology transfer of laboratory-based discoveries.

THE UNIVERSITY OF SOUTHERN MAINE FY07 HIGHLIGHTS

USM R&D activity marked significant milestones in FY07:

- USM invested $3.0 million in state funding to leverage $4.2 million in federal and private-sector funding from R&D grants and contracts that comprised 50 projects.
- Overall grant and contract activity at USM continued at a significant pace in FY07, with 167 awards totaling $45 million.
- Development activity in the MEIF areas for targeted technologies included 59 new proposal submissions of just under $20 million and new federal awards of $3 million.
- USM had its most successful year competing in National EPSCoR (Experimental Program to Stimulate Competitive Research) programs, winning several new R&D awards from NASA and the Department of Defense.
- MEIF dollars and the associated R&D grants and contracts supported a total of 90 full-time positions, comprising faculty, technical staff and students.
- With MEIF-leveraged funds awarded from the U.S. Department of Energy, USM completed construction and equipment fit-out for a new laboratory for the Maine Center for Toxicology and Environmental Health on the Portland campus, building USM's research capacity in the target area of environmental technologies.
- In partnership with Maine Medical Center, USM entered into a licensing agreement with a Maine-based company for production of a monoclonal antibody that may serve a valuable role in diagnosing human diseases such as cancer.

2007 AQUACULTURE AND MARINE SCIENCES

■ Assessing Aquatic Animal Health

A more than $396,000 grant from the state's Marine Research Fund will be used to purchase equipment to facilitate applied research in marine animal health assessments and investigations at the university's new Maine Aquatic Animal Health Laboratory (MAAHL).

Several instruments will enable MAAHL to serve as a magnet research facility for marine researchers. For example, a Biolog Microbial Identification System will allow for database building and consistent identification of microbial assemblages of marine aquatic animals. The system will be key to lobster and mollusk diagnostics and health assessments. The database can be shared with private and government aquatic animal diagnostic laboratories.

The Marine Research Fund grant also facilitates the establishment of the state's first, state-of-the-art marine samples repository, featuring high-capacity minus -80 degree C freezers and a computerized laboratory information management system. The repository will facilitate comparative studies over time and provide historically supported scientific data critical for informed ecosystem management.

With a fully equipped lab in place, MAAHL personnel will be better able to support marine animal health research, and foster entrepreneurial activity and technology transfer.

MAAHL is a collaborative service of UMaine's Department of Animal and Veterinary Sciences, Cooperative Extension and the Lobster Institute.

■ Indoor Urchins

At the University of Maine's Center for Cooperative Aquaculture Research (CCAR) in Franklin, UMaine researchers hope to develop efficient and reliable techniques for raising juvenile urchins. Hatchery-raised urchins could one day be used to reseed the Maine coast, where overharvesting in the late '80s and early '90s led to the collapse of the urchin fishery.

UMaine graduate student Nicole Kirchhoff's work first focused on urchins' reproductive biology. By manipulating the length of day and the temperature in the lab, she was able to change urchins' seasonal spawning cycle, causing them to produce viable eggs and sperm year-round.

UMaine graduate student Nicole Kirchhoff's work has put CCAR at the forefront of green sea urchin aquaculture research in the U.S.

Another part of her work looked at urchins' rate of growth under varied environmental conditions. Captured and caged in mesh tubes beneath the waves of Penobscot Bay, a population of more than 5,000 urchins was carefully measured and monitored for six months. Data collected on the juveniles will help to determine optimal bottom type, currents, temperatures, and other factors that could influence the success of green urchin aquaculture and reseeding programs.

Kirchhoff is now applying what she learned from her initial research to develop a better understanding of urchins' breeding biology and to determine the optimal conditions for successful rearing of juveniles.

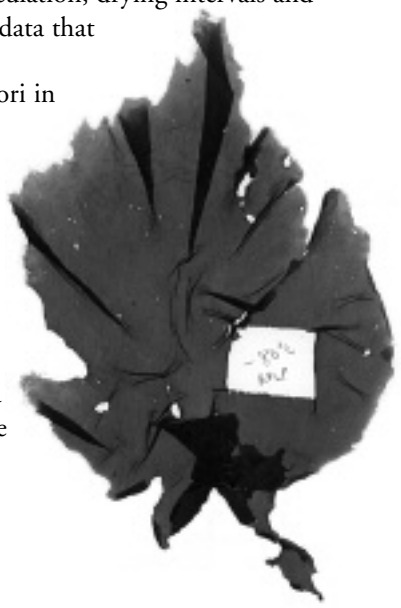
■ Nurturing Nori

Research taking place at Schoodic Point in Acadia National Park is focused on the reproductive biology of the red alga known as nori.

Doctoral student Nic Blouin, along with UMaine marine sciences professor Susan Brawley, is taking a multifaceted approach to studying nori, combining cutting-edge laboratory research with hands-on field trials.

By managing temperature, circulation, drying intervals and nutrient inputs, Blouin gathered data that could provide the foundation for large-scale cultivation of native nori in Maine waters.

Blouin and Brawley see tremendous potential in expanding sea vegetable aquaculture in North America. The two have made presentations at conferences and forums and helped to organize the highly successful Sea Vegetable Celebration Day on the UMaine campus.



They plan to continue doing basic research and market development to find new ways to make sea vegetable aquaculture a viable enterprise in the U.S.

■ Protecting Salmon Rivers

University of Maine doctoral student Lucner Charlestra is working with UMaine Professor of Chemistry Howard Patterson to determine the concentrations of harmful pesticides in Maine's salmon rivers. His research has included a successful pilot project that pioneered the use of the Polar Organic Chemical Integrative Sampler (POCIS) to measure concentrations of dioxin.

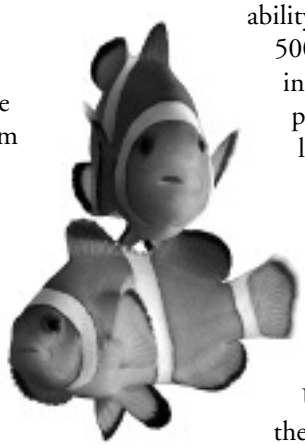
Pesticides used on blueberry fields and farms, and in residential applications, often find their way into Maine's rivers and streams, but in most areas their concentrations are largely unknown. Under a federal mandate to protect populations of endangered Atlantic salmon in Maine's rivers, policymakers are looking for ways to better understand the relationship between the use of pesticides and the health of the rivers' fish populations.

According to Charlestra, the POCIS allows researchers to study changes in concentrations during long periods by suspending the specialized sampler in the water column for several days or weeks.

Charlestra hopes that his research, supported by the Maine Department of Environmental Protection, the Atlantic Salmon Commission, the Environmental Protection Agency and the U.S. Geological Survey, will provide new information for scientists and policymakers.

■ Raising Halibut

The University of Maine Center for Cooperative Aquaculture Research (CCAR) halibut program in Franklin represents more than seven years of research into the unusual lives of the flatfish and benefits to Maine's aquaculture industry that have only begun to be realized.



Nick Brown, CCAR operations manager, and his UMaine research colleagues have successfully identified the environmental and nutritional requirements for halibut larval growth, and can now rear tens of thousands of larvae in the Franklin facility for research and commercial aquaculture.

Brown and UMaine aquaculture nutrition expert Linda Kling oversee a research program that includes the longest-running halibut brood stock nutrition study ever conducted. Brown and Kling have made significant strides toward understanding the complex nutritional needs of adult halibut, comparing differences in growth rates, egg production rates and larval success based on feeding regimes.

One of CCAR's most important advances has been in the recirculation systems used to house the adult halibut brood stock, and in the incubation and larval rearing.

CCAR's innovative facilities and management methods are helping ensure that raising halibut will be a commercially viable enterprise in the state. From temperature-controlled incubation rooms to advanced recirculation technologies, CCAR's facilities and techniques have revealed new ways to reduce costs, increase growth and prevent disease.

With 25,000 young halibut at CCAR, a major facility expansion is under way. Giant concrete tanks and new technologies have been installed to expand the program's ability to grow halibut to market size. Capable of supporting 500,000 fish, the new expansion will allow CCAR and its industry partners to complete the progression from proof-of-concept experimentation to demonstrable, large-scale production.

■ Tropical Fish

According to UMaine doctoral student Søren Hansen, 95 percent of the fish found in the pet store are wild-caught. Hansen does research at UMaine's Aquaculture Research Center (ARC), where there are between 2,000 and 6,000 fish in the system at any given time.

Raising healthy fish for tabletop tanks and aquaria is a challenge. Working out the details of breeding, feeding and general care for each species can take months or even years,

and the task requires considerable research and equipment.

