WINTER 2006

MAINE INBRE

IDEA NETWORK OF BIOMEDICAL RESEARCH EXCELLENCE

Developmental Biology and the Sea Urchin Genome

Who would have guessed that the lowly sea urchin, that brain-less, limb-less porcupine of the sea, would be the star of a multi-million dollar, worldwide effort to map out every letter of its genetic code? Or that the information gathered in that effort may eventually lead to new treatments for cancer, infertility, blindness, and diseases like muscular dystrophy and Huntington's Disease?

Dr. James Coffman of the Mount Desert Island Biological Laboratory was one of the scientists who helped decode the 814 million pairs of nucleotide bases in the sea urchin's chromosomes. The Human Genome Sequencing Center at Baylor College of Medicine in Texas led the scientific team and announced last month the completion of the three-year project, which received its initial funding from the National Institutes of Health in 2002. Having the complete genome, Coffman says, "makes doing research on urchins so much easier."

College of the Atlantic students will have the opportunity to study sea urchins with Dr. Coffman this winter when he leads an INBRE research training. The intensive laboratory experience will explore fundamental problems of developmental biology and experimental methods used to address those problems. Students will use microscopy to directly observe urchin...

(continued on page eight)

STRONGYLOCENTROTUS PURPURATUS

Important Dates

January 19, 2007

Application deadline: INBRE Summer Fellowships for students. ***See page two for more information***

April 27th – 28th, 2007

34th Annual Maine Biological and Medical Sciences Symposium, MDI Biological Laboratory, ***Page six***

August 15th – 17th, 2007

Regional Meeting of the Northeastern IDeA States, at the University of Vermont. ***Mark your calendar!***

In this Issue

" I never thought I could get so much real world lab experience in one week – this course was wonderful."

INBRE Short Courses for Undergraduates: Schedule, Page 6

Written by Hand . . .

Dr. Patricia Hand, Administrative Director of MDIBL and Director of the Maine INBRE program.

Every fall back-to-school for our INBRE undergraduates also means back-to-school at the Mount Desert Island Biological Laboratory, as we begin preparations to host laboratory research experiences for students this winter and spring. This year as an addition to our curriculum we are offering "Methods in Developmental Biology," led by Jim Coffman who joined MDIBL last year. Dr. Coffman's work on sequencing the sea urchin genome adds another scientific resource to our INBRE in Comparative Functional Genomics.

We're pleased to give you in this issue profiles of two BRIN/INBRE graduates – Jocelyn LeBlanc and Joseph Aman – and we'll bring you more news on our alumni throughout the next year. It is very rewarding to see so many students who come through the program really benefiting from our IDeA network and continuing in the sciences.

Also in this issue, we're featuring an update on the research of Bates College Professor, Rebecca Sommer. Her work exemplifies the goals of INBRE: cutting-edge biomedical research that provides training opportunities for undergraduates. The aim of "allowing individual faculty to pursue their research with the expectation that this will enrich their institution's educational mission" – as EAC member Dr. Christopher Bayne puts it – is evident in Dr. Sommer's laboratory.

Finally, we're making plans for the 34th Annual Maine Biological and Medical Sciences Symposium to be held at MDIBL in April, and for next summer's programs. 2006 has been a fantastic year for our INBRE, and we have much to look forward to in the new year.

Wishing you a continued sense of discovery in you work and Happy Holidays!

Patricia Hand, Principal Investigator

2007 Student Summer Research Fellowships

Applications for the INBRE Student Summer Research Fellowship are due January 19, 2007. The fellowship program provides an 8 to 10 week intensive, hands-on biomedical research experience in which students pursue a hypothesis-driven project in the laboratory of an INBRE mentor. Maine INBRE mentors conduct research in a variety of areas, from molecular toxicology, bioinformatics and genetics, to neuroscience.

More information is available at: http://www.maineidea.net. The site provides an overview of the program, a directory of mentors and their research projects, and application forms, as well as a list of the past year's summer fellows and their research projects.

Students treasure their summer experiences, and the new skills they develop in the lab. "This was a wonderful opportunity and I can't stress enough how rewarding it is to be able to participate in a laboratory environment with other students and researchers," wrote one. "It was one of the most valuable experiences I ever had."

