ISU Biotechnology Surges Forward with a Boost from the Grow Iowa Values Fund

Adapted from a release written by Mike Krapfl, ISU News Service

Iowa State University researchers will use grants of state money to develop an instrument that reveals single molecules, test technology that can detect food contamination, design taller wind turbine towers and advance seven other projects with potential to grow the state’s economy.

The state Board of Regents recently approved Iowa State’s proposal to award 10 competitive grants totaling $942,389 from Iowa State’s $1.459 million share of this year’s Grow Iowa Values Fund. Iowa State has awarded the grants since 2006 to research projects with potential for commercial development.

“These grants are part of Iowa State’s System for Innovation program that’s focused on transferring university technologies to startup or existing companies,” said Sharron Quisenberry, Iowa State’s vice president for research and economic development. “This system recognizes that the fuel for transferring university technology to the Iowa economy is faculty and staff research.”

The largest grant in this year’s competition, $120,075, is awarded to Sanjeevi Sivasankar, an assistant professor of physics and astronomy, demonstrates a microscope he’s developing that can reveal the individual characteristics of a biological molecule. Bob Elbert photo

Sanjeevi Sivasankar, an assistant professor of physics and astronomy, demonstrates a microscope he’s developing that can reveal the individual characteristics of a biological molecule. Bob Elbert photo

Sivasankar, who has been working to refine a prototype of the instrument, said the microscope is very useful in his own studies of how the cells of the body bind and organize themselves. He said the instrument could also be a powerful tool in biomedical research, drug discovery, cancer diagnostics and bio-sensing applications.

As a post-doctoral researcher at Stanford University and the University of California, Berkeley, Sivasankar worked with Steven Chu, the current U.S. Secretary of Energy and co-winner of the 1997 Nobel Prize in Physics, to develop and build a single-molecule microscope. Supported by startup research funds from Iowa State, Sivasankar’s laboratory has significantly refined the instrument by increasing its measurement capabilities, efficiency and ease of use. The instrument integrates two single-molecule technologies that have been used separately: atomic force microscope technology that manipulates molecules and measures forces; and fluorescence resonance energy transfer technology that observes single molecules at very high resolution.

Using one or the other technology is like “having hands but no eyes or eyes but no hands,” said Sivasankar. “We can combine these two technologies into one instrument.”

That makes a big difference in biological studies, Sivasankar said. Typically, biologists study samples made up of thousands of molecules. The resulting data describe the average molecule in the sample. He said the new instrument can reveal the individual characteristics of a single molecule.

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The other biotechnology-related Iowa State projects to win 2010 grants from the Grow Iowa Values Fund are:
$106,961 to Byron Brehm-Stecher, an assistant professor of food science and human nutrition. He’s working with Advanced Analytical Inc. of Ames to study how an instrument developed by the company can be used to quickly detect foodborne pathogens and increase food safety.

$99,883 to Rick Sharp, professor of kinesiology and director of Iowa State’s Kinesiology Laboratories. He’ll work with Metabolic Technologies Inc. of Ames to develop a new gel system to deliver HMB, a dietary supplement that can reduce muscle damage and inflammatory response after exercise while promoting muscle recovery.

$83,000 to Patrick Halbur, professor and chair of veterinary diagnostic and production animal medicine and executive director of Iowa State’s Veterinary Diagnostic Laboratory; James West, director of food supply veterinary medicine; Marianna Jahnke, a research associate in veterinary diagnostic and production animal medicine; Paul Plummer, assistant professor of veterinary diagnostic and production animal medicine; Rodger Main, director of operations for the Veterinary Diagnostic Laboratory; and Vickie Cooper, a senior clinician for veterinary diagnostic and production animal medicine. They’ll work with the Ames Center for Genetic Technologies to develop a genetic test of cattle embryos for inherited diseases and other traits.

### Service Facilities Information Available

The 2011 edition of *Service Facilities for Research in Biotechnology* is now available on-line and in hard copy. The web site and free brochure contain information regarding the 31 facilities that house biotechnology-related research equipment on the Iowa State University campus. Information about the new Doubled Haploid Facility and the Materials Preparation Center is included, as well as completely updated equipment and current fee information regarding the other 29 facilities. All facilities are available for use by researchers in academia and in Iowa-based industry.

The brochure may be viewed online at [www.biotech.iastate.edu/service_facilities/](http://www.biotech.iastate.edu/service_facilities/). To receive a free copy of the brochure, please send a request including your mailing address to Camie Stockhausen at camstock@iastate.edu.