Hansen and his team of undergraduate assistants constantly monitor the fish, making sure that water quality, temperature, space and food requirements are met.

The research is paying off. Hansen's spin-off company, Sea & Reef Aquaculture, is already filling orders for pet store owners across the country, providing young, healthy fish that are an environmentally sound alternative to their wild-caught counterparts.

Since the enterprise focuses on fish previously not developed for aquaculture, the opportunity for scientific discovery has been high. A number of UMaine undergraduates have been involved in research related to the project—from egg development to coloration—using fish and other resources housed at ARC.

■ Gliding in the Gulf

UMaine marine researcher Mary Jane Perry deployed an underwater glider into the chilly waters of the Gulf of Maine. The six-foot device, built for long-distance, low-energy travel, is equipped with multiple environmental sensors that gather data for up to four weeks.

The device can help monitor backscatter, fluorescence, water temperature, salinity and oxygen content. At set intervals, it rises to the surface, transmitting data back to the lab. The glider also has the ability to dive up to 200 meters, maintaining a predetermined course by checking its position via GPS.

Perry's goal is to have two or more gliders operating in Maine waters, allowing researchers to maintain a constant stream of data by replacing the autonomous devices monthly. With funding from the Office of Naval Research and the UMaine Office of the Vice President for Research, Perry worked closely with School of Marine Sciences researchers Neal Pettigrew, David Townsend and Carol Janzen to acquire the glider and initiate what they hope will become a longterm program of research utilizing multiple gliders.

Perry, a professor of Marine Sciences and Oceanography at UMaine's Darling Marine Center and a pioneer in the use of autonomous underwater gliders for remote research, hopes to develop a backbone of support for ongoing glider missions. She also plans to foster the educational potential of the device by using glider research missions as teaching and training opportunities for students.

Rob Bell and the crew from the R/V *Cape Hatteras* retrieve Nemo, an autonomous underwater glider for remote research, after a mission in the Gulf of Maine.

ADVANCED TECHNOLOGIES FOR FORESTRY AND AGRICULTURE

■ Changing Owners, Changing Harvesting

Using satellite imagery, University of Maine forest scientists Suming Jin and Steven Sader evaluated Maine timber harvest patterns in an effort to better understand current and future forest composition and structure over multiple ownerships.

During a six-year period, approximately 75 percent of the forestlands were sold to timber investment management organizations, with 25 percent sold to other industrial owners, who then parceled tracts to nongovernment organizations and loggers/short-term investors. The UMaine researchers found that, in the 1990s and early 2000s, timber investment management organizations and logger/short-term investors had higher harvesting rates than the industrial owners. Non-industrial private forest owners demonstrated more stable rates of harvesting over time.

Forestland with no ownership changes had significantly lower harvest rates than those that changed hands. Sales of several tracts of timber investment owners' land to loggers between 2000 and 2004 suggest that the timber investment management organizations may be willing to turn over some forest holdings in a shorter time, compared to the non-industrial owner group.

The researchers' findings were recently published in the journal *Forest Ecology and Management.*

■ MEIF and DOE Fund Biofuel Initiative

The Department of Energy (DOE) has awarded more than $1.5 million to the University of Maine to advance ongoing efforts to develop methods for converting biomass from Maine's forests into fuels and valuable chemicals. The state will contribute 50 percent in matching funds to the multifaceted project through the Maine Economic Improvement Fund.

The funding through the DOE's Experimental Program to Stimulate Competitive Research (EPSCoR) will be added to the $6.9 million the Forest Bioproducts Research Initiative received in a 2006 National Science Foundation EPSCoR award.

The UMaine initiative is a multidisciplinary collaboration of scientists from educational institutions and businesses across the state who are working to develop effective and efficient methods for transforming waste products from paper processing and other wood-based enterprises into fuels, plastics and other materials.

Supporting 12 researchers across the state, the new research cluster will allow UMaine to expand its efforts to overcome the technological barriers faced by Maine companies working to develop techniques for producing wood-based fuels and chemicals within the wood products industry's infrastructure.

■ Fueled by Seeds

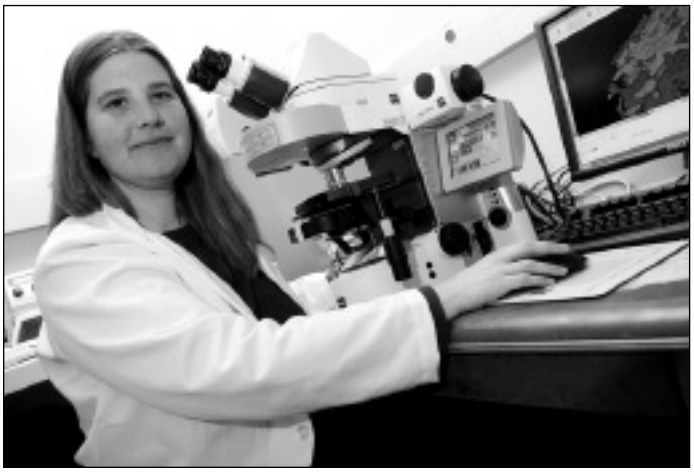
Working in collaboration with businesses in northern Maine, University of Maine Cooperative Extension Crops Specialist Peter Sexton has completed a pilot project that successfully converted Maine-grown seed crops into 1,000 gallons of biodiesel.

Sexton, a field crop specialist, planted 30 acres of oil-rich mustard and canola in Aroostook County. The experimental plots yielded more than 25 tons of oilseed, which was pressed by an independent mill that is one of several small businesses participating in the project.

More than 2,000 gallons of raw canola oil was extracted from the seeds harvested from Sexton's test plots. A portion of the thick, amber oil was later blended with petroleum-based fuel to produce the state's first 1,000 gallons of homegrown biodiesel, an alternative blend that can be used in the same way as traditional diesel fuel without any engine or burner modifications.

More than half of the biodiesel is being used for home heating and for fueling farm equipment in northern Maine. While oil from field crops will likely remain only a small piece of the nation's energy puzzle, Maine has the potential to greatly increase its oilseed production.

2007 BIOTECHNOLOGY



With a $1.28 million grant from NIH's National Institute of Child Health and Human Development, Clarissa Henry is conducting research in developmental biology that may lead to better treatment for conditions ranging from muscular dystrophy to tendinitis.

■ Developing Muscles

UMAINE researcher Clarissa Henry has pioneered a unique new system for studying how muscles and tendons develop inside the zebrafish. With a $1.28 million grant from the National Institutes of Health's National Institute of Child Health and Human Development, Henry is discovering embryonic processes that may lead to better treatment methods in humans for conditions ranging from muscular dystrophy to tendinitis.

Henry's current research, aimed at developing a better understanding of tendon formation and attachment in the embryo, is the next step in her pioneering efforts to describe the complexities of early development in vertebrates.

Henry and her UMaine colleagues continue to show that the zebrafish model has significant advantages over other research systems. Recent studies have shown that many of the processes that occur during zebrafish development are very similar to the developmental changes that occur in mammals, including humans.

While zebrafish development will remain the primary focus of her research, Henry is also the recipient of one of a handful of New Investigator Awards from Mount Desert Island Biological Laboratory (MDIBL) where she will work with MDIBL scientists for several weeks, examining muscle growth and development in the dogfish.

Henry hopes that comparisons between dogfish and zebrafish embryonic development offer insights into the evolution of muscle development and function.

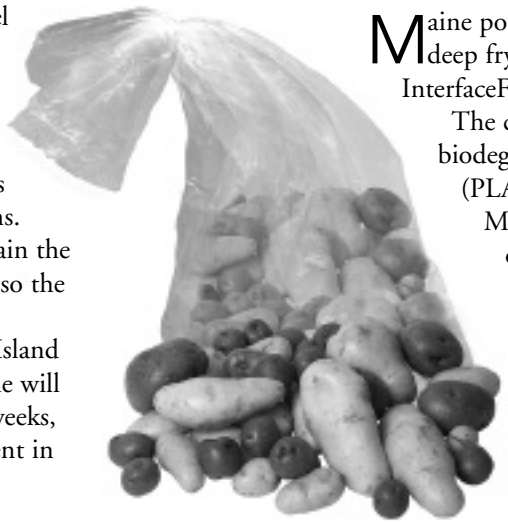
■ Biosecurity in the Potato Fields

University of Maine researchers Laurie Connell and Rosemary Smith are combining their expertise in molecular biology and sensor development to help combat potato wart, a dangerous disease that can ruin an entire potato crop. With a four-year, $800,000 grant from the U.S. Department of Agriculture Biosecurity Program, Connell and Smith are working with the Canadian Food Inspection Agency to create a fast and effective device for detecting potato wart in soil.

