

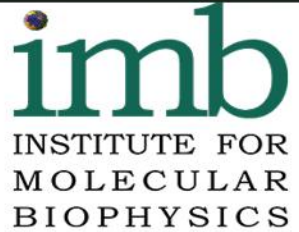


Maine

EPSCoR

Quarterly newsletter for research and development initiatives supported throughout Maine by the National Science Foundation's Experimental Program to Stimulate Competitive Research

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Molecular biophysics gets a new home

Throughout history, new imaging capabilities — from the first 17th-century light microscopes to the latest MRIs and electron microscopes — have opened new worlds in biomedical research. But today, with such breakthroughs as the sequencing of human and mouse genomes, researchers need nanoscale imaging technologies to explore the structure and function of genes and chromosome .

The Institute for Molecular Biophysics (IMB) was created to develop and deploy the biological imaging technologies of the future. The interdisciplinary program brings together expertise in biophysics and engineering at the University of Maine in Orono, cell biology at the Maine Medical Center Research Institute in Scarborough, Maine, and genetics and genomics at The

Jackson Laboratory, Bar Harbor, Maine. In this 'virtual institute' model, facilities and resources are distributed among the three partners, and interactions are facilitated through videoconferencing. The IMB's initial funding was provided by a FY 2003-2006 NSF EPSCoR RII award. "The IMB is an interdisciplinary leap into the future," says Barbara Knowles of The

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4pi Microscope installed and operational at Jackson Lab

The 4Pi Confocal Laser Scanning Microscope is the world's most advanced optical microscope-capable of revealing the nanostructure of genetic material within a cell in three dimensions. Thanks to a \$732,624 National Science Foundation



Jeorg Bewersdorf, operating the new 4Pi microscope.

program grant to the Institute for Molecular Biophysics (IMB), the first such microscope was recently installed at The Jackson Laboratory. The NSF grant includes funding for a specialized operator to analyze samples on the 4Pi. With the microscope and the 4Pi instrument installed the IMB team is now working on developing the best platform on which to place the cells

Institute (MMCRI) in Scarborough, and geneticists and molecular biologists at The Jackson Laboratory.

The 4Pi microscope, whose designation refers to the unique way in which light is emitted, will enable IMB researchers to examine structures within a cell - such as a single gene on a chromosome - at a resolution four to seven times greater than previously possible. Scientists from all three institutions sharing the 4Pi are very enthusiastic about pursuing the IMB's goal of exploring the structure and function of genes and chromosomes within cells. By so doing, they hope to understand precisely how genes control normal development and disease.

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More graduate, undergraduate students linked with IMB

As the IMB continues to grow into its third year, additional programs for both graduate and undergraduate student programs are in the process of being developed. By taking advantage of the interdisciplinary nature of the IMB and its researchers, NSF EPSCoR will have provided a very valuable infrastructure that allows for the direct integration of educational programs with state-of-the-art facilities and researchers on the cutting edge of science

In an acknowledgement of how critical it is to cross-train top-quality students who can then perform research for institutions such as those in the IMB, the University of Maine has created a new Graduate School of Biomedical Sciences.

The new school, which will premiere next year, encompasses four tracks: functional genomics; cellular and molecular biology; neuroscience; and nanotechnology.

These students will have the opportunity to gain valuable experience by studying and working with researchers at the IMB partner institutions.

Currently, the IMB NSF EPSCoR award supports three post-docs, four graduate students, and three undergraduate research students, who all participate directly with IMB personnel in their research. Several students in the University's masters degree program for science teachers have also had the