Liz Petit, Colby College, studied "Osmoregulation and stress responses in the euryhaline fish, *Fundulus*" with mentor Dr. Robert Preston, MDIBL and Illinois State University

Presentations, Honors and Awards

ANNE CZECHANSKI, INBRE and College of the Atlantic alumna, presented an abstract at the American Society for Cell Biology Meeting held in San Diego, December 3rd – 9th, 2006. Her poster, "/in drosophilo/: Using *Drosophila* melanogaster as a tool to better understand mouse oogenesis and early development," presented work she began as an INBRE student which she has continued in the Barnes Laboratory at the Mount Desert Island Biological Laboratory.

KAY GONSALVES, Bates College Class of '07, has been awarded a 2007 Pfizer Undergraduate Student Award for the Annual Meeting of the Society of Toxicology. Gosalves works on INBRE Researcher Dr. Rebecca Sommer's project investigating putative dioxin response elements (DREs) in beta-1 and beta-2 adrenergic receptor genes, and will present her results at the March meeting in Charlotte, North Carolina, along with Bates INBRE technician **MARYBETH CARMODY.**

NATHANIEL JILLETTE, University of Maine-Machias student and 2006 INBRE Summer Research Fellow, will attend the meeting of the Society of Integrative and Comparative Biology in Phoenix, Arizona, January 3rd – 7th, 2007. His abstract is entitled "Down-regulation of carbonic anhydrase activity and expression in the gills of *Carcinus maenas* in response to high salinity."

INBRE Research Profile: Rebecca Sommer, Bates College

Bates College Professor Rebecca Sommer (center) and short-course students studying Environmental Toxicology

INBRE researcher Rebecca Sommer, Ph.D., Associate Professor of Biology and Environmental Sciences at Bates College, knows that what we can't see – or taste or feel – can hurt us. She is an environmental toxicologist and studies, among other things, the effects of dioxin.

When you think of dioxin, maybe you picture the bumpy rash on the face of Ukranian presidential candidate Victor Yushchenko, whom doctors treated for poisoning when they found a concentration of the toxicant in his blood that was 6,000 times higher than normal. The average level of dioxin in the blood is between 15 and 45 units per gram – which may cause ill-effects in humans, but often in the form of health problems which are more insidious and less obvious than Yushchenko's. Dioxin has been linked to cancer, reproductive and developmental problems, damage to the immune system, endometriosis, diabetes, and learning disabilities. Less well-studied are the mechanisms by which developmental dioxin exposure leads to cardiovascular problems, which is what Sommer is investigating.

Dioxin works by entering a cell and binding to a dioxin receptor protein. When bound to dioxin, the receptor can then bind to DNA and alter the expression of some genes, changing the level of specific proteins and enzymes in the cell. Sommer studies dioxin's effect on beta-adrenergic (β-AR) receptor signaling. These signal transduction systems give the heart its ability to increase its output quickly, as in the "flight-or-fight response," and also play an important role in heart failure and other cardiovascular problems.

Sommer's research takes a comparative approach, studying the various effects of dioxin-disrupted β-AR signaling in the cardiovascular development of chicks, zebrafish and mice. These three organisms are the leading models for human cardiovascular research, yet they have varying degrees of sensitivity to dioxin exposure. Mice and other mammals are less sensitive to the toxicant than fish or birds, which are the most sensitive. She hopes through this comparison to help determine the best vertebrate model in which to study the impairment of β-AR signaling.

Sommer's initial data from chick embryos exposed to dioxin *in ovo* suggests that an amplified expression of β-AR initially leads to an increased heartbeat, but may eventually cause a desensitization of the organism to the hormones produced by β-AR signaling (like epinephrine and adrenaline), leading to heart failure. Her research could play an important part in determining how physicians treat cardiovascular disease, if the role of dioxin toxicity is considered in treating patients.

Sommer's research is very much a part of her teaching at Bates. Over the past two years ten undergraduates have worked in her laboratory. Two more joined her lab this past summer under the INBRE Summer Research Fellowship program, and are now continuing their work for academic credit. This semester one of her classes is a "Research and Seminar Course" whose curriculum is built around her lab research.