The mobile, handheld sensor currently being developed will use groundbreaking techniques in nanotechnology to identify the RNA sequence specific to the potato wart pathogen, providing faster, more accurate results than the field identification techniques currently in use. The new sensor, which utilizes a bridge of gold nanoparticles that reacts to specific molecular configurations, could provide researchers with an important new tool for detecting a broad range of potential toxins and pathogens in the field.

Connell and Smith are developing the specialized surfaces and attachment methods required for the nanoparticles and streamlining the process for extracting the potato wart pathogen from the soil. The project promises to greatly improve the chances of early detection of the disease, which is critical to its control.

■ Turning Potatoes into Plastic



Maine potatoes may be destined for more than the deep fryer if Maine-based manufacturer InterfaceFABRIC has its way.

The company, which currently uses biodegradable fiber made from polylactic acid (PLA) in corn, contracted the University of Maine's Margaret Chase Smith Center to determine if Maine potatoes could be used instead as a starch source for the plastic production. The study found that the costs associated with converting potatoes would be similar to the current costs of converting corn, and would require little or no start-up or equipment costs for Maine's potato growers.

The research, conducted by Kate Dickerson of the Margaret Chase Smith Policy Center and Jonathan Rubin of the Smith Center and the School of Economics, further found that InterfaceFABRIC's current demand for PLA could be met using below-grade potatoes and potato waste from processing once tools and techniques are developed.

If produced, the new potato-based plastics would be nontoxic, biodegradable and renewable, unlike the many petroleum-based plastics currently in use.

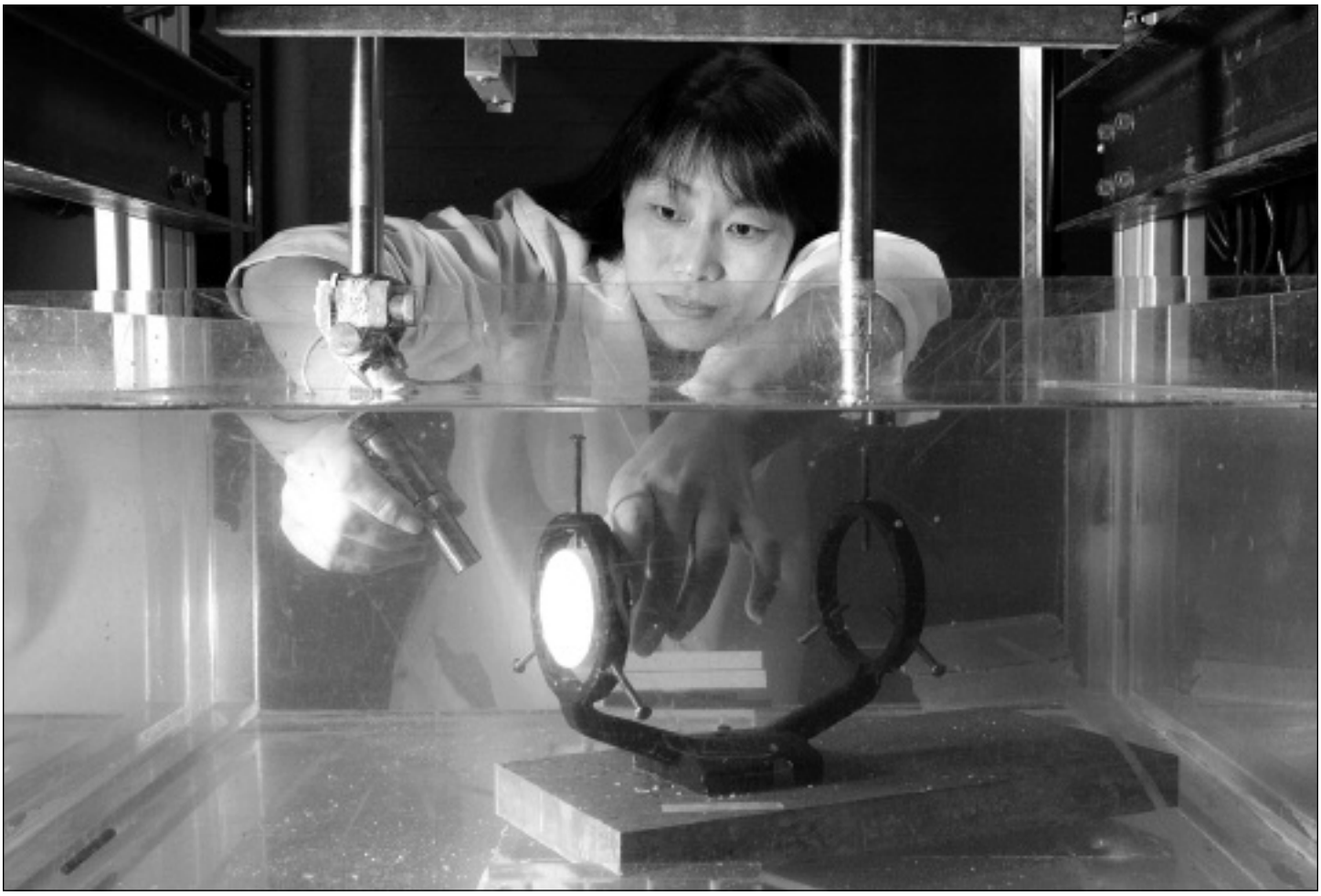
■ Filter factor

University of Maine doctoral candidate Lin Lin, working under the guidance of UMaine mechanical engineering professor Michael Peterson, is quickly becoming a leading expert in the use of ultrasonic waves for the study of membranes, and is working to develop important new tools for both research and industrial applications.

With such applications as the filtering of active viruses from vaccines and the removal of impurities from water, membranes are a critical part of thousands of manufacturing processes. Making sure they are operating at maximum efficiency can save time, money and even lives.

Lin's doctoral research focuses on the basic science behind the action of membranes. By comparing the behavior of reflected sound waves at the interface of sample membranes and the fluids in which they are immersed, her work is helping scientists better understand how pore size and other factors affect membrane function. Industry collaborators have helped support Lin's work and have shown a strong interest in the potential it has for improving manufacturing processes.

Graduate researcher Lin Lin uses ultrasonic technology to detect defective membranes used in industry and medicine.



2007 COMPOSITES AND ADVANCED MATERIALS TECHNOLOGIES

■ Healthy Bridges

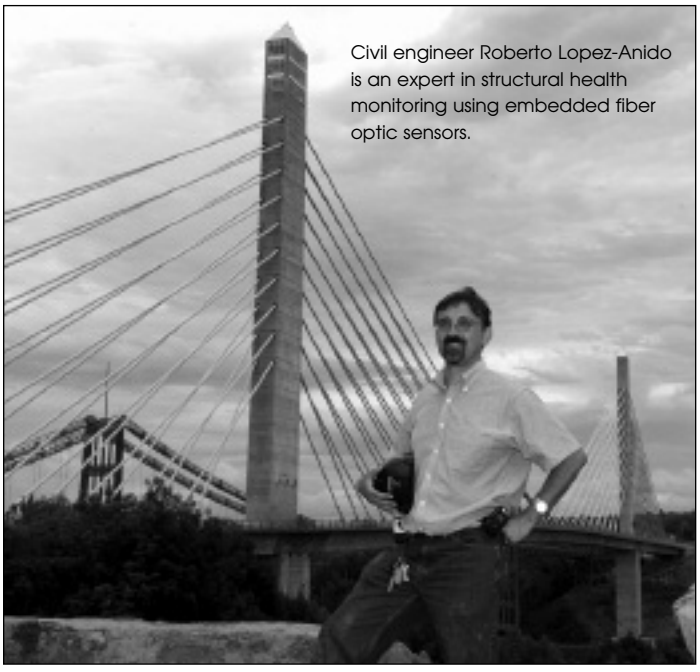
The Penobscot Narrows Bridge in Bucksport is a shining example of the latest in bridge designs and technologies, and the University of Maine played a part in its success.

UMaine civil and environmental engineering professor Roberto Lopez-Anido, mechanical engineering professor Vince Caccese, Ph.D. student Keith Berube and a small team of undergraduate engineering students helped install a sensor-based structural health monitoring system that provides information, such as tension levels in the structure's carbon composite and epoxy-coated steel strands, and any temperature fluctuations in the surrounding environment.

In addition, the team developed an effective new method for measuring strain within the cables. By embedding existing fiber optic strain sensors in the composites, Lopez-Anido created a tube-like sheath for the composite strands to provide additional data on changes in the tension force.

