12-2008

State Funded Research Annual Report FY08

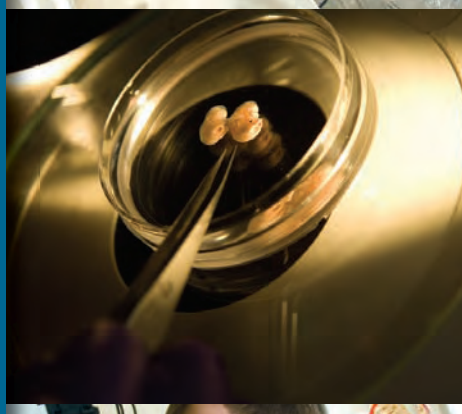
University Of Maine System

Maine's Public Universities

UNIVERSITY OF MAINE SYSTEM

Return on Investment: Maine's Universities

Building our State's Economy through Research, Development & Jobs



MAINE ECONOMIC IMPROVEMENT FUND

UNIVERSITY OF MAINE SYSTEM

Annual Report 2008

Maine's Public Universities

UNIVERSITY OF MAINE SYSTEM

STATE FUNDED RESEARCH ANNUAL REPORT

DECEMBER 2008

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* The narratives provided demonstrate the breadth and diversity of research conducted at UMaine and USM in FY08. 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

2008 STATE-FUNDED RESEARCH REPORT

December 2008

In 1997 one of Maine's smartest and most successful public investments began, with the creation of the Maine Economic Improvement Fund (MEIF). Funded through an annual state appropriation and periodically augmented through voter-approved bond referenda, MEIF provides university-based researchers with the capital necessary to leverage federal and private-sector research grants and contracts. Those grants and contracts, in turn, create and sustain economic development through new jobs, products, technologies, companies, and opportunities.

During FY08, the University of Maine System (UMS) received $13.7 million in MEIF funding. That FY08 MEIF appropriation helped university faculty and students successfully earn $51.3 million in grants and contracts. As stipulated in Maine law, the University of Maine System directs MEIF dollars specifically 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

In FY08, the two UMS universities with graduate programs in some or all of those seven targeted research areas received MEIF funds: The University of Maine (UMaine) and the University of Southern Maine (USM). UMaine and USM use MEIF resources 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 statewide. 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. It 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 annually across all seven UMS institutions.

MEIF in 2008

SUCCESS:

By leveraging MEIF funds, UMaine and USM have attracted a combined $51.3 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 $11.1 million in MEIF funds to attract $45.5 million in federal and private-sector research funds. USM continued to build its research capacity, using $2.7 million in MEIF funds to leverage an additional $5.8 million in federal and private-sector grants and contracts.

STRATEGIC IMPACT:

In 2008, $65 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 2008, 597 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	$11,135,534	$2,691,099	$13,826,633
Grants & Contracts Received	45,480,234	5,792,722	51,272,956
Total Funds	$56,615,768	$8,483,821	$65,099,589

2008 UNIVERSITY OF MAINE *HIGHLIGHTS*

GRANTS AND CONTRACTS:

The Return on Investment in University-based Research

Total new dollars (MEIF + all grants) available for R&D expenditures were $65,664,571 in FY08. UMaine used $11,135,534 in MEIF funds to leverage $45,480,234 in external grants and contracts in the state's seven targeted sectors (see table below).

TABLE 1.

MEIF Leveraged New FY08 External R&D Grants and Contracts in the Seven Sectors — Dollars/Sector

State Technology Sectors	Amount
Forestry and Agriculture	$10,122,678
Aquaculture and Marine	$7,414,345
Biotechnology	$3,207,729
Composite Materials	$8,319,474
Environmental Technologies	$4,167,250
Information Technologies	$8,457,940
Precision Manufacturing	$2,884,664
Cross Sectors	$906,154
Total Grants/Contracts/Gifts Leveraged	**$45,480,234**

The increase in R&D infrastructure and activity has enhanced UMaine's capacity to spur industrial growth, with industry contracts for FY08 totaling $4.1 million.

UMaine submitted a total of 619 proposals during FY08, involving 339 faculty and professional staff from 57 departments or units as principal investigators or co-investigators. A total of $217.3 million was requested from external sponsors, up from $137 million in the previous year. UMaine faculty and staff produced more than 3,500 publications in FY08, including papers, books, book chapters, and technical reports.

POSITIONS LEVERAGED

In FY08, 509 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.

- More than $2.5 million in new equipment was procured to support UMaine R&D activity. Major purchases (greater than $50,000) through various FY08 grants included 20+ pieces of scientific equipment. This equipment outfits labs throughout the university.
- Planning began on numerous facilities that were subjects of proposals to the R&D Bond competition.

INCREASED STUDENT INVOLVEMENT IN RESEARCH

Nearly $4 million from grants and contracts was used to support students' tuition and salaries to work in all technology sectors, including over $1,000,000 to support more than 433 undergraduate students. Many of the student projects are featured in this report.

Lisa Kranich, Biochemistry and Molecular Biology major; UMaine Molecular Forensics Lab

TECHNOLOGY TRANSFER AND COMMERCIALIZATION

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

In FY08 UMaine filed 23 new patent applications. Six new U.S. patents were issued and 3 were published by the U.S. Patent and Trademark Office (USPTO).

US Applications – Issued in FY08

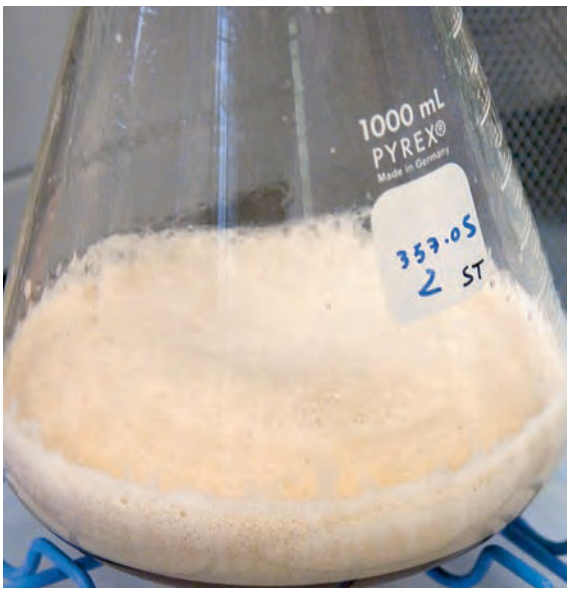
- **U.S. 7,403,867** Spectroscopy instrument using broadband modulation and statistical estimation techniques to account for component artifacts (precision manufacturing)
- **U.S. 7,396,974** Oxidation using a non-enzymatic free radical system mediated by redox cycling chelators (environmental technologies)
- **U.S. 7,360,565** Fuel overflow prevention device (environmental technologies)
- **U.S. 7,358,593** Microfabricated miniature grids (precision manufacturing)
- **U.S. 7,300,894** Composites pressure resin infusion system (ComPRIS) (composite technologies)
- **U.S. 7,285,894** Surface acoustic wave devices for high temperature applications (precision manufacturing)

U.S. Patent Applications published by USPTO during FY08

- Process of treating a lignocellulosic material (application #20080142176)
- Composite panels for blast and ballistic protection (application #20070180982)
- Composite construction members and method of making (application #20070175577)

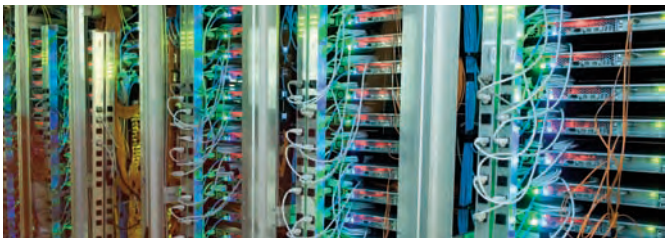
New Patent Applications Filed by UMaine during FY08

- Hemicellulose and pulp production
- Method of producing carbon nanotubes using natural fiber as the starting substrate
- High-temperature surface acoustic wave sensor
- Fire-retardant treatment for wood fiber insulation products
- Collector module for bioaerosol particles
- Coated wood products for ballistic resistance
- Netforms prefabricated sectional roofing system
- Cargo container intrusion monitoring
- Detection of chemical compounds using reactive films and IR spectroscopy
- Agricultural film (licensed to Cerealus)
- Infrared-based iron sensor
- Method to improve wood pellet manufacturing process and quality
- Separation of acetic acid from an acidic aqueous wood extract
- Process to convert lignocellulosics into products with high yield and efficiency
- Method of producing high-yield pulp
- Method of producing composition useful as dry strength additive and/or retention aid
- Fire-resistant fibrous composite articles
- Interior blast and ballistic protection of ISO container
- Zeolite composite materials for waste odor control
- Biologically active peptide and method of using the same invention
- RSE process



Efficiently extracting hemicellulose is key in forest biorefining.

2008 UNIVERSITY OF MAINE *HIGHLIGHTS*



TECH-BASED START-UP COMPANIES

Several existing start-up companies made significant milestones in the past fiscal year.

Maine Marine Manufacturing, a start-up company commercializing technology developed during the design, test, and build of the U.S. Navy Mark V.1 technology demonstrator (Navy Seal Boat), announced plans to open a shipyard in Hampden to build new vessels employing these technologies. (See "Vessel" story on page 19.)

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." 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 seventh 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. Combined, tenant companies raised more than $3 million in investment capital and research grants this year.

- **Stillwater Scientific Instruments (SSI)**
  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.

- **Intelligent Spatial Technologies (IST)**
  IST is a University of Maine spin-off company formed to commercialize the technology developed by 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 high-value data against the risk of compromise by trusted insiders, as well as outside pirates. Its focus is on national security. It also partners with UMaine's supercomputer program to further the company's development and commercialization activities. (See related story on page 21.)