With her INBRE research support Sommer has also been able to hire a full-time technician. "Having an experienced technician who can keep the research going when I am teaching or away from the laboratory has been a tremendous benefit," she says. "When my son was sick this fall I could send emails to my tech from my son's hospital room and she kept the project moving forward." Her INBRE funding may also enable Sommer to take a full year's leave, rather than just one semester's, to concentrate on her research during her sabbatical next year.

Sommer – who also studies tributyltin (TBT)-related imposex in whelks on the Maine coast, as well as the effects of arsenic on cardiovascular development in mice – will lead an INBRE short course on Environmental Toxicogenomics at MDIBL in the spring. An earlier short course allowed her to explore Quantitative Real-time PCR, a technique she herself was not that familiar with, along with her class. She plans to work with her spring class on determining whether zebrafish show the same β-AR traits as mice and chicks. "The short courses provide great laboratory time for all of us, and they make a big difference for our students," she says. "All ten Bates undergraduates who participated in the 2005 environmental toxicology course have remained in science."

Dioxin Facts

- Dioxin is a general term that describes a group of hundreds of chemicals that are highly persistent in the environment
- These chemicals are unintentional by-products of many industrial processes such as pulp and paper bleaching, chemical and pesticide manufacturing, and waste incineration.
- Agent Orange, which is composed of ½ dioxin, has been linked to a high incidence of Spina Bifida in children of exposed veterans.
- Since dioxin is fat-soluble, it bioaccumulates, climbing up the food chain – a typical American will receive 93% of their dioxin exposure from meat and dairy products.
- The heat introduced by microwaving food in a plastic container or plastic wrap causes the plastic to release dioxin.

External Advisory Committee Profile: Christopher Bayne

INBRE External Advisory Committee member Dr. Christopher Bayne brings to our Maine IDeA Network both a long career in marine and freshwater biology and experience in working with the new bioinformatics tools so vital to comparative functional genomics. As a member of Oregon State University's Marine and Freshwater Biomedical Sciences Center, Bayne directed its Microarray Facilities Core. When he needed assistance developing a microarray for the rainbow trout, he sought counsel, including that of Dr. Carolyn Mattingly of the MDI Biological Laboratory. He made his first trip to Maine as a researcher in 2003, and has been coming back every summer since.

Bayne is a comparative immunologist with an interest in the evolution of immunity and the nature of innate immune systems. His lab at OSU studies two research models: rainbow trout, in which he examines the effects of genetics and stress on the fish's innate immunity, and molluscan schistosomiasis, in which he investigates the mechanisms that determine susceptibility and resistance in the host-parasite system.

Schistosomiasis is a disease caused by parasitic worms; it infects over 200 million people worldwide, with another 600 million at risk. Although it is not transmitted in the United States, the disease affects tourists, the armed forces, and others traveling in Asia, Africa, South America, and the Middle East.

The life cycles of schistosomes (parasitic worms) depend upon two hosts – an intermediate (molluscan) host and a vertebrate host. Humans become infected when they wade or swim in fresh water where snails that carry schistosomes are living and Schistosoma parasites penetrate their skin. The worms then grow inside the new host's blood vessels and produce eggs that travel to the bladder or intestines and are then passed in the urine or stool (further contaminating water in areas where sanitation is inadequate). Eggs can also travel to, and damage, the liver, lungs, and, in rare cases, the brain or spinal cord.

Residents of Maine can experience a mild form of discomfort from a related parasite which produces a rash called "Swimmer's Itch" or "Clam-diggers Itch." In its local form, the schistosome parasite's life cycle depends upon snails as the intermediate host, and water birds such as ducks, gulls, and geese, or other aquatic animals like muskrats and beaver as the vertebrate host. Humans make poor hosts for this strain of schistosomes, which die within a few days of burrowing into human skin, and in the meantime can cause an allergic reaction that produces a skin rash.

Bayne's research focuses on the host/parasite interplay with the aim of breaking the cycle of infection either by removing the intermediate (snail) host or by determining what makes a particular host strain susceptible or resistant to the parasite. Oxygen-dependent cytotoxic pathways play a major role in the host's ability to kill parasites, and Bayne is examining genes encoding enzymes relevant to these pathways. Schistosomes also secrete factors that interfere with leukocyte functions in the snail hosts, and Bayne is characterizing these events at a macromolecular level.