The sensors will generate invaluable data that will allow researchers to compare the carbon composite test strands to the more traditional epoxy-coated steel strands supporting the bridge.

Lopez-Anido is fine-tuning a longterm monitoring program for the bridge that will record data at one minute intervals 24 hours a day, 365 days a year.



Civil engineer Roberto Lopez-Anido is an expert in structural health monitoring using embedded fiber optic sensors.

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

■ Tamper-Resistant Cargo Containers

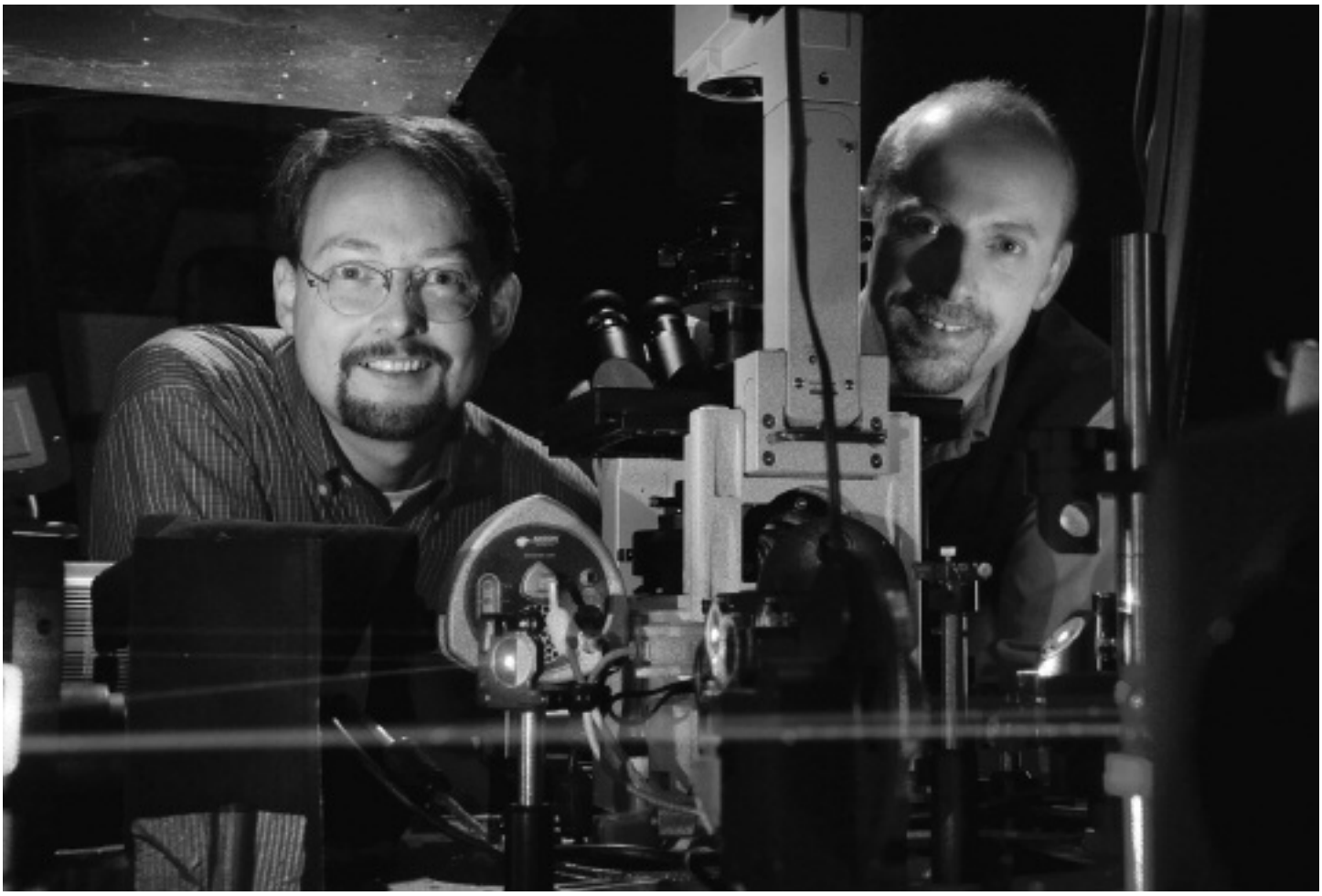
The University of Maine's considerable resources and expertise in the areas of composites and sensor technologies are being used to develop a new kind of tamper-resistant maritime shipping container.

UMaine graduate student Anthony Viselli and Advanced Engineered Wood Composites (AEWC) Center Director Habib Dagher spearhead the research at UMaine, being done in partnership with Maine Secure Composites LLC, which is based at the Target Technology Incubator and focuses on the development of maritime container construction using composite materials.

In 2005, Maine Secure Composites, led by Fred and Cynthia Smith from Angel Secure Networks LLC, and Professor Dagher from AEWC, received a U.S. Department of Homeland Security contract to develop a composite anti-tamper container with embedded sensors.

The design team is now developing a pilot production line for the containers to demonstrate how the technologies can be incorporated into a manufacturing process. The new containers can be manufactured to the same design standards as traditional steel and can be packed, stacked and shipped like any others on the market. The composite panels are designed to host a variety of sensor systems to help maintain port security, monitor environmental conditions inside the container or detect damage to the contents during shipping.

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



A new method of microscopy using fluorescence photoactivation could help address biological questions. The technology was developed by physicist Sam Hess, left, and engineer Mike Mason.

A Better View of the Molecule

University of Maine researchers Sam Hess and Mike Mason have developed a new microscope system that combines existing technologies to build an image based on the fluorescence of individual molecules. The device, Fluorescence Photoactivation Localization Microscopy, uses lasers to excite dye molecules on the surface of the subject being observed. The laser causes a portion of the molecules to fluoresce, and the light given off creates an image that is captured digitally. The process is repeated as new sets of molecules are excited, and the individual images, each reminiscent of a starry sky at night, are layered with the help of a computer to create a composite image.

The resolution of the new image is at least eight times better than any traditional light microscope available today. Mason, whose research utilizes single molecule imagery to probe local processes in biology and materials science, brought in a highly sensitive camera to aid in detection of the faint single molecules. The prototype yielded its first preliminary data in October 2005.

In the final stages of the peer review process, Hess and Mason were asked to calibrate their device to show that the new microscope did, indeed, break the refraction barrier. They collaborated with a team of researchers at UMaine's Laboratory for Surface Science and Technology—George Bernhardt, Scott Collins and Patrick Spinney—who were able to make a calibration sample and image it by atomic force microscopy in just three days.

2007 COMPOSITES AND ADVANCED MATERIALS TECHNOLOGIES

Chemist Touradj Solouki is working to isolate the molecular biomarkers of ovarian cancer found in human breath. In his laboratory, multiple technologies have been used to create an advanced research tool.

■ Breath Test for Cancer

With nearly $500,000 in funding from the Department of Defense Ovarian Research Program, UMaine chemistry professor Touradj Solouki is using one of the Northeast's most powerful superconducting magnets to isolate and identify molecules contained in a human breath and to possibly save lives in the process.

By comparing the molecular components found in a healthy person's breath with those found in the breath of a cancer patient, Solouki and his team hope to identify specific biomarkers that indicate the presence of ovarian cancer.

Researchers suspect that, unlike normal cells, cancer cells emit different metabolic waste products. Solouki's molecular identification techniques promise to determine the source of those differences, providing not only a new way of detecting cancer, but also a greater understanding of how the disease affects the body.

Once the biomarkers for ovarian cancer and other diseases are identified, a sensor could be developed for quick, accurate testing in hospitals and doctors' offices, increasing the chances of early detection and significantly improving the odds of successful treatment.

ENVIRONMENTAL TECHNOLOGIES

UMAINE NARRATIVES

■ Warning Light

With more than $400,000 in funding from the federal Environmental Protection Agency's homeland security research programs, a team at UMaine is in the midst of developing an algae-based sensor system that can be easily integrated into the existing monitoring networks of public water supplies.

UMaine chemistry professor Howard Patterson and John Peckenham, assistant director of the Sen. George J. Mitchell Center for Environmental and Watershed Research at UMaine, are overseeing this research effort.

Tiny algae plants react in distinctly different ways to various contaminants, making them uniquely valuable for water quality monitoring. Once a baseline response is established for each potential toxin, the associated fluorescence levels for the algae become a computer-based standard against which sensor data can be immediately evaluated.