- **Maine Secure Composites LLC**, a start-up commercializing secure composite container technology for the Department of Homeland Security, received approval of an additional $13 million federal contract. The first $3 million has been funded, with the balance available based on success. MSC has just opened a light manufacturing facility in Bangor and continues to maintain office space at the Target Technology Incubator. (See related story on page 17.)

- **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**
  Started by a new media graduate student at the University of Maine, versionZero development company now has clients in New York City and throughout the State of Maine. The company was hired to redesign the Web site for the Bangor Region Chamber of Commerce, and has worked with UMaine departments to develop marketing and trade show materials, including the Forest Bioproducts Research Initiative.

- **Knife Edge Productions**
  A digital video company founded by two UMaine graduates, Knife Edge combines the latest video hardware and software with artistic talents and innovative visions.

Deborah Neuman, Director of the Target Technology Incubator

New Tenants and Graduates

- **Zeomatrix LLC - New**
  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.

- **Orono Spectral Solutions - Graduate**
  OSS is a UMaine spin-off company commercializing patented and patent-pending liquid sensor technology developed in UMaine's Laboratory for Surface Science and Technnology. The company recently secured over $2 million in development funding and moved into its own facility in Old Town, Maine.

Target 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 commercializing new technologies.

- Forest Research (advanced technology for forestry and agriculture)
- Just Enough, LLC, d.b.a. GudMuse (information technologies)
- Mainely Sensors (UMaine patents in precision manufacturing)
- Com-Jet Papers (advanced technologies for forestry and agriculture)
- Spill Free Oil Drainage Products LLC (precision manufacturing)
- Tirranna (information technologies)

The Center for Cooperative Aquaculture Research at Franklin

The Franklin Center provides on-site space for start-up aquaculture businesses. FY08 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 FY08

- BioEdge Fishing Products
- Maine Halibut
- Sea Vegetable Solutions Inc.
- Friendship International
- Great Bay Aquaculture
- Little Pearl LLC

2008 UNIVERSITY OF MAINE *HIGHLIGHTS*

UMAINE STUDENT START-UPS

Forever Green Laminates

This company is positioning itself to be an innovator in the manufacturing and installation of Structural Insulated Panels (SIPs). SIPs provide an alternative to traditional, stick-framed housing that is stronger and much more energy efficient. It is working with the Advanced Engineered Wood Composites (AEWC) Center and the Advanced Manufacturing Center (AMC). The company was founded by a UMaine alumnus, with assistance from an MBA student.

Local Food Solutions

Local Food Solutions is a value-added food processor that networks with local family farms to brand, process, and distribute their products. Through this service, local family farms can receive a higher price for their products and maintain their farm's identity throughout the supply chain, and the consumer has easy access to local food and the peace of mind knowing where it came from. LFS won the 2008 Green Products Business Plan Competition and is currently working with a local organic dairy farm to pasteurize and bottle its milk. (See related story on page 23.)
Team members: 2

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 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, the technology boards, and proposal review committees.

The 2007 R&D Bond — Maine Technology Asset Fund

In November 2007, Maine voters approved a $50 million R&D bond to support research development and commercialization at Maine's universities, nonprofit institutions, and private companies. A program called the Maine Technology Asset Fund was created by the Maine Technology Institute to administer the funds and make competitive awards to Maine applicants working on technologies within the state's seven designated sectors (MEIF sectors). This new process replaced previous R&D bond funds and required UMS institutions to compete through a peer-reviewed grant process. The funds can be used for standard bond expenses, such as equipment, buildings, and lab renovations. Proposals were required to be collaborative in nature, and partnering with complementary organizations and companies.

The University of Maine had 5 successful proposals and was a major partner on 2 additional ones.

Maine Technology Asset Fund Projects at UMaine

Center	Project Title	Project Location	Award Amount
AEWC Center, University of Maine	Advanced Nanocomposites for the Renewable Energy Industry	Orono	$4,999,460
Center for Cooperative Aquaculture Research, University of Maine	Building Capacity and Excellence in Maine's Marine Aquaculture R&D Infrastructure	Franklin	$2,619,807
Department of Physics & Astronomy, University of Maine	Ultra-High Resolution Imaging Facility	Orono	$158,706
Forest Bioproducts Research (FBRI) Technology Center, University of Maine	Forest & Ag Bioproducts Research, Development & Commercialization Facility	Orono & Old Town	$4,800,000
Laboratory for Surface Science & Technology (LASST), University of Maine	Maine Nanofabrication R&D Infrastructure Enhancement	Orono	$480,000
Company & UMaine Partnership			
CrossRate Technology LLC & Electical and Computer Engineering	Portable Non-Magnetic Compass/Positioning/Timing Device	Standish & Orono	$794,445
Maine Aquaculture Innovation Center and Center of Cooperative Aquaculture Research	Improvements to Maine's Aquaculture Business Incubation Infrastructure	Franklin	$360,548

UNIVERSITY OF MAINE FY08 HIGHLIGHTS

Total new R&D funding in FY08 was $65.6 million. Of that amount, MEIF funds accounted for $10.96 million, which was leveraged to bring in an additional $45.5 million in external grants, exclusively in the seven target sectors.

- A total of 619 proposals were submitted involving 339 researchers and 57 departments, with $217.3 million requested from external sponsors.
- More than 3,500 publications, papers and presentations were produced by faculty and staff.
- UMaine leveraged $45.5 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' tuition and salaries to work in all technology sectors, including over $1,000,000 to support more than 433 undergraduate students.
- Over $2.5 million in major equipment was secured to outfit labs throughout the university.
- A total of 23 new patent applications were filed, and six new U.S. patents were issued.
- The Target Technology Incubator housed 6 tenants, supported 7 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 5 companies moving toward full-scale commercialization.

2008 UNIVERSITY OF SOUTHERN MAINE *HIGHLIGHTS*

GRANTS AND CONTRACTS:

The Return on Investment in University-based Research

THE UNIVERSITY OF SOUTHERN MAINE invested $2.7 million in state funding to leverage $5.8 million in federal and private-sector funding for MEIF-related contracts. Overall grant and contract activity at USM exceeded $40 million.

POSITIONS LEVERAGED

In FY08, MEIF dollars and the R&D grants and contracts those funds generated supported 88 full-time equivalency positions, including faculty, technical staff, and students.

In this year's MEIF report, USM focuses on faculty and student collaborations in research in the bioscience and information sciences, USM's areas of R&D investment. Throughout the stories highlighted here are examples of Maine students engaged in hands-on research under the guidance of committed and expert faculty. The excitement and enthusiasm for this work has generated new connections with local industry, national, and international recognition, encouraging career pathways for aspiring researchers and entrepreneurs.

STUDENTS AS RESEARCHERS

Wise Lab Highlights

Student involvement in faculty research has elevated the achievement and recognition of USM students as promising researchers in the fields of science and technology. The Wise Laboratory of Environmental and Genetic Toxicology at USM exemplifies productive student-faculty collaborations, with notable results:

- The Wise Laboratory reached a new milestone with its 25th peer-reviewed journal article published since 2006. Co-authors include 11 USM faculty and research staff, 11 graduate students, and four undergraduate and two high school students.
- Students in the Wise Laboratory received 12 regional, national or international research awards during the same period, including poster awards at scientific conferences, sponsored internships with NASA, and prestigious graduate fellowships from the Environmental Protection Agency (EPA) and Fulbright. Half of these awards went to graduate students, half to undergraduates.
- Since 2006, the Wise Laboratory has employed and trained over 50 students spanning all levels of educational development. Seventeen graduate students (master's and doctoral level) have conducted toxicology research in the lab, overseeing and mentoring the contributions of 19 undergraduate students and 15 high school interns representing seven southern Maine high schools.

Student Symposium: Thinking Matters

The high level of student participation in active research programs across the USM campuses has become the hallmark of the annual student symposium "Thinking Matters", a comprehensive, one-day conference that allows students and faculty from all fields to share their work with peers, their colleagues, and the public.

Over 150 student projects featured at the annual symposium demonstrate the broad range of research and scholarship that engages students directly in work that enriches their lives and their communities.

$3.1M NSF Grant Helps Attract Students with Disabilities to Technology Careers

From high school to graduate school, programs aimed at increasing participation in science, technology, engineering, and math (STEM) flourished in the past year at USM, in part because of the opportunities for student involvement in faculty research projects. The National Science Foundation has awarded $3.1 million to a USM alliance to increase the number and diversity of Maine students receiving degrees in science, technology, engineering, and mathematics. The five-year grant will fund Eastern Alliance in Science and Technology, developed by USM, several Maine community colleges and southern Maine high schools, to provide support and training in STEM activities for educators and students.

The goal is to encourage students with disabilities to choose science- and technology-related majors and careers by developing support systems, and by helping educators make science and technology more accessible.

An estimated 20 percent of the U.S. population has a disability, but only 5 percent work in scientific and engineering fields.

Summer Undergrad Research Fellowship

Each summer, eight students at USM are accepted into the Summer Undergraduate Research Fellowship (SURF) program to conduct research, scholarly or creative projects with a faculty mentor. Once selected, they receive a $2,600 fellowship, plus expenses, enabling them to take a more in-depth look at a subject that interests them. The group meets regularly to share their progress; at the end of the eight-week fellowship, they give formal presentations of their findings. This year, 23 students applied for the eight fellowships. Students from all academic disciplines and majors are eligible. This year's fellows are not only in physics and biology, but also philosophy, history, and media studies.