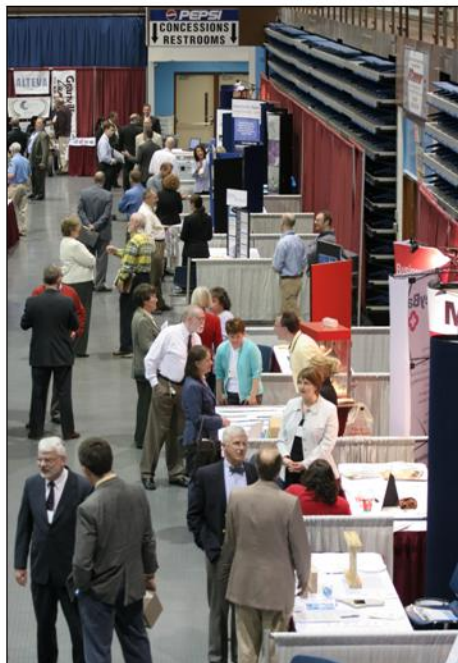
opportunity to intern with IMB researchers, and a collaboration with the University of Heidelberg has resulted in opportunities for research exchanges that involve IMB faculty, post-docs, and graduate students.

At the Jackson Laboratory, high school and undergraduate students have also interned with IMB researchers over the past two years with the support of various programs such as NIH INBRE and NSF REU.

MaineTech 2005

NSF EPSCoR sponsors 2nd biennial Maine technology summit

The second biennial MaineTech exposition on May 10 was as big a success as the first, hosting exhibits from more than 100 technology-based companies, University research groups, and service providers in the Augusta Civic Center. The event is intended to highlight the recent growth in the number of Maine companies developing new technologies, in industries ranging from boatbuilding to biotechnology. In addition to the exhibits, a number of technology and business-related workshops and presentations were offered to the public throughout the day. This year MaineTech was also on special display for members of the State Legislature and government officials on the afternoon of May 9. With sponsorship from the Maine NSF EPSCoR program, UMaine's Department of Industrial



Maine Tech 2005 showcased over 100 technology-related exhibits for the public all day May 10, and to groups of Maine Legislators and government officials on May 9.

Cooperation teamed up with Maine's Applied Technology Development Centers, the Maine Technology Institute, the Maine Manufacturing Extension Partnership, the Technology Law Center at the University of Maine School of Law, and the University of Southern Maine, to develop and create the event.

A second IGERT comes to UMaine Orono campus

UMaine's Laboratory for Surface Science and Technology awarded NSF Grant for Graduate Sensors Program



Building on existing research infrastructure, the University of Maine will use a new five-year, \$3.16 million research award to establish an interdisciplinary graduate education program in Sensor Science, Engineering and Informatics.

Funding comes from the National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT) program, which exists to train Ph.D. scientists through interdisciplinary programs that address pressing global needs. IGERT grants are awarded through an exceptionally competitive process.

According to the NSF Web site, 146 IGERT grants have been awarded since the program began in 1998. Eighty-four institutions have received

at least one award; only 32 have received more than one. UMaine is also home to a second IGERT program, in Functional Genomics. "An IGERT grant is a real indicator of research strength," says UMaine President Robert Kennedy. "The fact that UMaine now has two speaks volumes about the internationally recognized quality of our research faculty and our proven ability to develop effective interdisciplinary programs." The IGERT program will benefit from the resources and reputations of two of UMaine's most productive and best-known research centers, the Laboratory for Surface Science and Technology (LASST) and the National Center for Geographic Information and

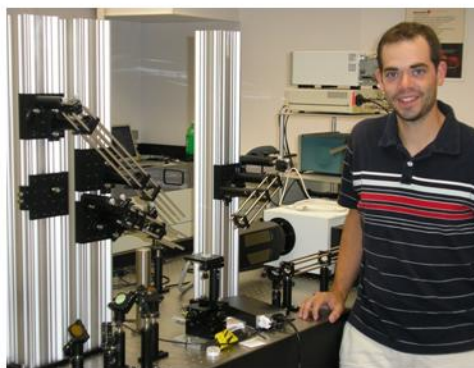
Making the most of a lot

PhD student weaves his education through a number of complimentary programs

If you're looking for evidence of NSF EPSCoR's impact in Maine, the case of PhD student Andrew Doyle isn't a bad place to start. Doyle is immersed in the growing multi-disciplinary research network which has developed among four institutions - The University of Maine, The Jackson Laboratory, The Maine Medical Center Research Institute and The University of Heidelberg, - with the support of the National Science Foundation. Doyle's research is threaded through all four institutions by way of two programs - The Institute of Molecular Biophysics (IMB), and the Functional Genomics NSF IGERT.