By installing an array of sensors in the water supply, the system allows utilities to more accurately isolate the source of contamination and helps to avoid false alarms. Water companies are interested in the technology not only because it can be easily integrated into existing systems, but also because the sensors can monitor the algae population.

The project's emphasis on the reliability of the system is revealed in the methods used for examining the algae. The relative fluorescence of samples collected from area water supplies are quantified along with laboratory cultures, providing a more realistic picture of what can be expected in the field.

The project promises to improve both the security and management of public water supplies. It already is proving to be an outstanding model for collaboration in addressing environmental concerns.

■ Environmental Estrogen

UMAINE doctoral candidate Emily Notch has found evidence that waterborne synthetic hormones, like those in oral contraceptives and hormone replacement therapies, not only impair fish reproduction, they have the potential to disrupt an aquatic organism's natural ability to perform DNA repair, which could lead to mutations and tumors.

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

Synthetic hormones enter the natural aquatic environment via wastewater treatment plants. Estrogens are known carcinogens, but current science lacks a complete understanding of estrogen-induced cancer.

Notch, who received a U.S. Environmental Protection Agency (EPA) Science to Achieve Results (STAR) Fellowship, conducts research in the laboratory of Greg Mayer, an assistant professor of molecular and environment toxicology. With this grant, she will further study whether environmental estrogens alter DNA repair, leading to increased mutations and, ultimately, cancer.

Graduate student Emily Notch is studying the potential of synthetic estrogen to suppress nucleotide excision repair (NER) in organisms.

■ Navigational Noise

UMAINE students Kaitlyn Allen and Christie Mahaffey are conducting doctoral research in the university's unique ocean engineering program. By examining the acoustic signature of large ships, as well as whale biology and movement patterns, they hope to better understand the circumstances that can lead to ship-whale collisions and to develop new strategies to reduce the number of whale deaths and injuries.

Allen hopes to focus her research efforts on developing an inexpensive sensor that could be mounted on large ships. The device would be designed to detect whales and to emit a signal that would drive them toward safer waters.

Recognizing that public education is a critical component of protecting whales and other marine creatures, Allen, Mahaffey and others are working to implement an outreach program for students in Maine's public schools.

UMaine ocean and mechanical engineers have secured seed money to develop hands-on and Web-based materials to help students of all ages learn more about whales. The researchers also hope to work directly with school groups to increase understanding of marine mammals and the many problems they face.

2007 INFORMATION TECHNOLOGIES

■ Digital Access

This fall, the first copies of Fogler Library's newly digitized out-of-print books are available to patrons throughout Maine via the library's online catalog and to the public through Amazon.com.

In a large-scale project to digitize public domain titles, including rare books, the University of Maine, Toronto Public Library, Cincinnati Public Library and Emory University partnered earlier this year with BookSurge, Amazon.com's print-on-demand service, and Kirtas Technologies, the manufacturer of automated book scanning systems.

The collaboration and cutting-edge technology provide greater access to materials once only available on-site to patrons researching in the libraries' special collections. Digitalization also is a strategic preservation effort for leading libraries nationwide.

Fogler Library and the Maine State Library are collaborating on the project to digitize such out-of-print and rare materials as UMaine publications, historical Maine town reports, local history, and documents relating to Wabanaki peoples.

Ultimately, the scanned titles will be available to be read online (with full text search capability) or downloaded by URSUS users. Low-cost, bound copies will be sold through BookSurge, with a portion of the proceeds being recouped by the libraries to cover the expense of digitalization.

■ Superpowered

University of Maine Associate Professor of Electrical and Computer Engineering Bruce Segee and his talented team of student engineers have developed a visualization system for computer images that allows users to combine multiple monitors to create oversized images without sacrificing resolution.

The work is partially supported by a National Science Foundation Major Research Infrastructure grant, awarded to Segee and several other UMaine researchers.

Segee's device, which utilizes special software that divides the image and coordinates its distribution to any number of monitors, is already proving to be a valuable tool for scientists who specialize in computer modeling. Three-dimensional images, created using thousands or even tens of thousands of data points, can be easily viewed in their entirety on Segee's supersized visualization monitor.

Segee's team is also working to make the new visualization system a reality for Maine's middle schoolers. He envisions a simple, easy-to-use program that teachers could access through the Web, allowing them to use their students' laptops in the same way that Segee uses linked monitors in the lab. From interactive maps of the world to detailed diagrams of a microchip, a broad range of images could be easily viewed by groups of students, offering an exciting new perspective on learning.

Inland Fisheries and Wildlife wardens drop off evidence in Irv Kornfield's Molecular Forensics Lab.

■ CSI: Orono

UMAINE professor Irving Kornfield is one of the country's leading experts in wildlife DNA analysis, as well as director of UMaine's Molecular Forensics Laboratory.

Kornfield's lab is unique in its approach to scientific inquiry. Highly trained students, both graduate and undergraduate, not only work as researchers in molecular biology and population genetics, they also conduct tests and interpret data in the forensics lab, providing a valuable service to state agencies and other clients.

Kornfield and his team have handled hundreds of samples. Most are for the Maine Warden Service, but the lab also handles casework for many other states. Kornfield has testified numerous times in Superior Court, and his test results have been used in cases ranging from accusations of night hunting to possession of endangered species. But because these analyses are done in an objective, academic, scientific context, whether the suspect is innocent or guilty is immaterial—the evidence speaks for itself.

By helping to establish an extensive reference database of genetic markers, UMaine researchers have made significant contributions to scientists' overall understanding of the genetic complexities of New England's deer and moose populations, as well as marine life.

PRECISION MANUFACTURING

UMAINE NARRATIVES

■ Sensing Hazardous Materials

A new handheld sensing device designed to detect hazardous materials has the potential to be a real boon to firefighters and other first responders at 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 students 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.

In their research into medical uses for foam metals, 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.

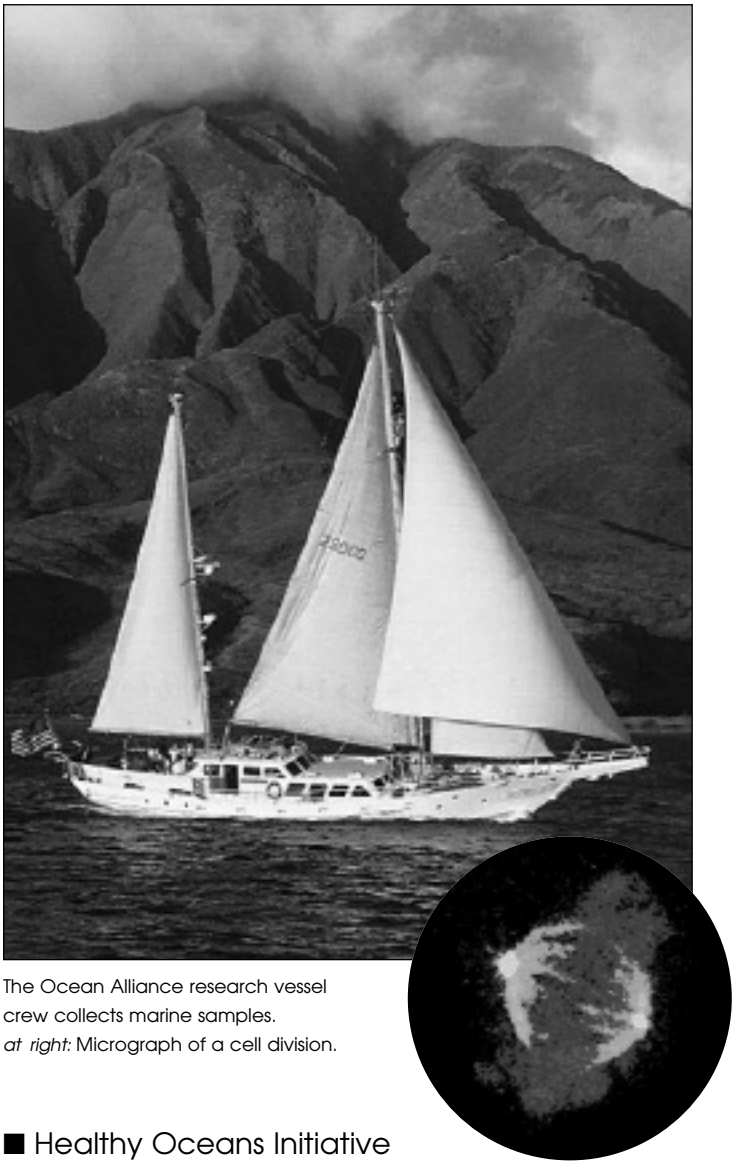
Their discoveries will help foam metal manufacturers to develop a new line of products that will improve patients' lives.

