

MAINE INBRE

IDEA NETWORK OF BIOMEDICAL RESEARCH EXCELLENCE

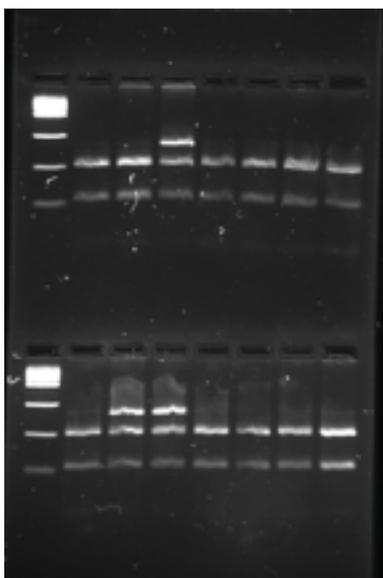
High School Students Get Results at the Summer Academy of Genomics

The INBRE Summer Academy in Genomics took place at the Mount Desert Island Biological Laboratory this summer from August 15-19. Students from 17 high schools across Maine spent five days in the laboratory studying personalized medicine, learning about bioinformatics and participating in a bioethics workshop.

During the course, the students used traditional techniques such as PCR and restriction digests to identify single nucleotide polymorphisms (SNPs) in two human genes. To highlight these new technologies, students also sequenced the fragments of the genes and used a fluorescent, allele-specific PCR technique to genotype DNA samples. The gene that produces a protein vital to metabolizing



Anastasia Gianakas, undergraduate teaching assistant for the Summer Academy of Genomics course, reviews data with high school students.



PCR product-restriction digest gel run by the Summer Academy of Genomics course.

drugs such as Plavix and Valium was genotyped for two common human SNPs. In addition, students sequenced and genotyped SNPs in a separate muscle protein gene, variations in which have been correlated with athletic performance in Olympic sprinters and power-lifters. During bioinformatics exercises students were introduced to Entrez Gene, DNA sequence analysis programs and the Ensembl and UCSC genome browsers. Dana Waring from Harvard University's Personalized Genome Education project conducted a bio-ethics workshop.

The course, directed and taught by MDIBL staff scientist Dr. Charles Wray with the support of Dickinson College undergraduate fellow Anastasia Gianakas, got rave reviews from the students. Deering High School senior Maddie Ostwald said, "I learned more than I ever thought I could in a week and it has piqued my interest in genomics as something

"My favorite part was that we actually got to do experiments as hands-on work, instead of just sitting in a science class and listening."

Written by Hand . . .



Principal Investigator Dr. Patricia Hand

It was another busy and productive summer for Maine INBRE and our efforts at enhancing biomedical research and education in our state. We continue to forge new collaborations,

welcome new participants, and broaden the scope of our regional impact.

Over 140 students from twenty eight undergraduate and graduate institutions and high schools participated in laboratory training short courses this season. *The Molecular Mechanisms of Human Disease*, a unique course for first-year medical students, has expanded its curriculum and outreach. As you will read in our cover story, the *Summer Academy of Genomics* course has had a significant impact on high school students, resulting in significant improvements in the students' understanding of laboratory methods and basic genetics principles.

Held in late April, the 38th Maine Biological and Medical

Sciences Symposium was the largest to date, with over 200 participants, 90 posters, and 25 presentations.

Our investigators met with the External Advisory Committee in August and received feedback and guidance on their research programs and careers. Immediately following was the 2011 Northeast Regional IDeA Meeting, another opportunity for network-building and collaboration with other INBRE scientists.

We look forward to welcoming a new INBRE investigator on November 1, when Dr. Sandra Rieger joins MDIBL as an assistant professor. Dr. Rieger's project will focus on the study of nervous system regeneration.

As we gear up for winter to arrive in Maine, I wish you all a productive end to 2011 and look forward to new endeavors in 2012.

Medical School Course Gains Momentum

In its second year, the Molecular Mechanisms of Human Disease course expanded its scope of outreach by including medical students from the University of New England College of Osteopathic Medicine, in addition to Dartmouth Medical School and University of Vermont College of Medicine. The course, an intensive and focused one-week research short course for first year medical students, took place at MDIBL from July 31-August 6. The goal of the course is to deepen students' understanding of fundamental physiological mechanisms of human disease, and to engage students in research that will give them an appreciation for the possibility of combining research with clinical practice as a career choice. It is intended to give students insight into fundamental elements underlying the molecular mechanisms of disease and to strengthen their ability to apply this knowledge to future research and clinical applications.