Doyle returned in February from his second five-month stint as a visiting scientist in the high-energy spectroscopy lab of the University of Heidelberg in Germany. His research in Germany - funded by the IMB and Heidelberg's

publication, and a solid foundation for his future research under Dr. Neivandt. Doyle is now a first year student in the Functional Genomics IGERT, where he's working towards a dual PhD in Chemical Engineering and Functional Genomics.



Functional Genomics PhD Student Andrew Doyle

It's really a nice combination of the IMB and the Functional Genomics program... a good example of what multiple NSF grants in related fields can do to strengthen the research that's being done

—UMaine Assistant Prof. David Neivandt

Baden-Wurttemberg Scholarship, advised by UMaine Chemical and Biological Engineering Assistant Professor Dr. David Neivandt, and overseen in Heidelberg by IMB co-director Dr. Michael Grunze - resulted in Doyle's first

While in Heidelberg, Doyle used Sum-Frequency generation vibrational Spectroscopy (SFS) to study how a model cellular membrane facilitated the non-classical transport of FGF-1, one of a small number of proteins identified as lacking the signal peptide sequence which facilitates the cellular excretion of most proteins. The release of many of these signal-peptide-less proteins are implicated in a host of diseases and disorders (in the case of FGF-1, Alzheimer's, retinosis, and some cancers).

Using SFS, a method typically applied to synthetic systems and only recently being used to study model membranes, Doyle demonstrated that the presence of FGF-1 deformed the membrane and that the

deformation was reversible upon the proteins removal. Now that Doyle is funded through the IGERT, he and Neivandt are moving on to study this same process with other techniques which are complimentary to SFS.

"It's really a nice combination of the IMB and the Functional Genomics program, it's an excellent example of what multiple NSF grants in related fields can do to strengthen the research that may be performed," says Neivandt, Doyle's advisor since 2003.

"Here we have an example where the IMB has picked up some of the costs and the Functional Genomics program has taken them over. At the end of the day the student has benefited in terms of two trips to Heidelberg plus a stipend from the Functional Genomics program to complete a Ph.D. when he would otherwise have terminated his studies with a Masters degree."

A native of Lyman, Maine, Doyle says these new programs have not only given him the opportunity to take part in cutting-edge interdisciplinary research, but to do it in his home state.

"I feel so fortunate that the IMB started at the same time I was coming here," he says. "Without it I really don't think I would have had these opportunities. I don't think I would have gone to Germany, I wouldn't have gotten published, I probably wouldn't even be at this University to be honest. Five or six years ago this department was primarily Pulp and Paper driven. Now it's got a burgeoning Biological branch to it. The IMB, focusing at the University of Maine level, has brought a lot of new faculty and exciting research here."

AEWC awarded new \$6.2 Million U.S. Army R&D Program

In a move that is expected to increase opportunities for Maine businesses and University of Maine faculty and students, the University recently announced a \$6.2 million U.S. Army research program in the UMaine Advanced Engineered Wood Composites (AEWC) Center. The program takes advantage of newly expanded laboratory space financed with a voter-approved bond in 2004, building on infrastructure funded

by a FY 1996-1999 NSF EPSCoR RII grant.

The research focus will be on studies of high strength structures for military applications, including advanced materials, tent protective structures, high-performance airbeams, rigidified inflatable structures, rapidly deployable bridges, and ballistic modular building components. AEWC engineers will work with the U.S. Army Natick Soldier Center and

the U.S. Army Corps of Engineers.

The \$4.5 million, 15,000 square-foot laboratory expansion was a key part of UMaine's ability to meet the Army's research needs, says Habib Dagher, AEWC director. "The facilities investment by the voters, the Legislature and the Governor allowed us to take on this large new R&D program." The facilities include equipment and space to develop thick composites technologies, resin

infusion processes and polymer extrusion. The space accommodates an anticipated 35 additional research personnel, including engineers, scientists and support staff who will be funded through the new research program. "UMaine is looking forward to developing advanced lightweight construction materials and structures that will better protect our troops from attacks, while

AEWC

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providing unique learning opportunities for our students, and business procurement opportunities for Maine industry" says Dagher. Researchers in the UMaine Composites laboratory develop and investigate the properties of synthetic and natural fiber based composites at scales from molecules to large structures.