Cooperative Program Increases State R&D Capacity

As part of a cooperative Ph.D. program, USM, UMaine, the Jackson Laboratory, the Mount Desert Island Biological Laboratory, and the Maine Medical Center Research Institute are sharing a variety of academic and research resources, including professional and faculty expertise and a talent pool.

Eleven doctoral students are currently taking part in the program at USM, working as research associates in the university's laboratories. Researchers at the partnering institutions are eligible to earn doctoral degrees through the University of Maine or to conduct postdoctoral study in their specializations, and scientists are allowed to hold appointments as adjunct graduate faculty. Degrees being offered through this program include biochemistry, molecular biology, and biomedical sciences with concentrations in toxicology, immunology, epidemiology, and virology.

High School Students Assist with Lab Research

Students from Windham High School have been volunteering each week in USM's Wise Laboratory of Environmental and Genetic Toxicology. Working with research staff, who include several faculty, Ph.D., master's, and undergraduate students, the high school students are testing chemical damage to DNA and the toxicity of certain compounds.

USM also participates in the Maine Space Grant Consortium's MERITS (Maine Research Internships for Teachers and Students) program, which provides summer research opportunities for high school juniors and seniors interested in careers in science, technology, engineering and mathematics. They have the opportunity to experience "real-time" applications in a research-focused work world at host institutions conducting research and technology development.

UNIVERSITY OF SOUTHERN MAINE FY08 HIGHLIGHTS

- USM's R&D activity reached a new high of $8.5 million in FY08. This amount includes $2.7 million in state MEIF allocation and $5.8 million in new grant awards from federal and private sector sources.
- Total proposal submissions by USM increased to 249 in the past year, and funds requested were up almost 30 percent to $78 million. Significantly, 73 of these proposals were for R&D projects, with $32 million in external funds requested.
- Overall grant and contract activity at USM continued to exceed $40 million, despite increased competition for federal dollars, a general downturn in the economy and tightening of resources.
- R&D projects in the School of Applied Science, Engineering and Technology generated the greatest increase in funding levels in 2008, with a doubling of awards from the prior year.
- In FY08, MEIF dollars and the R&D grants and contracts those funds generated supported 88 full-time equivalency positions, comprising faculty, staff, and students.

Collecting eggs from an adult female halibut are CCAR research assistant Marcela Hincapie and operations manager Nick Brown

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.

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.

Coral Reef Loss Impacts Marine Life

A rise in the temperature and acidity of the oceans that threatens the existence of the world's coral reef ecosystems could also have troubling implications for marine life and fishing industries, according to University of Maine professor of marine sciences Robert Steneck.

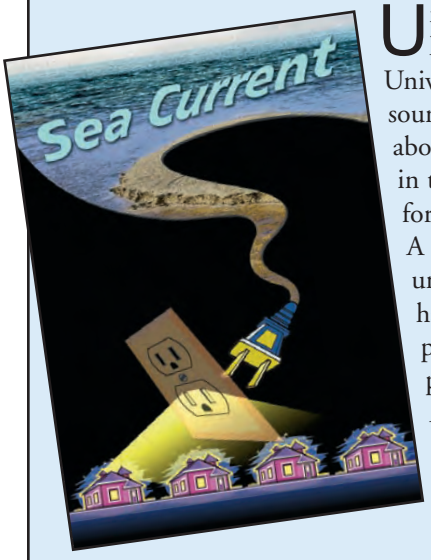
Steneck is one of several authors of a new study predicting that increasing concentrations of carbon dioxide in the atmosphere, if not abated, will continue to deteriorate coral reefs to the point where they are likely to disappear altogether in the next few decades.

Coral reefs are made of limestone, which lobsters, sea urchins, clams, and scallops need to calcify the hard parts of their bodies. Reduced carbonates in the world's oceans are forcing marine creatures to spend more energy making their shells, placing them under greater stress.

While some marine organisms have shown they can adapt to warmer temperatures, the projected increases in carbon dioxide buildup and temperature will overwhelm that ability in the decades to come.

Because eliminating emissions won't happen overnight, Steneck urges the fishing industries in Maine and elsewhere to manage themselves with greater sensitivity to the health of the ecosystems that sustain them.

Tidal Power Generation Projects



University researchers are hoping to make the University of Maine a leading source of public information about tidal power and its role in the larger energy picture for the state and the nation. A variety of projects are under way in Maine, which has some of the most promising potential tidal plant sites in North America — Cobscook Bay and the Western Passage of Passamaquoddy Bay.

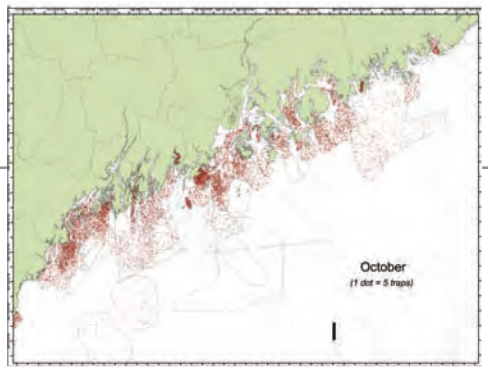
- UMaine oceanographer Huijie Xue uses sophisticated 3D computer models to examine the circulation characteristics of Cobscook Bay. Her group has also created maps outlining the areas of highest density where turbines would be able to extract the most energy.
- In another lab, Kiran Bhaganagar, assistant professor of mechanical engineering, has a supercomputer that can determine the velocity of fluid motions from which power is extracted. Turbines can then be introduced into the equation to determine how they alter the character of the current. She believes that coupling her data with Xue's ocean circulation model would create an extraordinarily valuable resource for the development and teaching of tidal energy.
- In an engineering lab directed by Michael "Mick" Peterson, Libra Foundation professor of engineering, graduate students are working on a computer model of a propeller design that can be adapted for use as a tidal turbine. Undergraduate students used the model to build a turbine and test its power-generating potential in a 120-foot tow tank.
- At the Advanced Engineered Wood Composites Center, Robert Lindyberg, the assistant director for boatbuilding and composites, is working with his industry partners to identify tidal generation systems with the potential to use composite materials in their designs.

Mississippi Mud

How much carbon Mississippi River mud contributes to the ocean and to the atmosphere is the focus of research by a University of Maine Ph.D. student in oceanography.

Margaret Estapa, a recent recipient of a NASA Earth and Space Science Fellowship, is measuring the release of carbon from mud delivered by the Mississippi River and deposited along the Gulf of Mexico coast.

When exposed to intense sunlight, some of the carbon is released from the mud and flows out into the ocean, where it could be consumed in the ocean food web or released as carbon dioxide, a heat-trapping greenhouse gas. Using light-measuring equipment and satellite data, Estapa is hoping to determine how much carbon is liberated by the sunlight, and how much remains buried in the mud.



Taking Stock of Maine's Lobster

Is Maine's lobster stock healthy? That's the focus of UMaine fisheries population dynamics researcher Yong Chen.

Chen found that existing study models used only one source of survey data, which didn't include the range of lobster sizes and ages. He developed a new computer model based on lobster size that accounted for many factors, including seasonal patterns and lobster biology.

In 2008, the model was adopted by the Atlantic States Marine Fisheries Commission to assess all the lobster stocks in the United States.

For Chen, the key to his research is working closely with managers and biologists, and attending government meetings to get input. Chen regularly meets with staff at Maine's Department of Marine Resources (DMR) and many DMR employees take his course in fisheries population dynamics.

In turn, DMR provides Chen with data collected in its trawl surveys and landings reports from fishermen, which he uses to develop models and assessments that he hands back to the agency.

Left, Yong Chen with third-year Ph.D. student Yuying Zhang

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

Arsenic and Zebrafish

In one of the first reports of its kind, UMaine microbiologists have shown that arsenic exposure, at levels deemed safe in drinking water, suppresses the overall innate immune health in zebrafish.

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

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

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

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

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

Peppers May Help Burn Fat

Researchers at UMaine's Department of Food Science and Human Nutrition received a $100,000 grant from the U.S. Department of Agriculture Cooperative State Research, Education, and Extension Service to study the levels of capsinoids present in different varieties of peppers.

Satyavan Singh

Like their spicy counterpart, capsaicinoids, these naturally occurring compounds have antioxidant and antimicrobial properties, and they've been shown to increase the metabolism of lab rats. Translated to the human population, these compounds may help us burn fat as well.

However, unlike capsaicinoids, capsinoids don't cause a tingling sensation on the skin or burning in the stomach.

Researchers Satyavan Singh, a master's student, and adviser Brian Perkins, synthesized analytical capsiate standards, and developed a method for extracting and quantifying the compound. Singh then spent a year screening 500 varieties of peppers in which capsinoids were present in 50 of them. Singh now uses the lab's cutting-edge gas and liquid chromatography equipment to extract and measure capsinoid levels in the top 10.

Singh's results could be used to help commercial food processors introduce new varieties of peppers into their food lines, raising both the nutritional and monetary value of their products.

Clinical laboratory sciences major Stephanie Bouchard, left, in class with Anne Hanson

Culture Club

UMaine's microbiology lab, led by instructor Anne Hanson, tests pathogens and documents results so students and colleagues — on campus and worldwide — can benefit. Her work is part of the Atlas-Protocol Collection, developed in 2004 as a training tool for microbiology students and faculty.

The protocol collection includes images, historical background, and step-by-step instructions to help educators replicate the tests in their own labs. Hanson and other collection contributors must conduct the lab work and have the accompanying written materials peer reviewed, a process that takes about a year from start to finish.

For undergraduate microbiology instructors, the Atlas-Protocol Collection is an invaluable tool. Working with pathogens can be risky, and many smaller schools or organizations don't have the proper safeguards. Pathogens must be tested in a sterile environment. They require specific conditions for growth and must be disposed of properly. For schools that don't have a comprehensive microbiology curriculum, those demands can be cost-prohibitive.