With his interest in the evolution of immunity, Bayne is particularly excited about the growing field of bioinformatics and its powerful tools. He has observed them applied successfully in the Maine INBRE and the University of New Mexico COBRE, with its Center for Evolutionary and Theoretical Immunology, for which he also serves as an EAC member. In the latter part of the 20th century, Bayne says, scientific research was often considered respectable only when it was "hypothesis-driven," and purely exploratory efforts were commonly deemed mere "fishing expeditions." However, it has recently become respectable, once again, to pursue *discovery* science, and this has provided a rich source of observations on which new sets of hypotheses can be erected – often with potentially very rewarding hypotheses resulting from more complete information. For example, the genomes of many different species contain stretches of nucleotides that do not code for proteins, and were once referred to as "junk DNA" but are now being found to contain sequences that have been conserved through evolutionary time – a likely indicator of functions that remain to be discovered.

As a new EAC member, Bayne is pleased to have noticed a "real sense" of the more senior faculty in the INBRE program reaching out to help and being supportive of the younger faculty. He is also interested to see the participating institutions wrestling with what he calls "a great dichotomy in higher education" – the need for talented young faculty members to balance teaching and research activities. INBRE, Bayne says, provides a wonderful opportunity to integrate these two goals, allowing individual faculty to pursue their research with the expectation that this will enrich their institution's educational mission.

The INBRE mentorship program helps junior faculty negotiate this terrain, and Bayne wishes that such mentoring had been available earlier in his own career. Instead, he found his sabbaticals – which took him to the Netherlands, England, Norway, Sweden, Scotland and Japan – richly rewarding, as they exposed him to new environments and different ways of thinking and doing things. A successful career in science, Bayne believes, relies not just on careful planning but also on being a bit of an opportunist.

Like a true adventurer, you have to be prepared to explore what you find, not just what you expected to find. Ideas, he says, will sprout and flourish in minds that are imaginative, informed and open.

Alumni Profile: Jocelyn LeBlanc, Colby College '05

JOCELYN LEBLANC

Jocelyn LeBlanc developed an interest in science early, growing up with two parents who are scientists. But when the time came to choose a college, she wanted to explore other disciplines as well, and picked Colby College for its liberal arts and small size. At Colby, she found a curriculum that nurtured her diverse interests, and she completed a double major in both French and biology, with a concentration in neuroscience. She also discovered the BRIN/INBRE program, which led her more deeply into research and to her current position as a technician in the laboratory of Dr. Leonard Zon, Howard Hughes Medical Institute Investigator at Children's Hospital in Boston.

LeBlanc received two BRIN/INBRE summer fellowships before graduating from Colby in 2005. After her sophomore year, she came to the Mount Desert Island Biological Laboratory (MDIBL) with Colby neuroscience professor Dr. Andrea Tilden and studied the effects of the hormones melatonin and serotonin on male-male aggression in the fiddler crab, *Uca pugilator*. Tilden and LeBlanc isolated fiddler crabs from each other, injected them with melatonin, serotonin, or ethanol as a control, and then paired crabs together. Using a video camera to document the crustaceans' interactions, they counted any ensuing "aggressive" incidents.

At MDIBL, LeBlanc found an intimate environment similar to Colby's, with its close interaction between students and faculty and its rewarding lab experiences. "The Bio Lab is a really amazing place," she says. "It was incredible just to be sitting on the grass eating lunch with so many accomplished scientists."

Tilden and LeBlanc returned to MDIBL in 2004 to conduct a new study, "Endogenous rhythmicity of retinal photosensitivity in *Uca pugilator*," in which they used electroretinograms to measure the sensitivity of the crabs' retina when they were periodically flashed with light, but otherwise kept in total darkness. The experiment demonstrated that retinal response to light stimuli maintains a circadian rhythm even when crabs are removed from normal day/night light exposure.