With eight different labs occupying 48,000 square feet, AEWc provides the only university-based research facility in the US where new Composites products can be taken from initial concept to prototype design and full scale production and testing under one roof.

The ASC Laboratory/AEWc Center began in 1991 as a small pilot study (2% of an NSF EPSCoR RII grant to the University of Maine).



Capitol Hill Day 2005

The University of Maine recently presented a Technology Forum in Washington, D.C., featuring exhibits in 14 key research areas for the state. Forty researchers and administrators from the University interacted with over 100 legislative, government agency, and industry representatives who attended. Left, Vice President for Research Michael Eckardt discusses IMB research with NIH representative Karen Peterson.

4Pi

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Dr. Barbara Knowles of The Jackson Laboratory, and IMB's co-director comments: "Astronomers have space-based telescopes like the Hubble Space Telescope to understand the history and structure of the universe. Physicists have giant particle accelerators to isolate the fundamental elements of energy and matter. Now researchers in genetics and biology

have an advanced tool to examine the very structure of the mouse, human, and other genomes."

IMB co-director Dr. Michael Grunze, who holds joint appointments with the University of Maine, The Jackson Laboratory, and the University of Heidelberg in Germany says: "Imagine looking at a satellite image of your state at such a high resolution that you can spot the local college football field. Now, imagine being able to see the football itself, in 3D. The 4Pi represents a comparable increase in

resolution, only on a nanoscale." Grunze anticipates that researchers will be able to either send or bring biological samples to the IMB for analysis. "I see biology moving towards specialized high-tech centers like the IMB, bringing in investigators from all over the world."

Kenneth A. Ault, MD, director of MMCRI, is equally excited: "In addition to applications involving imaging of genes and nuclear structure, our researchers are particularly interested in using this

microscope to image large, multi-molecular structures migrating within and across the cell membrane. For example, a recent discovery at MMCRI indicates that controlling the migration of fibroblast growth factor can prevent re-occlusion of coronary arteries after angioplasty. We are confident that this fruitful collaboration with the physicists in the IMB will reveal many as yet unsuspected discoveries of value to the medical community."

IMB

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Jackson Lab, who co-directs the institute with UMaine's Michael Grunze.

"It is the forum for the integration of newly developed instrumentation that will allow the application of optical physics and nanotechnology to genome structure."

The ultimate goal is to understand precisely how genes control both normal development, and human diseases and disorders."

IGERT

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Analysis (NCGIA). Both were funded by an FY 2000-2003 NSF EPSCoR RII grant. Two advisory boards will be created as part of the project.

Five Ph.D. students, to be known as IGERT fellows, began studies this week. Over the course of five years, the program will train 20 IGERT fellows, each of whom will be mentored by an interdisciplinary group of faculty members. The program's academic focus will be on sensor systems, including the creation of new materials and new methods for the interpretation of sensor data.

Prof. Mary-Kate Beard-Tisdale from the UMaine Dept. of Spatial Information Science and

Engineering and NCGIA is the program director and grant's principal investigator. Other UMaine professors who are project leaders include Robert Lad (Physics and the Laboratory for Surface Science Technology), Rosemary Smith (Electrical and Computer Engineering/LASST), John Vetelino (Electrical and Computer Engineering/LASST) and Michael Worboys (Spatial Information Science and Engineering/NCGIA). Nineteen UMaine faculty members from several science and engineering departments will be involved in the program.

"I am convinced that this project will be a success, because of the outstanding team we have assembled," says Beard-Tisdale.

"Each of my colleagues has expressed great enthusiasm for this project, and the spirit of cooperation is evident. That will serve our students and our research very well. "The increasing use of sensor technology presents significant societal and technological challenges," she says. "Through this program, we aim to create new knowledge that will have economic and quality of life benefits, and will help us create policies to manage the new capabilities provided by sensors."

UMaine has an extensive history of education and funded research in sensor-related fields. Its work in this area has led to the development of six sensor-related businesses during the past several years.