Though UMaine students are able to conduct the tests with live pathogens, they still turn to the collection's online microbe library when they need to see how a test result should look. The students who plan to work in a clinical setting say they'll continue to use it as a reference, for example, to accurately diagnose a staph infection or a strep throat.

Unlocking Disease-fighting Secrets

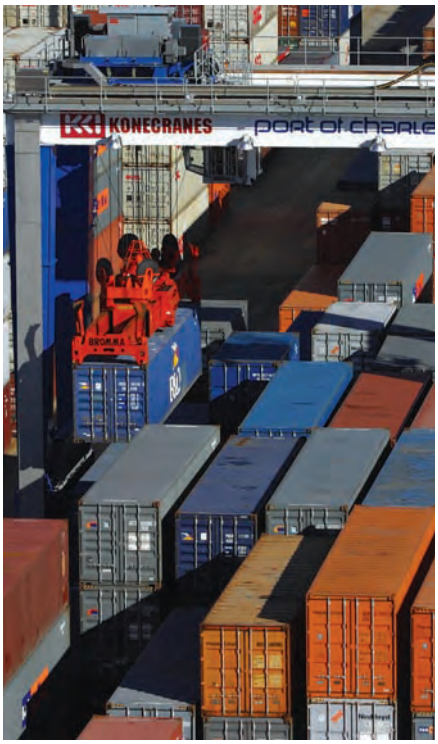
With a five-year, $1.4 million grant from the National Institutes of Health, University of Maine microbiologist Carol Kim will conduct a comparative immunology study to shed light on the distinctions that evolved in the innate immunity systems of zebrafish and mammals, such as mice and humans. Kim is director of UMaine's Graduate School of Biomedical Sciences.

Her prediction is that identifying those unique disease-fighting molecular processes in the zebrafish will provide researchers with clues to finding similar defense mechanisms as yet unidentified in humans.

Unidentified components may be masked or maintain minor roles in the complex structure of mammals' innate immunity. But if their contributions to the body's immunity system were boosted, the result could be a complementary approach to fighting infectious disease.

The research could open the possibilities for new vaccines.

Carol Kim



Tamper Resistant Cargo Containers

The University of Maine's considerable resources and expertise in the areas of composites and sensor technologies are being utilized 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 Dagher, received a U.S. Department of Homeland Security (DHS) 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 they can be packed, stacked, and shipped like any others on the market. The composite panels are designed in such a way so that they can "host" a wide 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.

Ballistic Panels Lauded

Construction panels with a lightweight coating that gives them the strength to withstand bomb blasts and hurricane-force winds are being developed by UMaine's Advanced Engineered Wood Composites (AEWC) Center for the U.S. Army Corps of Engineers.

The panels create a 12-foot by 20-foot building that can be raised by a dozen people in approximately 90 minutes. Such a blast-resistant structure could have military and homeland security applications, and residential uses in areas prone to severe weather.

Blast testing of the modular structure at Fort Polk in Louisiana last August found the coated construction material to be up to seven times more energy absorbing than conventional wood structures.

The coated wood is the second type of blast-resistant building material developed by AEWC in the past two years. Ballistic panels that fit inside tents to protect soldiers in combat zones were developed in AEWC labs and are now being field-tested in Iraq and Afghanistan. That technology was recognized by the American Composites Manufacturers Association as the "Best of the Best" in 2007, signifying its status as the year's top composites technology innovation.

Photo courtesy of NASA

NASA Grant Develops Wireless Sensors

Initial funding by the Maine Space Grant Consortium led to a $1.5 million grant from the NASA Experimental Program to Stimulate Competitive Research (EPSCoR) and the University of Maine.

UMaine electrical and computer engineers Ali Abedi and Mauricio Pereira da Cunha have teamed up with mechanical engineers Vince Caccese and Mohsen Shahinpoor, as well as University of Southern Maine computer engineer Mariusz Jankowski to develop a first-of-its-kind wireless sensor network system to monitor the structural integrity of inflatable space structures after they've been deployed in space.

The wireless system will allow the researchers to visualize the shape of a structure after it is deployed. That final shape data, when compared with computer modeling data, can be used to assess how successfully the structure was inflated and eventually to help in correcting any troubling deformations.

The researchers plan to involve 15 undergraduate and four graduate students in the three-year project. They will be trained in campus laboratories, as well as at NASA's Johnson Space Center in Houston, Texas, and Glenn Research Center, Cleveland, Ohio, which are collaborating on the UMaine research and development work.

The UMaine team also intends to create new course materials pertaining to the research and to hold seminars for the public at high schools in the state.

New Patent Granted for Composites Technology

Researchers at UMaine's Advanced Engineered Wood Composites (AEWC) Center have developed a new composite fabrication process that they hope will revolutionize the industry.

Their method involves the use of applied pressure to infuse polymer resins into fabrics, wood, concrete, ceramics, and other materials to produce stronger, more durable composites for the marine, automotive and construction industries, and others.

Barry Goodell, a professor of wood science and technology in the College of Natural Sciences, Forestry, and Agriculture, Roberto Lopez-Anido, associate professor of civil and environmental engineering in the College of Engineering, and Ben Herzog, a former UMaine grad student now working as a scientist with APA – The Engineered Wood Association, were granted a patent for their Composites Pressure Resin Infusion System, or ComPRIS.

The use of pressure produces a more consistent, evenly distributed resin infusion that saves both money and labor and is environmentally safer than other methods. It also allows fabricators to produce more complex infusions, including simultaneous laminating and reinforcement of other materials.

The ComPRIS technology can produce very thick composite products without the microscopic voids caused by a vacuum process. Wood products can also be reinforced and laminated at the same time. When properly infiltrated with resin, wood becomes more stable and decay-resistant, thereby eliminating or reducing the need for preservative treatments.

Although the AEWC Center does not produce composites commercially, it does make prototype products to attract industrial partners who can help develop the technology.

2008 COMPOSITE AND ADVANCED MATERIALS TECHNOLOGIES

U.S. Navy Prototype Vessel Debuts

UMaine, the Office of Naval Research (ONR), and Maine Marine Manufacturing, a spin-off of Hodgdon Yachts in East Boothbay, teamed up to design new materials for the U.S. Navy SEAL's Mark V.I special operations craft.

An 83-foot research prototype was unveiled in January 2008. The prototype, developed for ONR and Special Operations Command, looks similar to the current patrol boats, but is constructed with a new hull made from composite materials.

The vessel's construction united cutting-edge composites technologies spearheaded by UMaine's Advanced Engineered Wood Composites Center and the long tradition of quality boatbuilding at Hodgdon Yachts.

A primary goal of the redesign is to absorb the shock created by high-speed travel, which is transmitted to the vessel's occupants, resulting in injuries. The prototype is 50 percent stronger and somewhat lighter than the vessel currently used by the Navy.

By combining the facilities and expertise at Hodgdon Yachts with the technological advances being made at UMaine, the team has the potential to compete for $200 million in contracts to build the new vessels and offer a huge boost to Maine's shipbuilding industry.

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

Discovering What's Next: Maine Technology Asset Fund Awards

In August, the Maine Technology Institute identified the first 14 projects to receive nearly $30 million of the $50 million R&D investment Maine voters approved last fall. University of Maine researchers developed five of the funded projects, which were awarded more than $13 million. The largest award of nearly $5 million funds two Advanced Engineered Wood Composites Center (AEWC) initiatives focused on the renewable energy and transportation industries. One laboratory addition will support processing of nanocomposites from cellulose fiber. Another will be used for pilot manufacturing and large-scale structural testing of advanced composite structures for the energy industry, one of the fastest-growing markets for composite products. In such a facility, researchers will test the integrity of structures such as turbine blades to harness wind and tidal energy. AEWC has begun structural testing of wind blades and is pursuing research to integrate nanomaterials into composite products for improved strength and durability.

Advanced Engineered Wood Composites (AEWC) Center

Mussels Hitch a Ride

When it's time for the larvae of freshwater mussels to disperse, they hitch a ride on the gills, fins or scales of certain fish species. Finding out which fish the parasitic larvae prefer as hosts is essential to regional conservation efforts leading to recovery of natural populations.

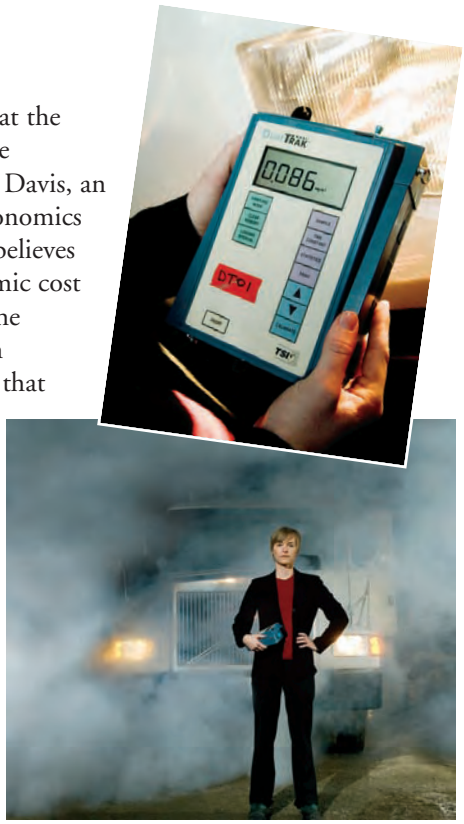
In Maine, that's particularly important to two state-designated threatened species — the yellow lampmussel and tidewater mucket.

University of Maine wildlife ecologists Stephen Kneeland and Judith Rhymer have developed and used a molecular identification key for the 10 species of freshwater mussels in Maine in an effort to determine which fish in the wild serve as hosts for the larvae.