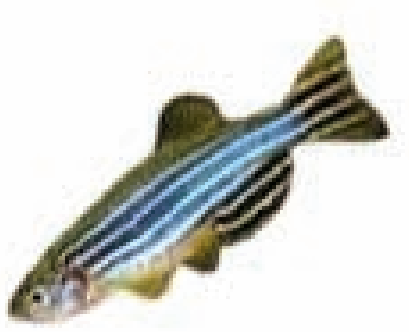
When LeBlanc was presenting her poster on this study at the INBRE student symposium in August that summer, she met Dr. Leonard Zon, a summer scientist at MDIBL and a Howard Hughes Medical Institute Investigator. Zon's laboratory at Children's Hospital uses zebrafish (*Danio rerio*) as model system for studying the genetic pathways in vertebrate blood development and cancer. After graduating from Colby, LeBlanc began working in his lab as a technician studying blood formation during embryonic development

Working with zebrafish, Zon and LeBlanc are able to watch embryos develop more directly than they would be able to in mammals, because mammalian embryos develop in utero. Zebrafish are externally fertilized and produce a transparent embryo in which all the organs – including circulating blood – can be seen. Hematopoietic stem cells are derived early in vertebrate embryo development, making early stages of growth particularly important to observe.

LeBlanc credits her experience in the Zon lab with expanding her skills and scientific knowledge. Most of her course work and lab experiences at Colby focused on physiology, while her current research takes a molecular and genetic approach, examining vascular development, cell differentiation, and stem cell production.

She has also learned from her colleagues in the Zon laboratory. Its forty-two members include thirteen postdocs and eight graduate students, with a corresponding breadth of experience levels. Half the group conducts cancer research, while the other half works on blood development, although there is some overlap. LeBlanc has welcomed having so many potential mentors available to her, and has taken advantage of the opportunity to talk with others about their work and career paths.

LeBlanc is planning to apply to graduate programs this winter. She intends to forsake fish and conduct research with human subjects to explore the biology of human psychology, especially as it pertains to language and consciousness. She is turning her focus back to neuroscience, where her interest in cognitive processes and molecular science merge. She should do well, according to Leonard Zon. "Jocelyn has done a fantastic job," he says. "She is a critical thinker and has a bright future as a scientist."



2007 INBRE Undergraduate Short Courses

Providing education and training in biomedical sciences is a key component of Maine INBRE's mission. As part of our educational program we offer short courses in comparative functional genomics in conjunction with our partner outreach institutions. These courses give students intensive, hands-on training in subjects that may not be available at their alma mater.

"I never thought I could get so much real world lab experience in one week – this course was wonderful," said one student. Across the board participants rate their experience in the lab as one of the most valuable aspects of these courses. "I learned more in a week than I have learned in a whole semester in some classes," said another.

For more information on these and other training opportunities, contact: Mike McKernan or Charles Wray, Outreach Core Co-Directors at: (207) 288-3605.

January 14 – 19 Bowdoin College – First session	**Molecular Neurobiology** Hadley Horch, Ph.D., and MDIBL Course Leaders
February 19 – 23 University of Maine	**Molecular Biology Research Techniques** Charles Wray, Ph.D., MDIBL Course Leader
March 3 – 16 University of Maine - Honors College	**Functional Genomics of Membrane Transport** Denry Sato, Ph.D., MDIBL Course Director
March 10 – 16 Bowdoin College – Second session	**Molecular Neurobiology** Hadley Horch, Ph.D., and MDIBL Course Leaders
March 12 – 19 College of the Atlantic	**Methods in Developmental Biology** Jim Coffman Ph.D., MDIBL Course Director
May 11 – 25 Bates College	**Environmental Toxicogenomics** Rebecca Sommer, Ph.D., Course Director

Maine Biological and Medical Sciences Symposium: April 27th - 28th, 2007

Keynote Speaker, Dr. David Botstein

The 34rd Maine Biological and Biomedical Sciences Symposium (MBMSS) will be held April 27-28, 2007 at the Mount Desert Island Biological Laboratory in Salisbury Cove, Maine. MBMSS is a state-wide gathering of researchers and students — an opportunity to share research results, exchange ideas, promote collaboration, and network with other Maine scientists.

Invited and selected speakers will present short research reports, followed by question/answer and open discussion. A poster session and grantsmanship workshop will also be held. All Maine researchers, science faculty, graduate, undergraduate and high school students are cordially invited to attend.

The keynote speaker will be Dr. David Botstein, Director of the Lewis-Sigler Institute for Integrative Genomics at Princeton University. Dr. Botstein has made fundamental contributions to modern genetics, including the discovery of many yeast and bacterial genes and the establishment of key techniques that are commonly used today. Botstein was a leading scientist in mapping and sequencing the yeast genome, which was the first large eucaryotic genome to be sequenced. In addition, in 1980, Botstein and three colleagues proposed a method for mapping genes that laid the groundwork for the Human Genome Project.