The course content was expanded this year to provide training in a number of techniques and animal models to study cystic fibrosis, genetic screening, and

inflammation and human disease.

Course faculty included Bruce Stanton, PhD, Professor at Dartmouth Medical School, Carol Kim, PhD, Associate Professor at the University of Maine, Brent Berwin, PhD, Associate Professor at Dartmouth Medical Center, Denry Sato, MDIBL Visiting Scientist, and Elizabeth Stanton, JD, Director of Regional Risk Management at Dartmouth Hitchcock Medical Center.



Medical school students from Dartmouth, the University of Vermont, and the University of New England with faculty Dr. Bruce Stanton, Dr. Denry Sato, and Dr. Brent Berwin.

Summer Academy in Genomics *(continued from page 1)*



The Summer Academy in Genomics course participants in August 2011 on the MDIBL campus, with instructors Dr. Charlie Wray of MDIBL, Dana Waring from the Personalized Genomic Education Project at Harvard Medical School, and undergraduate teaching assistant Anastasia Gianakas.

I'd like to study in college someday." Erzebet Nagy, a junior at Lawrence High School, said her favorite part was that "we got to actually do the gels and look at the results of the experiments. We didn't just look

at the results of someone else's experiments; they were ours." MDIBL staff noted that the quality of the data sets that were generated by the high school students were on par with those of graduate students.

38th Maine Biological and Medical Sciences Symposium

The 38th Maine Biological and Medical Sciences Symposium (MBMSS) was held on April 15-16 at MDIBL and showcased how Maine students are conducting meaningful scientific research. Funded by INBRE, this year's event was a state-wide gathering of over 200 scientists and students representing 30 colleges and research facilities, including INBRE institutions as well as the University of Southern Maine, the University of New England, the Maine Medical Center Research Institute, the Maine Institute for Human Genetics and Health, and the Bigelow Laboratory for Ocean Sciences.

The Symposium gave students and faculty an opportunity to share research results, exchange ideas, promote collaboration, and network with Maine scientists in a variety of disciplines.

"In those five days at the INBRE Summery Academy in Genomics, I learned more than I ever could have imagined."



Students highlight their summer research projects at a poster session of the 38th Maine Biological and Medical Sciences Symposium, held at MDIBL on April 15-16, 2011.

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Undergraduate Summer Fellowships Highlights

Jennifer Baum, a junior at the **University of Maine at Farmington**, was awarded an INBRE fellowship this summer to work with MDIBL visiting scientist Dr. Gary Conrad on the effect of riboflavin and UVA on cross-linking in collagenous tissues. Baum is a Secondary Education in Science major with a concentration in Biology and Chemistry. She credits “a really amazing group of science teachers “ with her desire to become a science teacher herself.

The research plan for Baum’s project was revised unexpectedly when they experienced problems with the control experiment, which was a lesson in the scientific method. Baum said, “That is really what science is like sometimes; you can’t always figure out the answers.” Baum said that this experience motivated her to go a step further; to think outside the box to move beyond the roadblocks you may encounter in any research plan. Baum called the experience invaluable and considers the INBRE program a resource that she will be able to share with her future science students.

For Alyson Lowell, a junior at the **University of Maine**, collaboration is the key to a successful research experience. “This summer I have learned first-hand that if you work together you can learn more as a team.” Lowell worked in the the lab of MDIBL visiting scientist Dr. Bruce Stanton. The Stanton lab conducts experiments on the CFTR gene, which is the main gene involved in cystic fibrosis. Lowell spent the summer collaborating with her fellow students on eluci-

dating one of the CFTR pathways using killifish as the model organism. Lowell, a Biology and Veterinary Science major, learned about INBRE from her chemistry professor, Dr. Rebecca Van-Beneden, who recommended the program as a good fit for Lowell’s interests. The experience, Lowell said, has broadened her focus and made her aware of several potential avenues for a science career that she had not previously consid-



University of Maine Biology and Veterinary Science major Alyson Lowell, left, and fellow INBRE undergraduate Tracy Bantegui, from Husson University.