In their research, DNA samples were taken from mussels in the Penobscot, Kennebec, and St. George River drainages in Maine. The key was used to successfully identify more than 680 larvae on the gills of 230 fish, representing 18 species from 13 locations in the study area.

As a conservation tool, molecular identification keys provide efficient and accurate information on host use by the entire mussel community. In this case, potential new host fish were identified for five of six mussel species, including three considered by the state to be of "special concern."

Costs of Being on the Road and on the Seas



Mary Davis

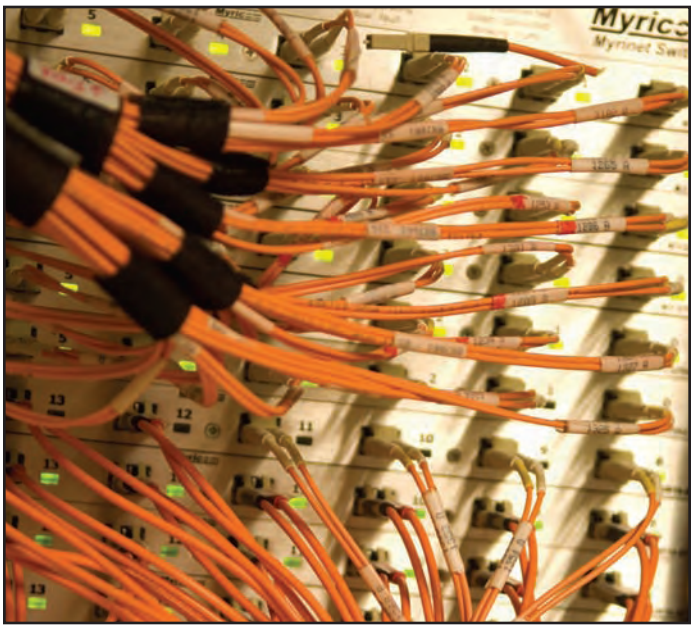
One UMaine researcher is looking at the impact of the environment on the development of human diseases. Mary Davis, an assistant professor in the School of Economics and environmental health economist, believes that in order to understand the economic cost of exposure to airborne pollutants or the policies that address such public health concerns, she must learn the nature of that exposure and whether it causes illness.

Some of the important industries she is analyzing:

- One project is a comprehensive examination of the connection between elevated lung cancer rates and exposure to diesel exhaust fumes among some 55,000 unionized truck drivers. Davis helped to collect and analyze 5,000 air samples from 36 trucking terminals nationwide. She is creating an exposure model to predict the risk of lung cancer for employees in various aspects of the trucking industry, including drivers, diesel forklift operators, and loading dock workers.
- Funded by a $200,000, two-year Maine Sea Grant, Davis has teamed up with the Harvard School of Public Health, and the Maine Marine Patrol on a first-ever assessment of the rate of safety compliance among Maine commercial fishermen. Her research will be used to create an economic model of the cost of compliance, which can then help industry regulators better understand the impact of imposing new federal safety laws in the future.

New Use for Idled Paper Equipment?

Money may not grow on trees, but good health just might. Resveratrol, the antioxidant compound found in grape skins and red wine, is also present in the bark and foliage of trees harvested from Maine forests. University of Maine chemistry professors Barbara Cole and Ray Fort, along with graduate student Regan LeBlanc, are researching the viability of extracting resveratrol using equipment Maine's pulp and lumber mills already have. If it proves to be economically feasible, partnerships with pharmaceutical companies could be a huge boon to the industry.



Supercomputer Will Benefit Maine Schools

Schoolchildren in Maine soon will have an opportunity to experiment with variable climate change scenarios by accessing UMaine's environmental modeling programs from their classroom laptops.

The UMaine Department of Computer Science has received two National Science Foundation grants — $200,000 to buy a second supercomputer and $300,000 to develop new supercomputer software — to improve the transfer of massive data files.

The new supercomputer and an access portal being developed will allow Maine middle school students to access the University of Maine's Ice Sheet Model for environmental experiments. It also will enable the university to engage in much greater outreach and research activities, the type that require massive computing power, according to Phillip Dickens, a UMaine professor of computer science and the principal researcher receiving the grants.

Computer science faculty and students will create a user-friendly, scientific grid portal for accessing UMaine's vast computing resources, scientific applications, and research animations. Users, ranging from Maine's top research scientists to students, will access the grid portal with a standard Web browser.

The new 96-processor supercomputer is housed at Target Technology Center in Orono. The supercomputer will support the work of participating faculty, in addition to research by members of Maine's general research community, including Jackson Laboratory.

Cyber Caddie

Neither UMaine junior James Daniels nor Kurtis Petersons, a 2005 UMaine graduate, is a golfer, but that didn't hinder collaborative development on a prize-winning reality-based golf program.

The $10,000 cash prize and a $15,000 consulting services package they won in the annual statewide Business Plan Competition held by the Center for Entrepreneurship at the University of Southern Maine in April has enabled mCaddie to move to the next development level — national launch of a limited version of the program.

mCaddie allows golfers to track and replicate an actual game with a simultaneous virtual one that generates statistics. In addition, mCaddie offers an online social clubhouse, and allows players to see which of their friends are playing golf at a given time and how they are doing.

The system begins on the green with a cell phone with GPS function. Players save their tee off location with a waypoint. As the game progresses, mCaddie logs strokes and ball travel distances. The game is saved to the mCaddie Web site, where it can be reviewed and analyzed, or viewed by other players.

Petersons came up with the idea for mCaddie and Daniels provided the technical expertise. Since January 2008, the two have been refining mCaddie with help from UMaine's Foster Student Innovation Center and the Maine Center for Enterprise Development in Portland.

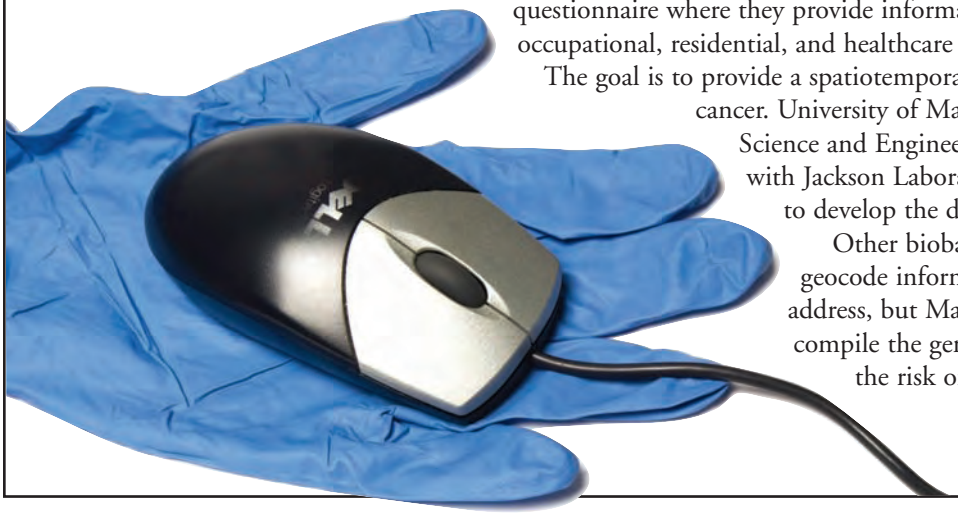
Mock-up of the iphone screenshot, courtesy of James Daniels

Cancer Biobank

In 2007, the Maine Institute for Human Genetics and Health launched the Biobank of Maine with a $1.8 million award from the Department of Defense. The goal is to investigate the effects of rural environments on human genetics and health to find solutions to reducing the high rates of cancer in Maine.

The biobank has two core components — a cancer tissue repository managed by the Maine Institute for Human Genetics and Health, and a complex geographic information system (GIS) database developed by the University of Maine and the Jackson Laboratory.

The first of the tissue samples were deposited in the biobank in November. Patients consenting to have their postsurgical blood and tissue samples archived in the repository complete a confidential geospatial questionnaire where they provide information about their behavioral, occupational, residential, and healthcare histories.



The goal is to provide a spatiotemporal database of the state's incidence of cancer. University of Maine Professor of Spatial Information Science and Engineering Kate Beard-Tisdale collaborated with Jackson Laboratory bioinformatics scientist Carol Bult to develop the database.

Other biobanks across the country record some geocode information like the patient's last known address, but Maine will be the first to comprehensively compile the gene-environment interactions that change the risk of cancer.

Using Math In Innovative Research

In May, David Hiebeler, a UMaine mathematics professor, received a five-year, $400,000 National Science Foundation career award — the most prestigious honor for promising young scholar-researchers. This marks the first NSF Faculty Early Career Development Grant for a professor in the UMaine College of Liberal Arts and Sciences.

Hiebeler's research centers on mathematical population ecology and epidemiology. Real-world applications for the research include understanding more effective pesticide application in Maine blueberry fields, studying how infectious diseases spread, and predicting and perhaps combating the worldwide spread of malicious software, such as viruses and worms, through computer networks.

To help incorporate undergraduate and graduate students into his research, Hiebeler established the SPEED (Spatial Population Ecological and Epidemiological Dynamics) Lab.

An earlier $180,000 NSF award made it possible for Hiebeler to hire more UMaine students and expand the lab's outreach to area high school students. In the future, high school students will meet weekly on campus to begin training with Hiebeler and his undergraduate students. They will later become directly involved in SPEED Lab research projects. By working with high school students, he hopes to cultivate their early interest in mathematics.

David Hiebeler

Competition Helps Launch "Green" Start-Ups

Justin Jamison's vision is to one day have a microdairy specializing in organic milk as part of a natural foods retail store, specializing in local produce and products.