For more information, including guidelines for abstract submission and registration, please visit the symposium website at: ***http://www.mdibl.org/courses/mbmss07.shtml.***

IDeA Network of Biomedical Research Excellence

Supported by:
National Center for Research Resources
National Institutes of Health

This publication was made possible by NIH Grant Number P20 RR-016463 from the INBRE Program of the National Center for Research Resources

INBRE Alumni Profile: Joseph Aman, UM-Farmington '05

Joseph Aman

A Maine native, Joseph Aman grew up in Fort Kent near the Canadian border, and attended The University of Maine at Farmington. There he found a nurturing group of faculty – including Dan Buckley, Jean Doty, Mary Schwanke, and Ron Butler – and an intimate department atmosphere, with only fourteen other biology majors. When UMF joined the Maine INBRE program in 2005, he jumped at the opportunity to participate. That spring he attended an INBRE short course in Molecular Biology Research Techniques taught by Dr. David Towle at the Mount Desert Island Biological Laboratory (MDIBL).

Aman credits that class with broadening his skills and knowledge. "The INBRE course was my first introduction to molecular biology," he says. "The curriculum at my alma mater focused on ecology, microbiology, and environmental sciences, and the INBRE course provided a molecular approach that wasn't previously available to me."

The following summer gave Aman his first introduction to bioinformatics, when he returned to MDIBL on an INBRE Student Research Fellowship to work in the laboratory of Dr. Rex Gaskins of the University of Illinois-Champaign/Urbana. Their project explored the use of *Ciona intestinalis* (sea squirt) as a model organism for studying comparative functional genomics. Using bioinformatics tools, they compared the genes responsible for detoxification in *Ciona intestinalis* with those in humans. Their results demonstrated that while evolutionarily distant, *Ciona intestinalis* shares many of those genes.

Aman loved the atmosphere at MDIBL and the experience of working and living at a research laboratory. "I was hooked," he says. "The summer fellows program was a great experience."

His fellowship study also gave Aman a new interest in the intersection between biology and computer science, and shortly after his graduation from UMF he began working as a Research Assistant to INBRE Research Scientist Dr. Carolyn Mattingly at MDIBL. He has spent the past year looking for regulatory motifs in ATP Binding Cassette (ABC) genes. Fourteen ABC genes are associated with genetic diseases such as cystic fibrosis, immune deficiency disorders, and Tangier's disease. In addition, several ABC genes play a significant role in multidrug resistance. When these genes are over-expressed in tumor cells, they interfere with the efficacy of chemotherapy drugs. Using computer technology, Dr. Mattingly's lab is working to identify the regulatory regions in these genes and provide insight into the molecular mechanisms that drive ABC gene expression.

"The curriculum at my alma mater focused on ecology, microbiology and environmental sciences, and the INBRE course provided a molecular approach that wasn't previously available to me."

"Joe is motivated, intelligent and extremely self-directed," says Carolyn Mattingly. "I'm very fortunate to have him as part of my INBRE research group - there's no question he has made major contributions to the project." Aman has participated in several publications and presentations over the past year, including one at the National IDeA Symposium of Biomedical Research Excellence in Washington, D.C. this past summer.

He has also had the opportunity to teach and learn from other researchers. Last winter he helped staff give a bioinformatics workshop and assisted students from The University of Maine who were taking the short course, *Functional Genomics of Membrane Transport*, at MDIBL. This past October he traveled to the Cold Spring Harbor Laboratory in New York for a two-week seminar, *Programming for Biology*, taught by Lincoln Stein, M.D. and Ph.D., who writes software for biological databases. "I was the only research assistant in the class," Aman says. "All the other participants were PIs, Post-docs, and Ph.D.s. That's the kind of opportunity I've had at MDIBL."

Through his research with Mattingly, Aman has gained an appreciation for bioinformatics and what it can accomplish. Eventually, however, he would like to return to a less abstract field and become a general physician. Aman plans to continue working at MDIBL and apply to medical school in the fall of 2007. As Maine has no medical school, he will look elsewhere for his professional studies, but plans to return when he's ready to put his knowledge into practice.