Short Course Highlights

Scott Collins, **University of Maine Honors College** junior and Microbiology and Biochemistry major, attended this year’s Molecular Mechanisms of Human Disease short course. The knowledge he took away from the course assisted him in his classwork at UMaine, where he was able to apply lessons he learned at MDIBL. “Back at school we recently performed an exercise in my biochemistry class involving the bioinformatics of a certain protein. It seemed that most students in the class were taking four hours to find the amino acid sequence, where it took me only two minutes.” Instructors Keith Hutchison (University of Maine) and Ben King (MDIBL) were pleased with the positive feedback and found it rewarding to learn that the lessons had an impact beyond the specific course.

Chris Demers, a student in the Graduate School

“I am looking forward to transitioning all this new knowledge to my own research.”

of Biomedical Sciences at the **University of Maine**, was awarded an INBRE fellowship to attend the Quantitative Fluorescence Microscopy course at MDIBL. He said, “The course was very intensive but extremely rewarding. I am looking forward to transitioning all this new knowledge to my own research.”

INBRE alumna Clare Bates Congdon, now an associate professor at the **University of Southern Maine** and instructor in their 2011 short course, passed on thanks for the support the course received from the INBRE Core teams at MDIBL. “A special thank you to (Training Manager) Chris Smith, who worked hard every day to make certain we had the right reagents, equipment, and computers for our experiments. To Dr. Voot Yin, who gave us an excellent seminar and graciously let us monopolize the Core’s QPCR machine. And to Dr. Tony Planchart, who gave us zebrafish cDNA on short notice, just when we really needed it. The students had a great experience and several seem interested in applying to next year’s INBRE summer research fellow positions.”

INBRE Alumni News

Emily Miller enrolled in Duke University's graduate school to study Developmental and Stem Cell biology this fall. Miller attended Ellsworth High School, was an INBRE-funded high school student in 2007 under the mentorship of MDIBL visiting scientist Dr. JB Claiborne, and received an INBRE undergraduate summer fellowship to study with University of Maine Professor Sharon Ashworth in 2009. She graduated from the University of Maine.

Michael McCann plans to major in biology when he attends Middlebury (Vt.) College in the fall and hopes to become a doctor. Mike went to Winslow High School and attended the 2010 Summer Academy of Genomics at MDIBL, which he credits with sparking his interest in biology.

Allison Saunders, a senior at Cheverus High School, attended the 2010 Summer Academy in Genomics at MDIBL, where she extracted DNA to see if it metabolized medication. She was eager to find another opportunity this past summer to propel her closer to her goal of attending medical school. She found it in a summer program at the University of New England that involves a partnership with the Center for Excellence in the Neurosciences and aims to introduce Maine high school students to the connection between medicine, research, and entrepreneurship. Saunders, of Saco, said her interest in

medical research is inspired by two friends with Duchenne muscular dystrophy. She would like to find cures or treatments for the disease. Saunders said it is hard to watch her friends lose motor skills as the disease progresses.

Kristopher Cooper was honored as valedictorian at his University of Maine graduation this past spring. Kristopher majored in biology and is beginning graduate studies at the University of Connecticut School of Dental Medicine this fall. Kristopher participated in the University of Maine Honors College INBRE short course in 2009.

"The Summer Academy of Genomics at MDIBL is what got me interested in biology."

Ryan Bavis, PhD, Associate Professor at Bates College, has agreed to join our INBRE Steering Committee, filling an active spot vacated by Dr. Pam Baker, a long-time INBRE supporter who is now serving as VP of Academic Affairs and Dean of Faculty at Bates. Dr. Baker will continue to serve in an advisory role on the committee.

Dr. Bavis was an INBRE junior investigator from 2005-2010 and conducts research in how the environment alters breathing in early life and adulthood.

Upcoming Events

Ensembl Bioinformatics Workshops

November 17 and 18, 2011 at the University of Maine in Orono

The University of Maine Graduate School of Biomedical Sciences and the Maine INBRE Network are funding two separate day-long Ensembl Bioinformatics workshops at the University of Maine on November 17 and 18. Ensembl (<http://www.ensembl.org>) is the world's most comprehensive genome browser that provides automatic annotation of genes and other features in the human, zebrafish and mouse genomes. Enrollment in the workshops is open to students and faculty at all institutions within the Maine INBRE Network. Complete the online form if you are interested in attending: <http://www.surveymonkey.com/s/VSPNVN8>. Enrollment will be limited. Contact UMaine Professor Keith Hutchison (keithh@maine.edu) or MDIBL Staff Scientist Ben King (bking@mdibl.org) with questions.

Visiting Scientist Seminar: October 27, 4pm at Druckenmiller Hall Seminar Room 20 at Bowdoin College
Managing the message: Alternative polyadenylation under cellular stress conditions.