The UMaine graduate student in business administration shared his entrepreneurial spirit and enthusiasm for local food production and promotion with MBA classmate Brooks Einstein and, together, they developed a business plan for launching a microdairy to supply local organic milk to the Bangor area.

In early 2008, their concept for Local Food Solutions got one step closer to reality with a $5,000 boost as the top prize in the 2007– 08 Green Products Business Plan Competition, sponsored by UMaine's Foster Student Innovation Center.

In the Green Products Business Plan Competition, participants describe the commercialization of a green product made from biobased, recycled or recyclable materials, or a technology that reduces environmental pollution or produces renewable energy. The prize money from the Green Products Competition will fund market research to determine such critical factors as the extent of the consumer base and how much organic milk the facility would have to process annually to be viable.

$30M DOE Biorefinery Grant Awarded

An innovative partnership involving UMaine, Red Shield Environmental and American Process Inc., was awarded an April 2008 grant of up to $30 million from the U.S. Department of Energy to design, build, and operate a small-scale commercial biorefinery. This biorefinery will produce ethanol, acetic acid, and other by-products, along with market pulp in the existing mill located in Old Town.

This award is the largest grant ever involving UMaine research.

UMaine is currently working with the mill's new owner, Patriarch Partners, on the details of this collaborate relationship.

Construction is expected to begin in 2009 and a fully integrated biorefinery will be in operation in 2011.

The project continues the work of a 2006 National Science Foundation EPSCoR grant, "Investing in Maine Research Infrastructure: Sustainable Forest Bioproducts". Known as the Forests Bioproducts Research Initiative (FBRI), the grant's research is designed to address the pressing issues of our time: replacements for fossil fuels, renewable energy, green chemicals and creative uses of sustainable resources.

Bioproducts Potential for Maine Pulp Mills

Incorporating biorefineries into suitable pulp mills could help to wean Maine from its crippling dependence on imported fossil fuels, while also allowing it to maintain its traditional manufacturing base, according to a study released recently by UMaine's Margaret Chase Smith Policy Center.

In the "Maine Bioproducts Business Pathway" report, research associate Kate Dickerson outlines in detail how the six mills in Maine that use the kraft pulping process could integrate technology developed at UMaine to produce valuable ethanol and acetic acid from woody biomass without degrading the quality of the pulp they make.

Patriarch Partners, the new owner of the former Red Shield LLC mill in Old Town, is working with UMaine to develop a partnership using UMaine's "near-neutral" hemicellulose extraction process for a proposed biorefinery at its Old Town pulp mill.

The report also discusses other processes that could be utilized in a Maine biorefinery. Dickerson analyzes the potential investment, production, and transportation costs for establishing such operations, as well as the proximities to wood resources and product transportation costs for potential wholesale and retail customers in the state.

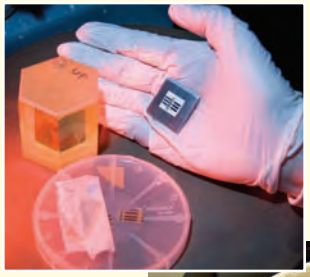
Patents Pending on High Heat Sensors

Researchers at UMaine's Laboratory for Surface Science and Technology (LASST) believe they have developed the first sensor that can stand up to the intense heat of aeronautical and aerospace systems. The Air Force is very interested in this technology because it would potentially help save more than $1.6 billion in engine maintenance costs.

The high-temperature acoustic wave sensor, which is a few millimeters in size, is made of new materials that allow it to function at about 1,832 degrees F and possibly much higher.

With a nearly $392,000 grant from the Defense Department's Experimental Program to Stimulate Competitive Research (DEPSCoR), and additional funding from the Air Force Research Laboratory, Mauricio Pereira da Cunha, a UMaine associate professor of electrical and computer engineering and member of LASST, and Robert Lad, physics professor and director of LASST, are now pushing the new sensor technology to operate at 1,000 degrees C and more for use in Air Force jet engines.

Two UMaine patents are pending on the sensors, which are fabricated and tested on campus.



Pereira da Cunha and Lad believe the devices could be of enormous benefit to the commercial aviation industry as well as the military.

John Vetelino

Biological Agent Sensor Research

A sensor developed by a UMaine engineer to detect the presence of dangerous chemical and biological agents has been chosen as one of the National Science Foundation's notable achievements for 2008.

John Vetelino, a professor of electrical and computer engineering, is one of the world's leading researchers in sensor technology and one of the founding members of UMaine's Laboratory for Surface Science and Technology.

With NSF funding about four years ago, Vetelino and his research team focused on development of a sensing element for certain chemical and biological agents that pose a serious health threat in high concentrations.

The UMaine-patented sensor can detect a pesticide known as phosmet, which is similar to chemical-warfare agents. It also senses a particularly virulent strain of E. coli, as well as saxitoxin, the worst of several toxins released during red tide.

Vetelino's sensor project led to two more NSF grants, totaling $250,000, to continue his work with E. coli detection. He also received $400,000 in September from NSF to develop a sensing element to detect peroxide-based explosives that can be made with common household ingredients.

NSF is using Vetelino's sensor work, along with other noteworthy research efforts nationwide, to demonstrate the importance of federally funded scientific activity.

For additional information on UMaine's research projects, contact Jake Ward, Assistant Vice President for Research, Economic Development and Government Relations, 207-581-2201 or jsward@maine.edu.

New Life Returns to a Marsh

Grad student Abby Pearson working on Sherman Marsh Restoration Project, surveying permanent vegetation plants

Students in USM's Department of Environmental Science have been given a once-in-a-lifetime opportunity to study one of Maine's largest saltwater marsh restorations at Sherman Lake in Newcastle, where a 2005 storm caused the failure of a 71-year-old dam at the Marsh River.

The once 200-acre freshwater lake is now seeing the return of saltwater plants, shorebirds, and saltwater fish to its low-lying tidal marshlands.

Since the Maine Department of Transportation announced that it would not rebuild the dam, assistant professor Karen Wilson, an aquatic biologist at USM, has led a team of researchers, including undergraduates and graduates, who are monitoring the area's vegetation growth and salinity, in collaboration with NOAA's Habitat Restoration Program and DOT.

In the first year, the USM team discovered a "mystery plant" growing at the marsh that turned out to be juncus (or Black Rush), the seeds of which had been hibernating since the dam was built in 1932.

This past summer, graduate student Abby Pearson began her master's degree in biology by studying the invasion of phragmites — a perennial grass that has invaded New England's salt marshes — and its effect on the salt marsh restoration. Jackie Vachon, a DES undergraduate, spent the summer working with Pearson mapping *Phragmites* patches, and surveying plants and nitrogen.

Alewives Key to Coastal Ecosystem

The reason river herring harvests have been in precipitous decline along the Atlantic coast in the past 50 years is unknown, but many attribute it to a loss in habitat access from human-made dams and other barriers. River herring, including alewives, are migratory fish that live primarily in the ocean, but travel upstream to freshwater lakes and ponds to spawn each spring.

Karen Wilson and Theodore Willis are researchers in USM's Aquatic Systems Group who are engaged in a multi-year Northeast Consortium project to investigate the food web links between alewives and historically important groundfish, such as cod. Alewives can be the basis of the food chain and restoring them could help other species whose populations are in crisis. As part of their research, Wilson and Willis work with Maine fishermen who harvest alewives for lobster bait.

The Earth's Smallest Photosynthetic Organism

With support from the National Science Foundation, professor Lisa Moore has been traveling the globe with undergraduates from USM's biology department in search of prochlorococcus, the world's smallest cyanobacteria, or blue green algae.

From the Sargasso Sea to the Galapagos, Moore's students are joining her on research cruises to collect samples of this important phototroph, a photosynthetic organism that converts sunlight into the energy it needs to grow. First discovered in 1988, prochlorococcus are not only the smallest, but also the most abundant single-celled life form of its type on Earth. A milliliter of water can contain 100,000 cells or more. Living deep below the surface of the ocean, they are particularly remarkable for their ability to proliferate in nutrient-poor conditions.

Prochlorococcus account for much of the ocean's photosynthesis, which means they are very important to the Earth's carbon cycle.

An important aspect of the project is giving students the experience of field research. For example, Tammy Swett, who received her bachelor's degree from USM, traveled to Hawaii with Moore and researchers from Tufts University and MIT to search the landlocked coastal ponds of the island.

Mapping Maine Online

A growing number of industries use geographic information systems (GIS) for uses ranging from selecting a building site and surveying endangered species, to identifying the spread of disease. Advances in technology have significantly expanded public access to GIS maps, photographs, and data that record life across the globe.

Researchers from USM's Research Computing Group (RCG) have partnered with the Maine GeoLibrary Board to develop custom software that will increase access to, and use of, the GIS information collected on their Web site.

Working with associate professor David Briggs, Matt Blanchette, a graduate student in USM's Department of Computer Science, has customized the search features on the GeoLibrary's new GeoPortal site and is creating a high capacity, Web-based warehouse for spatial data, that will include maps, photographs, and other graphics. Eventually, users will be able to visit the site and build maps using available data.

Researchers note that a central goal of the RCG is to find more open source solutions — software with programming code that is open to public collaboration — like the one being developed for the GeoLibrary.

Associate professors David Briggs and Matthew Bampton discuss GeoPortal web site with graduate student Matt Blanchette

NASA Grant Helps Map Wells Reserve

Students collect data at the Wells National Estuarine Research Reserve in Wells, Maine.

Using the latest global positioning system (GPS) and satellite technology, USM associate professor Firooza Pavri and director of USM's Geographic Information Systems lab Vinton Valentine have received a grant from NASA to map a section of the Wells National Estuarine Research Reserve, a 2,200-acre research, education, and recreation facility at Laudholm Farm in Wells.