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.

Dr. Ian Dickey, a surgeon who specializes in reconstructive surgery at Eastern Maine Medical Center, collaborates in research on foam metal implants with engineer Darrell Donahue.

For additional information on UMaine's research projects contact James Ward, Assistant Vice President–Research, Economic Development and Government Relations, at 207-581-2201.

2007 AQUACULTURE AND MARINE SCIENCES



The Ocean Alliance research vessel crew collects marine samples.
at right: Micrograph of a cell division.

■ Healthy Oceans Initiative

As levels of environmental contaminants in the ocean are rising, loss of key commercial fisheries, such as clams, cod and lobsters, may result. Pollutants are more than likely the bulk of the problem.

To address these pressing environmental and scientific concerns, John Wise, USM professor and director of the Maine Center for Toxicology and Environmental Health (MCTEH), is assessing the levels and impacts of pollutants in the Gulfs of Maine, California and Mexico with his colleagues in the Healthy Oceans Initiative. Of particular concern is the possibility that recent hurricanes in New Orleans may have devastating effects on the fisheries in the Gulf of Mexico, dumping potentially massive new levels of pollutants into the water.

The broad goal of MCTEH is to develop a nationally competitive research program for studying the health effects of contaminants that pollute the environment and, in turn, provide new knowledge to improve the health of Maine citizens and improve the regional economy by expanding biomedical research resources in the region.

In addition to the Healthy Oceans Initiative, two major areas of research within the center are the effects of arsenic on health and development, and the potential impact on human health of exposure to nanoparticles. While based at USM, the Healthy Oceans initiative includes partners from around the nation, as well as within the state, including the Maine Centers for Disease Control and Prevention; the Maine Department of Agriculture, Food and Rural Resources; the University of Maine; the University of New England; and Bowdoin College.

Professor John Wise investigates marine mammal cell lines

■ High Chromium Levels Found in Right Whales

USM researchers have documented toxic levels of chromium in the endangered right whales of the Gulf of Maine, the first such documentation of chromium exposure in the population. Chromium is a common sediment pollutant that is discharged from metal-finishing, leather tanning and textile dyeing industries. It often is found in stainless steel, other alloys, and dyes or paints.

John Wise Sr. of USM, lead author of a report on the findings, is founder of USM's Maine Center for Toxicology and Environmental Health. The results are featured in an article, "Hexavalent Chromium Is Cytotoxic and Genotoxic to the North Atlantic Right Whale *(Eubalaena glacialis)* Lung and Testes Fibroblasts." The article is scheduled to be published in the journal *Mutation Research—Genetic Toxicology and Environmental Mutagenesis.*

The USM researchers, in collaboration with The Ocean Alliance, the New England Aquarium, the Mystic Aquarium and others, have been investigating the genetic effects of chromium and other environmental contaminants on North Atlantic right whales. Their work has led to development of cell lines generated from right whale skin, lungs and testes. Data from these sources has increased knowledge of the physiology and toxicology of the right whale, and resulted in the latest findings.

■ Pollutants and Effects on Human vs. Whale Cells

Toxicologists and environmental researchers at the University of Southern Maine are studying how human and whale cells react to various pollutants and pesticides in order to discover why they seem to affect the two mammals so differently.

David Kirstein, administrative director of the Wise Laboratory for Environmental and Genetic Toxicology, said his group is studying whales that congregate in the waters off Alaska. The water in the area has currents that bring pollutants to the area from farther west in the Pacific Ocean. The whales are surrounded constantly by chemicals and pesticides that would severely harm humans over long periods of time; however, the whales sometimes live very long lifespans and suffer very few instances of cancer.

Other marine animals, however, are severely endangered by overfishing and, perhaps, pollution that washed into the streams, then into rivers and oceans.

By examining cultures of human and whale cells after adding pesticides or chemicals like mercury, the researchers hope to find out if whales really do have something that makes them less susceptible to pollutant-related diseases and why they react so differently to the chemicals when compared to humans.

■ Marine Hot Spots and Aquatic Life

Researchers with the Aquatic Systems Group at the University of Southern Maine hope to explain the biology under the Gulf of Maine's surface at Platts Bank.

During certain seasons and weeks of the year, whales, dolphins, sharks and birds flock by the hundreds of thousands to this active marine life hot spot, located about 40 miles off Portland's coast. Researchers have been traveling to Platts Bank for the past three years in an effort to uncover a pattern of when and why these hot spots pop up.

These hot spots tend to "turn on and off" throughout the year, according to Research Associate Nick Wolff, and two explanations are being studied. Either predators eat all the food in the area and have to move on, or underwater waves drive the tiny red mats of krill toward the surface, creating a buffet line for whales and other predators.

Wolff and his colleagues are using underwater cameras and acoustics equipment to monitor these underwater waves and determine if and how they drive the dense groups of krill to the surface. This would bring other, larger, creatures to the surface to feed on the krill—and each other.

By learning more about how these hot spots occur, researchers hope to get a handle on the migration patterns of marine creatures and learn more about the thousands of species that pass through Maine's waters each year.

USM Professor Awarded EPSCoR Grant

This summer, the Department of Defense's Office of Naval Research awarded USM Research Professor Lew Incze of the USM Aquatic Systems Group more than $626,000 to study "Energy Transfer to Upper Trophic Levels on a Small Offshore Bank."

This research builds on work by Incze and his team to determine the use of the Gulf of Maine's offshore banks and ledges by seabirds, marine mammals and large fish. Developing a better understanding of how natural changes in this environment affect marine life usage patterns will help future management of the Gulf of Maine and its resources. Using a 48-foot lobster-type research vessel, the team has made numerous trips to Platts Bank and Three Dory Ridge off the coast of Cape Elizabeth to research and record the conditions of the bank and ridge when these creatures are present and absent.

Platts Bank, in particular, was chosen for study because it is thought to be a hot spot, an area where the biomass of organisms is at times notably elevated. Hot spots are frequently characterized by the presence of higher trophic level vertebrates, such as birds, migratory fishes, cetaceans and pinnipeds. Predators must exploit a network of such sites, foraging at each while conditions are favorable, and then moving on. The predictability and temporal dynamics of these hot spots therefore become an important part of how populations of upper trophic level organisms utilize such an environment. The study area is located 50 km off Cape Elizabeth, and covers Three Dory Ridge and the surrounding deep water.

The research will focus on the interaction of internal waves with the bank and its planktonic organisms, along with the relationship of these processes to the distribution, feeding and residence times of upper trophic level predators, especially humpback whales.

2007 BIOTECHNOLOGY

■ Studying Nanoparticles

In today's world, nothing is as simple as it may seem. Even a shirt is no longer just strands of woven fabric. Companies that make items ranging from clothing to washing machines are beginning to use nanoparticle technology in their products. However, USM researchers are looking into whether nanoparticles could harm people using these products.

Nanoparticles are microscopic clusters of atoms of various elements. For example, shirts with certain nanoparticles can act as an insect repellent or sunscreen (until the particles are washed out of the shirt after a certain number of rinse cycles), and in some modern, very expensive, washing machines, nanoparticles can help disinfect the clothes and reduce the amount of water used.

Even though the particles are embedded in the fabric of the shirts or the interior of the washing machine, they do eventually wear or wash off. Toxicologists at USM are experimenting with nanoparticles to see if they pose a threat to humans or the environment because of their extremely small size. If it is possible for the particles to be absorbed through the skin, ingested or inhaled, then they could potentially pose a risk.

Associate professor Monroe Duboise and a student examine a specimen in their lab.

■ Unraveling the Viral Genome

Since the 1970s, HIV-AIDS has killed more than 25 million people globally. Kaposi's sarcoma, a cancer caused by a gammaherpesvirus, is often associated with AIDS. USM researchers are working to learn more about the biology of gammaherpesviruses by using a similar virus that infects laboratory mice in the hope that knowledge gained may lead to better treatments for Kaposi's sarcoma and other illnesses caused by gammaherpesvirus infections.

Associate Professor of Microbiology Monroe Duboise, a virologist at USM, and his colleagues are studying the viral genome in order to unravel the tricks these viruses use to persist in humans indefinitely and avoid the body's natural defenses. For example, they are trying to understand how the viruses prevent a process known as programmed cell death, which can provide defense against the spread of viruses when an infected cell will kill itself rather than produce more virus to infect surrounding cells.

Understanding the various ways that gammaherpesviruses interfere with the body's defenses against infection and disease may lead to better treatments for Kaposi's sarcoma and also diseases caused by the very common Epstein-Barr virus, which Duboise says infects most people during their life.