Joel Graber, Associate Professor, The Jackson Laboratory and former INBRE investigator, http://research.jax.org/faculty/joel_graber.html

NCRR National IDeA Symposium of Biomedical Research Excellence (NISBRE) Annual Meeting

June 25-27, 2012 at the Omni Shoreham Hotel in Washington, DC

Visiting Scientist Fellow: Rachael Hannah, PhD

Dr. Rachael Hannah, Assistant Professor at the University of Maine at Presque Isle (UMPI), earned a Visiting Scientist Fellowship to support a three month research project at MDIBL this past summer. The INBRE-funded fellowship allowed Dr. Hannah to work with INBRE investigator Dr. Voot Yin in conducting research on creating a central nervous system injury model in the zebrafish to better understand neuron regeneration. Dr. Hannah explained that the goal of the project is to establish zebrafish as a model organism to help to answer basic questions regarding what happens to our brains after an injury.

Dr. Hannah chose zebrafish as a potential model because of their known genome, the ease with which they can be manipulated and the comparatively low cost at which this can be done. “Zebrafish on their own are a very powerful model system because of the ability to modify their genes,” she said. “Instead of mice where it takes two to three years to achieve a genetic model, zebrafish take two to three months to create viable genetic models.”

“I’m a young investigator and for somebody to fund this idea is a unique opportunity for me,” she said. If her model provides information that leads to further study of neuron regeneration in zebrafish, Dr. Hannah hopes to bring it to northern Maine to do research at UMPI and engage students in the research work.



Dr. Rachael Hannah works with summer students in the laboratory of INBRE investigator Dr. Voot Yin at MDIBL

Dr. Hannah earned Bachelor’s degrees in Molecular and Marine Biology in 1994 from the Florida Institute of Technology. She developed an interest in neuroscience, especially neurovascular research, while working at Merck Research Labs. This led her to her home state of Vermont, where she received a Ph.D. in Anatomy and Neurobiology at the University of Vermont in 2010. She continues to be fascinated by how stroke, subarachnoid hemorrhage, and traumatic injury affect the blood supply of the brain. She joined UMPI as a full-time faculty member in Fall 2011, where she teaches anatomy and neurobiology.

Dr. Hannah has published in several peer-reviewed journals, including two papers in the *Proceedings of the National Academy of Sciences*. Her article in the *Journal of Cerebral Blood Flow and Metabolism* was selected as a feature article. Dr. Hannah is a member of the Society for Neuroscience and the American Physiological Society. She is the recipient of two awards, both given in 2009: the award for Graduate Research Excellence from the New England Chapter of the American Society of Pharmacology and Experimental Therapeutics (ASPET); and the Graduate Student Travel Award from the Society for Neuroscience, Women in Neuroscience (Eli Lilly).

Dr. Hannah hopes that her experience as a Visiting Fellow at MDIBL will strengthen connections between UMPI and the laboratory, especially for future researchers. Dr. Hannah lives in Presque Isle with her husband, who is the nordic ski coach at UMPI. They just welcomed their first child in early October.



Dr. Rachael Hannah and students at MDIBL in July 2011.



Casco Bay High School student Noah Lupica-Nowlin takes notes at a Monday morning seminar at MDIBL in July. Noah's summer research experience was supported by INBRE.

INBRE Students Shine at the MDIBL Summer Student Symposium

INBRE-funded summer students delivered talks and presented posters on their research projects at the July 26 MDIBL Summer Student Symposium. Faculty, friends and relatives attended the event, which allowed many high school students and undergraduates their first experience with presenting a talk or poster about their research.

The award for the best talk was given to partners Tracey Bentegui, a sophomore at Husson University, and Westbrook High School's Ayantu Regassa for their presentation on "Elucidating Adult Zebrafish Regeneration and miR-21 Function." Both students were funded by INBRE and worked in INBRE investigator Dr. Voot Yin's laboratory this summer.

The best poster presentation award, for "Nervous System Regulation of the Cellular Osmotic Stress Response," was awarded to the team of Jennifer Ditano, a University of Southern Maine sophomore, and 2011 Old Town High School graduate Dacie Manion, who started her studies at MIT this fall. They worked under the mentorship of Dr. Kevin Strange and were supported by INBRE.



Jennifer Ditano, a sophomore at the University of Southern Maine, describes her research on osmotic stress response during a presentation class taught by Dr. Susan Fellner, an MDIBL visiting scientist. Jennifer was an INBRE fellow this summer.