In collaboration with scientists at the Wells Reserve and NASA's Stennis Space Center in Mississippi, Pavri and Valentine are detailing the distribution of species in the wetlands. In the long term, they hope to see how the species and their environments change over time, either due to human influence or fluctuations in climate.

USM undergraduates in geography and anthropology have been trained to use remote sensing technology and are collecting data with Valentine and Pavri in the field. The students use GPS to identify their geographic location and record the vegetation they see. Back in the lab, they compare their observations to multi- and hyper-spectral satellite images — some of which NASA has been gathering since the 1970s. Combining information from the ground and from space will allow the research team to create a detailed representation of life on the Wells Reserve.

IDEXX Funds Graduate Assistantship

USM graduate students now have opportunities to gain more real-world research experience and become better prepared for R&D-based careers with the creation of a graduate assistantship funded by IDEXX Laboratories Inc.

The IDEXX Software Engineering Graduate Assistantship is a renewable, academic-year opportunity for a USM computer science graduate student to work directly with IDEXX in software engineering R&D, and with computer science faculty from USM's Research Computing Group. The first IDEXX Software Engineering Graduate Assistantship was awarded in fall 2008. The recipient receives $18,000 for educational and related expenses for the academic year.

Don Kennel, senior director of software engineering at IDEXX, where the graduate student will be assigned, and Glenn Wilson, director of USM's Research Computing Group, have been working together on ways to increase the effectiveness of both educational and industrial experiences for students. Both underscore the value of such graduate-level assistantships in enhancing a student's education that can be applied to real-world situations, contributing to Maine's economic development.

Computer Fun and Games

USM undergraduate Peter Kemeraitis, graduate student Alan Fitzgerald, and assistant professor of computer science Clare Bates Congdon won an international competition to develop an artificial intelligence program capable of mastering the arcade game Ms. Pac-Man.

At the World Congress on Computational Intelligence in Hong Kong in May 2008, the team outperformed 11 competitors. The USM entry scored 18,050 points in the competition, and reached level 5 of the game, far better than many humans can accomplish.

In fall 2008, Fitzgerald continued work on the project, applying machine learning to design and develop a way for the agent to adapt and improve with experience. This type of research has practical applications ranging from manufacturing and military applications to Mars explorers and entertainment.

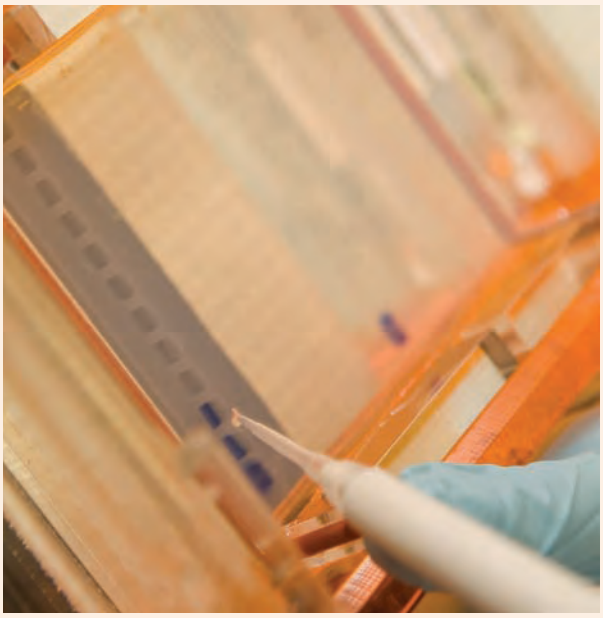
Another student, undergraduate Ryan Small, gave a presentation at the international Genetic and Evolutionary Computation Conference in Atlanta in July 2008 on learning how to play the game Unreal. Both Fitzgerald and Small plan to enter their agents in new competitions at the international Congress on Evolutionary Computation in Norway in May 2009, and to present research papers there.

Bioinformatics & DNA

USM researchers are using bioinformatics — computer science tools analyzing biological data — to search for patterns in non-coding DNA. Once referred to as "junk DNA" because it had no known function, non-coding DNA represents the vast majority (97 percent) of the human genome, and is now understood to influence gene expression. USM's Clare Bates Congdon, assistant professor of computer science, hopes these patterns will provide useful clues that could help explain how the human body responds to genetic diseases like cystic fibrosis.

USM undergraduate Junes Thete and University of British Columbia undergraduate Rachel Teo worked with Congdon this past summer and presented their bioinformatics work at the international Genetic and Evolutionary Computation Conference in Atlanta in July.

Her bioinformatics research is conducted through Maine INBRE (IDeA Network of Biomedical Research Excellence), a collaboration among Colby, Bates, and Bowdoin Colleges, the Jackson Laboratory, and Mount Desert Island Biological Lab. The goal of INBRE is to strengthen Maine's capacity to conduct biomedical research. It is funded by the National Institutes of Health.



Testing Toxins with NASA Flight

This summer, a team of USM and UMaine students, research staff, and faculty traveled to Johnson Space Center in Houston to participate in NASA's Microgravity University. Flying 30,000 feet above the Gulf of Mexico, the team tested the effects of space travel on cell function.

Originally used to train astronauts, NASA's Weightless Wonder is now used by students from around the U.S. to conduct their own experiments. This passenger-sized C9-B aircraft simulates hypergravity and zero gravity by rising and falling thousands of feet, several times in succession.

While aboard the airplane, the student team tested two known carcinogens, lead chromate and sodium chromate, as well as silver nanoparticles and their potentially damaging effects on DNA in human lung cells. Their results will help to establish exposure guidelines for space travelers and contribute to protecting the health of astronauts during extended missions to the International Space Station, to the moon, and, eventually, to Mars.

The project was funded by a grant from NASA's Microgravity University, with matching funds committed by the Maine Space Grant Consortium.

Johnny Wise Jr., "floating" at Johnson Space Center Reduced Gravity Program, summer 2008

Berries Potentially Fighting Disease

Visiting Libra Scholar John Lechner in USM's Wise Laboratory of Environmental and Genetic Toxicology is building on research he began at Ohio State University's Comprehensive Cancer Center. There, he fed rats with esophageal cancer a diet of 5 percent freeze-dried black raspberries, and observed a reduction in those cancers. He also provided another group of cancer-bearing animals drinking water laced with red beet juice and observed cancer reduction.

At USM, he is feeding laboratory mice the beet juice water to investigate whether it will stop the animals from getting lung cancer. Plans also are under way to investigate the benefits of compounds found in fish, and discussions have begun to start human trials that would attempt to reduce free radicals that negatively affect the health of diabetes patients.

Because it took a high percentage of berries in the diets of laboratory animals to show positive results, Lechner envisions a future where the healthful compounds now being discovered in berries, vegetables, and fish are concentrated and delivered in pill, water or snack bar form.

Lechner says a major nutraceutical industry in Maine would economically benefit not only researchers, but also growers and fishermen, and lead to the manufacturing of these supplements.

2008 BIOTECHNOLOGY

Assistant professor Doug Currie, Ph.D. student Dan Swett and Ashleigh Poole study tissue culture.

Arsenic's Effect on the Brain

Can arsenic affect brain development? When USM professor Doug Currie posed this question to a team of students, they came up with staggering results: arsenic can cause significant changes in the nerve cells.

Forty percent of Maine households rely on wells for drinking water, an important source of arsenic exposure, and up to 25 percent of those have arsenic levels above the national standard. Toxic exposures during brain development, which can take up to 20 years in humans, could lead to lifelong changes in structure and function. In fact, several international studies have shown a link between exposure and deficits in cognitive function.

USM students Sam Frankel, John Concannon, Eric Peitrowitz, Kristen Brusky, Stephen Giorgiani and Ph.D. student Dan Swett modeled the early stages of brain development by growing nerve cells in tissue culture dishes, then exposing them to high levels of arsenic. Their experiments showed marked reductions in the number, length, and complexity of neurites, the branches stemming from nerve cells that are necessary for the "wiring" of the brain. The team also identified key proteins in brain development that are the likely targets for arsenic toxicity.

Toxins Study Impacts Maine

Studies on flame retardants at the USM Center for Toxicology and Environmental Health have been instrumental to the passage of Maine laws designed to protect human health. Most recently, Maine became one of the first states in the nation to phase out and prohibit Decabrominated diphenyl ether, or "Deca", a proven contaminant.

Deca is the most widely used flame retardant found in common household items like electronics, mattresses, and furniture. Yet despite such widespread use, little is known about its effects on health.

When USM associate professor Vincent Markowski and his colleagues conducted a study on mice to determine Deca's effects on the brain, they observed motor hyperactivity and reductions in a thyroid hormone necessary for normal brain development. As the mice grew older, they began to show learning impairments as well. Their results suggested that Deca is a developmental neurotoxicant that can produce long-term behavioral changes.

This work is often cited by groups like the Alliance for a Clean and Healthy Maine that advocate for the removal of toxins from the environment.

Associate professor Monroe Duboise collects samples with a colleague in Kenya

Studying Bacteria in Africa and Maine

Researchers from USM's virology and transmission electron microscope laboratory were awarded a $100,000 grant from the National Science Foundation to develop an international partnership to study extremophiles in Kenya, Africa.

Scientists and students from USM and the University of Nairobi will be collaborating with NASA's Ames Research Center, Cosmos Education, and Jet Propulsion Laboratory on this educational exchange and research program.

Extremophiles include bacteria and bacteriophage (viruses that infect bacteria) and live in the Earth's harshest environments.

In a lab at the University of Nairobi outfitted by USM, researchers and students will look for diverse bacteria and viruses in the alkaline (high pH) lakes of Africa's Great Rift Valley. If the unique properties of these hearty bacteria can be identified and developed, they may have many beneficial applications—from better medicines to cleaner chemicals and much more.