Robert Friesel, scientific director of MMCRI, discusses opportunities for collaboration with ASET advisory board member Mike Wing, Ah-Kau Ng, Doug Thompson and Dean John Wright.

■ MMC and USM Sign Agreement to Move Research Beyond the Lab

Maine Medical Center and the University of Southern Maine have signed an Inter-Institutional Agreement to contribute to commercializing the result of their collaborative research. Although the result of their research, which could lead to new diagnostic tests for cancer, is still far from a commercial product, the agreement provides a legal framework for moving beyond the laboratory.

USM Professor of Immunology Ah-Kau Ng and Dr. Lucy Liaw of the Maine Medical Center Research Institute continue

to conduct their research on osteopontin, a protein considered to be a biomarker of human cancers. Graduate students in USM's Department of Applied Medical Sciences also participated in the research.

So far, the researchers have developed a series of monoclonal antibodies that bind osteopontin and may help to provide a prognosis for various types of human cancer. Earlier this year, the two completed a written description of their invention, "Monoclonal Antibodies Against Osteopontin." The description was used to file a patent application, which covers the technology.

The joint agreement provides that the invention will be administered and commercialized by Maine Medical Center on behalf of both parties. MMC is seeking qualified licensees. To date, there have been several discussions with potential commercial partners about developing particular applications of the technology.

■ Residential Soils

Several USM School of Applied Science, Engineering, and Technology students participated in summer undergraduate research projects with faculty. These experiences were funded by the Eastern Alliance in Science, Technology, Engineering, and Mathematics (EAST), a National Science Foundation Human Resources Division project dedicated to increasing the numbers of students with disabilities in science, technology, engineering and mathematics (STEM) majors and in STEM careers.

Environmental science students Jaime Cone and Mike Bradley conduct phytoremediation research in the Munjoy Hill neighborhood of Portland.

Jaime Cone, an environmental safety and health major, worked with professor Samantha Langley-Turnbaugh in the Department of Environmental Science on research focused on phytoremediation of lead in residential soils in the Munjoy Hill neighborhood in Portland. Phytoremediation is a low-cost, in-situ mitigation technique using vegetation to take up heavy metals from the soil.

Cone used spinach as her experimental plants to establish phytoremediation gardens. At the end of the growing season, soil lead levels had decreased in three of the four study sites. Cone, who graduates this year, is currently working full-time as an environmental safety and health professional for a Portland company.

■ Genetics Grant

USM professor Stephen C. Pelsue in the Department of Applied Medical Sciences is one of 15 recipients of a grant from the Lupus Research Institute (LRI). LRI funded 15 three-year, $300,000 novel research grants with the goal of understanding and stopping the effects of lupus. Over 1.5 million Americans are inflicted with lupus, a complex and devastating autoimmune illness.

Pelsue's proposal was selected from a record number of applications received by the Lupus Research Institute—92 in all—based on the novelty and potential of their hypotheses, as well as the promise of the investigators themselves.

The genes a person inherits may make him or her more susceptible to lupus. Pelsue's research is based on the finding that defective versions of a newly identified gene, Ttc7, results in a lupus-like autoimmune disease in mice. He will use sophisticated imaging and analytical tools to better understand this gene and its function in cells of the immune system. He also will use newly created mouse models to clarify how the gene contributes to the production of damaging autoantibodies—and thereby generate key insight into what causes such devastating autoimmune diseases as lupus.

2007 INFORMATION TECHNOLOGY

■ Research Computes

USM's Research Computing Group (RCG) provides a focus for collaborative knowledge and functional activities around novel approaches to solving research, creative and scholarly activities through the thoughtful and deliberate use of a broad spectrum of technology.

Professor Glenn Wilson, who directs the RCG, has encouraged, mentored and employed more than 30 students in research and development activities.

Currently, one of the primary research thrusts is in the area of marine informatics. USM students, faculty and staff are using Geographic Information Systems (GIS) and custom software and mapping systems to solve problems related to characterizing the biological and physical systems in the Gulf of Maine.

■ Turning Two-Dimensional Objects into 3D

Chris Aubut, a computer science student at the University of Southern Maine, is working to develop a new software program to acquire, register and make 3D reconstructions of tomographic data.

Tomographic images are 2D X-rays of solid objects. By running transmission electron microscope data through a program that would pass off some of the workload to a computer cluster, Aubut hopes to make it easier to turn these 2D slices into 3D images. The 3D images can be much easier to visualize and study.

This new method would be used for research and education in the wide and varied communities of scientists, educators and students in Maine.

Thanks to MEIF funding since 1997, students in the Computer Science Department at USM have been able to conduct research with the help of their professors according to Glenn Wilson, director of the Research Computing Group.

■ Urban Planning—A Real-time Simulation

The Research Computing Group at the University of Southern Maine and MRLD, a landscape architecture and urban design company based in Yarmouth, are developing a program that will provide a real-time simulation of urban development and planning.

The program, known as AREA CODE, is similar in many ways to the popular videogame SimCity, where you build your own city and every decision you make affects how your city develops. Web-based AREA CODE will allow everyone from engineers to the public to test and visualize ideas about city and town development and receive immediate feedback on various scenarios.

For example, an individual could focus on an undeveloped parcel of land in Portland and evaluate how green roof technologies would make a more efficient building and how it would impact the environment. The user would ask the interactive, database-driven program questions and would receive graphic and written responses.

Researchers hope AREA CODE will go to market and be a magnet for people who want to develop businesses and building projects in Maine.

Limin Feng, Adam Courtemanche and Jared Boudreau work on the high-performance computer cluster located in the new research wing of USM's science building.

■ High-Performance Cluster

Computer-intensive statistics is a major research interest of Cheng Peng, a USM faculty member in the Department of Mathematics and Statistics. That interest led him to USM's Research Computing Group (RCG) and its high-performance cluster (HPC).

The RCG recruits students with an interest in high-level computing. They typically collaborate with faculty and staff on research projects in computing and other programs throughout the campus and region. Students develop software applications, solve computer problems and set up scientific equipment for research.

Two of those students, Robert Robinson and Limin Feng, are working on a project with Peng. Robert, a computer science major, and Limin, a graduate student in statistics, are translating some of his statistical research to operate as a distributed multi-threaded program on the high-performance cluster.

The statistics require large data sets. It is anticipated that computations that once took up to two weeks to complete will soon be done in a few hours using the HPC. The technique being developed will help in future research projects to speed testing and development of theories, as well as increase the complexity of the statistical research.

PRECISION MANUFACTURING

■ USM Receives NASA MEMS Grant

Professor Mustafa Guvench of USM's Department of Engineering was awarded a $60,000 grant from NASA's Maine Space Grant Consortium.

For several years, Guvench has been working on micro-electromechanical systems (MEMS) sensors based on the principle that a mechanical system vibrates most at its resonant frequency. A tuning fork is a common example. One of the determinants of the resonant frequency is the mass of the object. A tiny reed, the mass of which increases if it absorbs gas from the surroundings, vibrates at a lower frequency.

Phase I of the project will focus on the proof of concepts and experimentation with different films for gas absorption on MEMS structures. Professor Henry Tracy in the USM Chemistry Department will assist with this work. Phase II will focus on multi-sensor integration and integration of sensors with circuits. Mathematics Professor Abou Aboueissa will provide assistance with statistical properties of gas sensing.

The project also has an educational component. Undergraduate students will participate in the surface chemistry and the MEMS research and development. Engineering Professor James Smith will develop a general education course on how ability to detect and measure the very large and the very small alters our perceptions of the world and the universe. Faculty will incorporate concepts relating to MEMS into existing courses. Additional higher education projects are under development.

The longterm goal of the research and development is to develop MEMS sensors that will detect, monitor and/or identify gases—for example, in a space vehicle or lunar habitat environment. In addition, there are many Earth-bound applications for such devices.

Researchers in the lab at USM's Bioscience Building

For additional information on USM's research projects, contact Nancy Martz, Director of Research Administration at 207-228-8053.

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 1999-00 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 APPROPRIATIONS 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 FY07

	FY07 Appropriation
UMAINE	$10,300,000
USM	2,500,000
Total	**$12,800,000**

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.