Do you have INBRE news?

Please let us know about upcoming events, items of interest and your program accomplishments.

Contact: Aimée Picard
Administrative Assistant
(207) 288-3605 x101
apicard@mdibl.org

continued from page one: Sea Urchin Genome

embryogenesis, beginning with fertilization of the egg, and continuing through each of the stages of normal development including cleavage, blastula, gastrula, and mature larva.

To examine the impact of the environment on development, students will expose sea urchin embryos to various toxicants and analyze their effect on developmental morphology and gene expression at different developmental stages. Analysis of gene expression will involve molecular techniques such as extraction of RNA from embryos and reverse-transcriptase coupled polymerase chain reaction (RT-PCR).

Dr. Coffman – who came to MDIBL last year with partial start-up funds from the BRIN program – has been studying sea urchins for more than twenty years, most recently at the Stowers Institute for Medical Research in Kansas City, Missouri.

Why would anyone want to do biomedical research on sea urchins? According to Coffman, sea urchins are remarkably similar to humans in many ways, sharing most of the same gene families, and yet differ in a few critical areas besides the obvious physical ones. For one thing, sea urchins have an "extraordinarily complex innate immune system" which is not based on antibodies, like that of jawed vertebrates, but is effective enough to give sea urchins a surprisingly long life span of up to a hundred years or more.

Innate immunity refers to a set of proteins that are "hard wired" to detect unique aspects of bacteria and signal to an organism's cells that there is an intruder. The rich repertoire of such proteins in sea urchins could end up providing new tools for use against infectious diseases.

Sea urchins are also extremely good at dealing with potential chemical threats in their environment through a "defensome" – a group of genes which can sense and then transform and eliminate threats from potentially toxic chemicals. Without this sophisticated response, exposure to these chemicals, including heavy metals, can lead to aging, illness and death, so it would be valuable to learn how sea urchins defend themselves against them.

The sea urchin has long had a strong fan base among scientists. One reason it was chosen for the genome-sequencing project is the size of the sea urchin research community. Over 140 laboratories are using sea urchins as a primary research organism. In fact, it was research conducted on sea urchins over a hundred years ago that led to one of the breakthroughs of modern biology, when Theodor Boveri discovered in 1902 that normal development requires that every cell in an embryo have a full set of chromosomes carrying the genetic or inherited material for an organism.

In terms of evolution, sea urchins are in an interesting position between vertebrates and invertebrates. "The sea urchin fills a large evolutionary gap in sequenced genomes," said George Weinstock, Ph.D., co-director of the sea urchin sequencing project. Being more closely related to humans than other invertebrates such as flies and worms, "it allows us to see what went on in evolution after the split between the ancestors that gave rise to humans and insects."

Who we are

The Maine IDeA Network of Biomedical Research Excellence (INBRE) is an NCRR/NIH-supported network of nine Maine institutions including Mount Desert Island Biological Laboratory (lead institution), Bates College, Bowdoin College, Colby College, College of the Atlantic, The Jackson Laboratory and The University of Maine. Maine INBRE outreach institutions include The University of Maine at Farmington and The University of Maine at Machias.

The overall goal of the Maine INBRE is to strengthen Maine's capacity to conduct NIH competitive biomedical research. Maine's INBRE provides research support and core facilities to junior faculty, creates research and training opportunities for undergraduates, serves as a pipeline for undergraduate students to pursue health research careers and enhances the scientific and technical knowledge of Maine's workforce.

CONTACT INFORMATION:

Maine INBRE
MOUNT DESERT ISLAND
BIOLOGICAL LABORATORY
P.O. Box 35
Salisbury Cove, ME 04672
www.mdibl.org

WWW.MAINEIDEA.NET

Patricia H. Hand, Ph.D.
Maine INBRE
Principal Investigator
207/288-3605 (tel)
207/288-2130 (fax)
email: phand@mdibl.org

Jerilyn M. Bowers
Director of Public Affairs
207-288-3147 (tel)
207-288-2130 (fax)
email: jeri@mdibl.org

Maine's INBRE is supported by NIH Grant Number P20 RR-016463 from the INBRE Program of the National Center for Research Resources