IDEA Network of Biomedical Research Excellence

Research Institutions:

Mount Desert Island Biological Laboratory
The Jackson Laboratory
University of Maine

Academic Institutions:

Bates College
Bowdoin College
Colby College
College of the Atlantic
Southern Maine Community College
University of Maine Honors College
University of Maine at Farmington
University of Maine at Fort Kent
University of Maine at Machias
University of Maine at Presque Isle

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Maine INBRE Program Coordinator:

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Keith Hutchison, PhD, UMaine
Cristle Collins Judd, PhD, Bowdoin
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Chris Petersen, PhD, College of the Atlantic
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Michael McKernan
Charles Wray, PhD

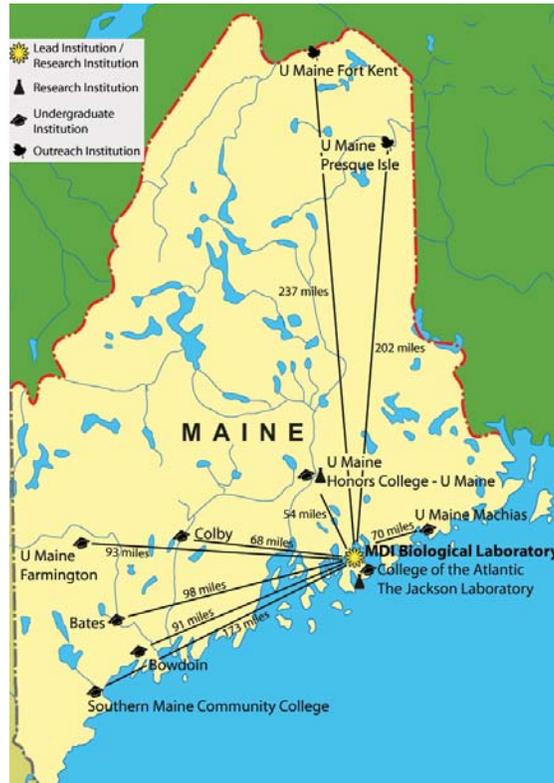
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Who We Are

The Maine IDeA Network of Biomedical Research Excellence (INBRE) is an NCCR/NIH-supported network of Maine institutions including Mount Desert Island Biological Laboratory as lead institution, Bates College, Bowdoin College, Colby College, College of the Atlantic, The Jackson Laboratory, Southern Maine Community College, UMaine-Farmington, UMaine Honors College, UMaine-Machias, UMaine-Fort Kent, UMaine-Presque Isle, and the University of Maine.

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 undergraduate and graduate students, serves as a pipeline for students to pursue health research careers, and enhances the scientific and technical knowledge of Maine's workforce.



NEWS AND PHOTO SUBMISSIONS ARE WELCOME
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Recent Publications

Gage Brummer, a senior at Kansas State University, recently published "The Role of Non-Enzymatic Glycation and Carbonyls in Collagen Cross-Linking for the Treatment of Keratoconus" in the journal *IOVS (Investigative Ophthalmology and Visual Science)*. Gage was a summer INBRE fellow at MDIBL in 2009 and 2010 and has been researching the underlying causes of eye disease under the supervision of Professor Gary Conrad, a visiting scientist at MDIBL and a professor at Kansas State University.

"These three institutions - Maine INBRE and MDIBL, Kansas INBRE, and the Johnson Cancer Center have undoubtedly given me the tools necessary to get this paper published."

Ben King, Staff Scientist at MDIBL, co-authored a paper titled "MicroRNAs support a turtle + lizard clade," which was recently accepted for publication in *Biology Letters*. The paper addresses the problem of the phylogenetic position of turtles and the root of the reptilian tree by comparing the complements of microRNAs in three different representative taxa (turtle, lizard and alligator). Ben noted, "This paper is a direct result of my INBRE-funded trip to visit MDIBL visiting scientist **Dr. Kevin Petersen** at Dartmouth in November 2010, where I adopted his miRminer software. The analysis of this large genome would have very difficult to complete without the new Linux server that was purchased last year and upgraded this spring, also supported by INBRE funds." The server is an important addition to the Bioinformatics Core for the analysis of high-throughput sequence (HTS) data. The miRMiner software is useful for annotating known and novel microRNAs from HTS data. Anyone interested in using the software can contact Ben.