FY07 SUMMARY OF STATE FUNDING FOR RESEARCH CAPITAL PROJECTS

UMAINE/USM COMBINED

	Referendum Bond Portion	Other Funds	Total Project Budget	Expenditures to Date
FY99 State Bond Issue (approved by voters 11/3/1998)				
UMAINE	$10,800,000	$1,168,622	$11,968,622	$11,944,787
USM	2,700,000	155,100	2,855,100	2,855,100
TOTAL	**$13,500,000**	**$1,323,722**	**$14,823,722**	**$14,799,887**
FY01 University R&D Revenue Bonds (Debt Service Paid by $2,500,000 State Appropriation – Issued 8/15/2000)				
UMAINE	$20,000,000	$1,203,296	$21,203,296	$21,008,635
USM	5,000,219	5,005,607	10,005,826	9,875,265
TOTAL	**$25,000,219**	**$6,208,903**	**$31,209,122**	**$30,883,900**
FY01 One-Time State Appropriation (signed by Governor 4/25/2000)				
UMAINE	$9,000,000	$3,441,899	$12,441,899	$12,416,315
FY02 State Bond Issue (approved by voters 6/11/2002)				
UMAINE	$5,000,000	$0	$5,000,000	$4,525,932
USM	4,000,000	45,029	4,045,029	4,045,029
TOTAL	**$9,000,000**	**$45,029**	**$9,045,029**	**$8,570,961**
FY03 State Bond Issue (approved by voters 6/10/2003)				
UMAINE	$7,000,000	$809,187	$7,809,187	$7,559,792
USM	4,400,000	0	4,400,000	4,400,000
TOTAL	**$11,400,000**	**$809,187**	**$12,209,187**	**$11,959,792**
FY05 State Bond Issue (approved by voters 11/08/2005)				
UMAINE	$3,800,000	$306,633	$4,106,633	$1,651,822

UNIVERSITY OF MAINE SYSTEM

UTILIZATION OF FY07 OPERATING RESEARCH APPROPRIATION

UMAINE

Targeted Research Area	Source of R&D Funds: FY07 R&D Base Budget	Source of R&D Funds: Unused R&D Funds from Prior Years	Source of R&D Funds: FY07 Total R&D Funds Available	Utilization of R&D Funds: FY07 R&D Actual Expenditures	Utilization of R&D Funds: Transferred To Match Grants & Contracts	Utilization of R&D Funds: Transferred Between R&D Accounts	Utilization of R&D Funds: Total R&D Funds Utilized	Unused Funds Carried Forward To FY08[1]	New Grants & Contracts Generated[2]	Total FTE Positions Supported By All R&D Funds[3]
Adv. Technology Forestry & Agriculture	$1,650,000	$2,043,044	$3,693,044	$2,633,015	$56,821	$241,291	$2,931,127	$761,917	$10,785,559	73.9
Aquaculture & Marine Science	1,450,000	(468,762)	981,238	1,816,269	572,669	(1,339,042)	1,049,896	(68,658)	8,342,107	64.7
Biotechnology	700,000	219,472	919,472	865,032	(116,262)	(299,129)	449,641	469,831	3,128,218	23.4
Composites	1,775,000	385,618	2,160,618	792,134	64,198	1,195,182	2,051,514	109,104	6,179,841	125.3
Environmental	887,000	(21,435)	865,565	1,390,698	36,887	(886,790)	540,795	324,770	7,472,495	67.9
Information Technology	1,421,000	(751,871)	669,129	2,556,374	350,556	(2,455,735)	451,195	217,934	3,170,619	95.4
Precision Manufacturing	1,717,000	333,656	2,050,656	1,582,260	41,973	356,747	1,980,980	69,676	1,432,078	53.8
Cross-Sector	0	0	0	47,581	95,504	(61,820)	81,265	(81,265)	1,674,462	5.4
GoMOOS & Commercialization (one-time[4])	540,000	0	540,000	0	0	540,000	540,000	0	0	
Unassigned reallocated by System	160,000	101,378	261,378	58,025[5]	0	0	58,025	203,353	0	0.0
Total State Funding	**$10,300,000**	**$1,841,100**	**$12,141,100**	**$11,741,388**	**$1,102,346**	**($2,709,296)**	**$10,134,438**	**$2,006,662**	**$42,185,379**	**509.8**
UMAINE Cost Sharing Funding[6]	$1,063,602	$1,557,654	$2,621,256	$0	($886)	$2,590,216	2,589,330	$31,926	$0	
TOTAL FUNDING	**$11,363,602**	**$3,398,754**	**$14,762,356**	**$11,741,388**	**$1,101,460**	**($119,080)**	**$12,723,768**	**$2,038,588**	**$42,185,379**	
2003 Jobs for Economic Growth Bond[7] —MEIF Matching Funds	$0	$1,354,421	$1,354,421	$0	$649,359 $	0	$649,359	$705,062	$0[8]	0.0

[1] Include year-end equipment carry-over funds (equipment ordered, not received and not paid).

[2] Dollar value of new grants & contracts that resulted from FY07 state R&D funds.

[3] One FTE position is equivalent to one full-time employee working for an entire year on R&D projects.

[4] Grants & contracts leveraged, and FTE's generated from these funds are reflected in sector totals.

[5] MEIF R&D Evaluation.

[6] Salary and benefits from University.

[7] Original amount was $2,880,000. Job creation & economic growth bond.

[8] Included in grants & contracts generated figures shown above.

UNIVERSITY OF MAINE SYSTEM

UTILIZATION OF FY07 OPERATING RESEARCH APPROPRIATION

USM

Targeted Research Area	Source of R&D Funds: FY07 R&D Base Budget	Source of R&D Funds: Unused R&D Funds from Prior Years	Source of R&D Funds: FY07 Total R&D Funds Available	Utilization of R&D Funds: FY07 R&D Actual Expenditures	Utilization of R&D Funds: Transferred To Match Grants & Contracts	Utilization of R&D Funds: Transferred Between R&D Accounts	Utilization of R&D Funds: Total R&D Funds Utilized	Unused Funds Carried Forward To FY08[1]	New Grants & Contracts Generated[2]	Total FTE Positions Supported By All R&D Funds[3]
Aquatic Systems	$270,578	$16,329	$286,907	$295,370	$29,376	$0	$324,746	($37,840)	$735,961	11.0
Information Science Research	306,777	(1,291)	305,486	458,704	0	0	458,704	(153,218)	189,069	12.0
Bioscience Institute	1,822,645	451,229	2,273,874	1,639,239	457,962	0	2,097,201	176,673	3,262,727	67.0
Unassigned reallocated by System	40,000	25,344	65,344	14,506[5]	0	50,838	65,344	0	0	0.0
GoMOOS & Commercialization (one-time)	60,000	0	60,000	0	60,000	0	60,000	0	0	0.0
Total State Funding	**$2,500,000**	**$491,611**	**$2,991,611**	**$2,407,820**	**$547,338**	**$50,838**	**$3,005,996**	**($14,385)**	**$4,187,757**	**90.0**
2003 Jobs for Economic Growth Bond[4] —MEIF Matching Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	0.0

[1] Include year-end equipment carry-over funds (equipment ordered, not received and not paid).

[2] Dollar value of new grants & contracts that resulted from FY07 state R&D funds.

[3] One FTE position is equivalent to one full-time employee working for an entire year on R&D projects.

[4] Original amount was $720,000. Job creation and economic growth bond.

[5] MEIF R&D Evaluation

UNIVERSITY OF MAINE SYSTEM

SUMMARY OF UTILIZATION OF FY07 OPERATING RESEARCH APPROPRIATION

UMAINE/USM COMBINED

	Source of R&D Funds: FY07 R&D Base Budget	Source of R&D Funds: Unused R&D Funds from Prior Years	Source of R&D Funds: FY07 Total R&D Funds Available	Utilization of R&D Funds: FY07 R&D Actual Expenditures	Utilization of R&D Funds: Transferred To Match Grants & Contracts	Utilization of R&D Funds: Transferred Between R&D Accounts	Utilization of R&D Funds: Total R&D Funds Utilized	Unused Funds Carried Forward To FY08[1]	New Grants & Contracts Generated[2]	Total FTE Positions Supported By All R&D Funds[3]
UMAINE	$10,300,000	$1,841,100	$12,141,100	$11,741,388	$1,102,346	($2,709,296)	$10,134,438	$2,006,662	$42,185,379	509.8
USM	2,500,000	491,611	2,991,611	2,407,820	547,338	50,838	3,005,996	(14,385)	4,187,757	90.0
Total State Funding	**$12,800,000**	**$2,332,711**	**$15,132,711**	**$14,149,208**	**$1,649,684**	**($2,658,458)**	**$13,140,434**	**$1,992,277**	**$46,373,136**	**599.8**

[1] Include year-end equipment carry-over funds (equipment ordered, not received, and not paid).

[2] Dollar value of new grants & contracts that resulted from FY07 state R&D funds.

[3] One FTE position is equivalent to one full-time employee working for an entire year on R&D projects.

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