With funds from the Maine Space Grant Consortium, USM has also strengthened its research team, lab resources, and student opportunities for exploring extreme environments in Maine. The microorganisms they collect will be photographed by USM's high-end electron microscope capable of providing 3D digital images up to nearly a million times original size.

Studying extremophiles may allow researchers to identify the genes enabling them to survive and provide necessary clues to decoding their secrets.

For additional information on USM's research projects, contact Nancy Martz, Director of Research Administration, 207-228-8053 or martz@maine.edu.

2008 APPENDIX A

LEGISLATIVE HISTORY OF STATE RESEARCH APPROPRIATION FOR OPERATIONS

The following is a summary of the actions of the 118th–123rd Maine Legislatures with regard to appropriating research funds to the University of Maine System for operations:

118th LEGISLATURE

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

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

119th LEGISLATURE

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

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

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

120th LEGISLATURE

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

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

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

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

121st LEGISLATURE

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

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

122nd LEGISLATURE

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

123rd LEGISLATURE

June 7, 2007: Governor signed into law a budget (Chapter 240, Part A, Sec. A-68) that provides an increase of $1.5 million in FY08 and an additional $1 million in FY09 on a "base budget" basis for research.

2008 APPENDIX A

LEGISLATIVE HISTORY OF STATE RESEARCH APPROPRIATION FOR OPERATIONS

NEW APPROPRIATION

118th LEGISLATURE

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

119th LEGISLATURE

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

120th LEGISLATURE

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

121st LEGISLATURE

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

122nd LEGISLATURE

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

*One-time funding

123rd LEGISLATURE

	FY08	FY09	Total 2-Year
UMaine	$1,200,000	$720,000	$1,920,000
USM	300,000	180,000	480,000
UMM	0	50,000	50,000
UMFK	0	25,000	25,000
UMPI	0	15,000	15,000
UMA	0	10,000	10,000
Total	$1,500,000	$1,000,000	$2,500,000

Total Yearly Research Appropriation for FY08

	FY08 Appropriation
UMaine	$10,960,000
USM	2,740,000
Total	$13,700,000

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.

FY08 SUMMARY OF STATE FUNDING FOR RESEARCH CAPITAL PROJECTS
UMAINE/USM COMBINED

	Referendum Bond Portion	Total Other Funds	Project Budget	Expenditures to Date
FY99 State Bond Issue (Approved by voters 11/03/1998)				
UMaine	$10,800,000	$1,168,622	$11,968,622	$11,963,896
USM	2,700,000	155,100	2,855,100	2,855,100
TOTAL	$13,500,000	$1,323,722	$14,823,722	$14,818,996
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	$21,019,456
USM	5,000,219	4,730,426	9,730,645	9,730,645
TOTAL	$25,000,219	$5,933,722	$30,933,941	$30,750,101
FY01 One-Time State Appropriation (signed by Governor 4/25/2000)				
UMaine	$9,000,000	$3,446,439	$12,446,439	$12,446,439
FY02 State Bond Issue (approved by voters 6/11/2002)				
UMaine	$5,000,000	$0	$5,000,000	$4,528,932
USM	4,000,000	45,029	4,045,029	4,045,029
TOTAL	$9,000,000	$45,029	$9,045,029	$8,573,961
FY03 State Bond Issue (approved by voters 6/10/2003)				
UMaine	$7,000,000	$799,189	$7,799,189	$7,659,656
USM	4,400,000	0	4,400,000	4,400,000
TOTAL	$11,400,000	$799,189	$12,199,189	$12,059,656
FY05 State Bond Issue (approved by voters 11/08/2005)				
UMaine	$3,800,000	$302,105	$4,102,105	$3,516,944

APPENDIX C

UNIVERSITY OF MAINE SYSTEM

UTILIZATION OF FY08 OPERATING RESEARCH APPROPRIATION

UMAINE

Targeted Research Area	Source of R&D Funds: FY08 R&D Base Budget	Source of R&D Funds: Unused R&D Funds from Prior Years	Source of R&D Funds: FY08 Total R&D Funds Available	Utilization of R&D Funds: FY2008 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 FY09[1]	New Grants & Contracts Generated[2]	Total FTE Positions Supported By All R&D Funds[3]
Adv. Technology Forestry & Agriculture	$1,797,000	$761,917	$2,558,917	$2,395,228	$738,156	($593,546)	$2,539,839	$19,078	$10,122,678	70.8
Aquaculture & Marine Science	1,580,000	(68,658)	1,511,342	2,360,836	575,021	(519,299)	2,416,558	(905,216)	7,414,345	61.6
Biotechnology	763,000	469,831	1,232,831	1,144,944	79,314	(171,943)	1,052,315	180,516	3,207,729	26.9
Composites	1,934,000	109,104	2,043,104	1,036,433	41,231	(370,639)	707,025	1,336,079	8,319,474	141.8
Environmental	966,000	324,770	1,290,770	1,554,413	73,070	(482,110)	1,145,373	145,397	4,167,250	53.1
Information Technology	2,000,000	217,934	2,217,934	2,400,768	97,725	(791,714)	1,706,779	511,155	8,457,940	111.0
Precision Manufacturing	1,420,000	69,676	1,489,676	1,495,907	193,756	(458,444)	1,231,219	258,457	2,884,664	25.3
Cross Sector	500,000	(81,265)	418,735	146,879	12,912	(26,718)	133,073	285,662	906,154	18.7
GoMOOS & Commercialization (one-time)	0	0	0	0	0	0	0	0	0	0.0
Unassigned - reallocated by System	0	203,353	203,353	0	0	203,353	203,353	0	0	0.0
Total State Funding	$10,960,000	$2,006,662	$12,966,662	$12,535,409	$1,811,184	($3,211,060)	$11,135,534	$1,831,128	$45,480,234	509.1
UM Cost Sharing Funding[4]	$2,995,574	$31,926	$3,027,500	$0	$0	$2,995,574	2,995,574	$31,926	$0	
TOTAL FUNDING	**$13,955,574**	**$2,038,588**	**$15,994,162**	**$12,535,409**	**$1,811,184**	**($215,486)**	**$14,131,108**	**$1,863,054**	**$45,480,234**	
2003 Jobs for Economic Growth Bond[5] - MEIF Matching Funds	$0	$585,981[6]	$585,981	$0	$370,495	$215,486	$585,981	$0	$0[7]	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 FY2008 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] Salary and benefits from University.
[5] Original amount was $2,880,000. Job creation & economic growth bond.
[6] Prior year audit adjustment reduced actual FY2007 carryover by $119,081.
[7] Included in grants & contracts generated figures shown above.

UNIVERSITY OF MAINE SYSTEM

UTILIZATION OF FY08 OPERATING RESEARCH APPROPRIATION

USM

Research Area	Source of R&D Funds: FY08 R&D Base Budget	Source of R&D Funds: FY08 Income from other Sources	Source of R&D Funds: Unused R&D Funds from Prior Years	Source of R&D Funds: FY2008 Total R&D Funds Available	Utilization of R&D Funds: FY08 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 FY09[1]	New Grants & Contracts Generated[2]	Total FTE Positions Supported By All R&D Funds[3]
Aquatic Systems	$421,428	$509	($21,721)	$400,216	$203,009	$0	$197,207	$400,216	$0	$1,942,169	14
Biotechnology	1,760,571	17,401	167,382	1,945,354	1,692,979	239,808	(53,351)	1,879,436	65,917	3,407,222	61
Information Technology	558,001	8,256	(154,961)	411,296	553,999	1,303	(143,856)	411,446	(150)	443,331	13
Total State Funding	**$2,740,000**	**$26,165**	**($9,300)[4]**	**$2,756,865**	**$2,449,987**	**$241,111**	**$0**	**$2,691,099**	**$65,767**	**$5,792,722**	**88**
2003 Jobs for Economic Growth Bond 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 R&D grants & contracts awarded in FY08.
[3] One FTE position is equivalent to one full-time employee working for an entire year on R&D projects.
[4] Prior year audit adjustment reduced actual FY07 carryover by $5,085.

APPENDIX C

UNIVERSITY OF MAINE SYSTEM

SUMMARY OF UTILIZATION OF FY08 OPERATING RESEARCH APPROPRIATION

UMAINE/USM COMBINED

	Source of R&D Funds				Utilization of R&D Funds						
	FY08 R&D Base Budget	FY08 Income from other Sources	Unused R&D Funds from Prior Years	FY08 Total R&D Funds Available	FY2008 R&D Actual Expenditures	Transferred To Match Grants & Contracts	Transferred Between R&D Accounts	Total R&D Funds Utilized	Unused Funds Carried Forward To FY09[1]	New Grants & Contracts Generated[2]	Total FTE Positions Supported By All R&D Funds[3]
UMAINE	$10,960,000	$0	$2,006,662	$12,966,662	$12,535,409	$1,811,184	($3,211,060)	$11,135,534	$1,831,128	$45,480,234	509
USM	2,740,000	26,165	(9,300)	2,756,865	2,449,987	241,111	0	2,691,099	65,767	5,792,722	88
Total State Funding	**$13,700,000**	**$26,165**	**$1,997,362**	**$15,723,527**	**$14,985,397**	**$2,052,296**	**($3,211,060)**	**$13,826,632**	**$1,896,895**	**$51,272,956**	**597**

[1] Include year-end equipment carry-over funds (equipment ordered, not received, and not paid).
[2] Dollar value of new R&D grants & contracts awarded in FY08.
[3] One FTE position is equivalent to one full-time employee working for an entire year on R&D projects.

NOTES

16 Central Street
Bangor, Maine 04401

800.804.3200
207.973.3240

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