### Biotechnology News

#### Biotechnology Update Goes Electronic

In a move designed to better serve our audience and increase awareness of the wealth of beneficial aspects of biotechnology research taking place at Iowa State University, including economic growth, health advances for humans and animals, and crop improvement, the Office of Biotechnology will begin providing monthly electronic newsletters (E-News) in the fall of 2010.

Subscribers who are currently receiving the Biotechnology Update in hard copy form and would like to receive E-News, are asked to provide a valid e-mail address to Camie Stockhausen at camstock@iastate.edu for addition to the E-News list. Those readers who are already electronically receiving the Biotechnology Update will be automatically added to the E-News distribution list, which also will have an opt-out feature. The hard copy edition of the Biotechnology Update will no longer be produced.

With the advent of the Office of Biotechnology E-News, readers will be kept current in a more visually interesting and timely manner, while simultaneously supporting Iowa State University’s Live Green! initiative.

#### Iowa State University Researcher Examines Mosquito Genes for New Disease Responses

An Iowa State University researcher searched for new genes that are turned on during infection in a type of mosquito that is not only a pest, but transmits disease-causing pathogens.

Lyric Bartholomay, assistant professor of entomology, along with colleagues from around the world, infected the common southern house mosquito, *Culex quinquefasciatus*, with various pathogens to see which mosquito genes are activated in response to the infection.

Bartholomay is the first author on the paper, “Pathogenomics of *Culex quinquefasciatus* and Meta-Analysis of Infection Responses to Diverse Pathogens,” published in the Oct. 1 issue of the journal *Science*.

The southern house mosquito is common to many areas of the United States and around the world. It feeds on blood from birds, livestock and humans, and transmits a wide variety of deadly and debilitating human and veterinary pathogens. In addition to transmitting West Nile virus, the mosquito can carry St. Louis encephalitis and the microscopic roundworm...
that causes lymphatic filariasis - a debilitating tropical disease that affects up to 40 million people every year.

Bartholomay participated in cataloging the infection-response genes for Aedes aegypti in a manuscript published in 2007. She was chosen to be first author of the current Science paper because she has experience describing the immune responses in the northern house mosquito, Culex pipiens.

In the research, mosquitoes were infected with viruses, worms and bacteria. The genes of the mosquitoes were monitored to see which changed during the response to infection.

“What we’re trying to do is broaden our understanding of infection response genes beyond those that we expect to be there,” said Bartholomay. “We took a two-pronged approach to understanding infection responses,” she added. “First, we scoured the genome sequence looking for those immunity genes that the mosquitoes can use to respond to an infection. Then, we looked at what genes comprise broad spectrum and specific immune responses.

“We next took it one step further and compared the infection responses in Culex quinquefasciatus to similar infections in Aedes aegypti and Anopheles gambiae.”

Bartholomay noted that the functions of many of the genes revealed in this analysis are still unknown, but as more is discovered about the functions of the genes, it could provide the first steps to controlling mosquito-borne diseases.

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**Faces and Places**

**Aileen Keating** joined the department of animal science in May of 2010 as an assistant professor. Keating earned her Ph.D. at the National University of Ireland, Galway, in biochemistry with an emphasis on mammary gland physiology.

She furthered her experience during postdoctoral training at the University of Alberta in Canada, where she worked on characterizing the regulation of conjugated linoleic acid formation in milk. She then switched to another aspect of reproduction and studied ovarian toxicology at the University of Arizona.

She received a Pathways to Independence award from the National Institute of Environmental Health Sciences to build an independent research program studying ovarian metabolism of xenobiotics, and how environmental toxins cause ovarian follicle loss. These research programs will be continued in her laboratory at ISU. Keating can be contacted by telephone at (515) 294-3894 or by e-mail at akeating@iastate.edu. Her office and lab are located in 2356J and 2336-1 in Kildee Hall, respectively.

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**Jeff Trimarchi** joined the genetics, development and cell biology (GDCB) department as an assistant professor in April 2010. He began his career in research as an undergraduate at Amherst College investigating how light affects the ability of certain enzymes to maintain retinal function. After graduation, he worked as a research technician at Boston University’s school of public health examining the mechanisms controlling the generation of spontaneous mutations in bacteria. He earned his Ph.D. at the Massachusetts Institute of Technology where he identified the transcription factor E2F6 and investigated its role in cellular proliferation. As a postdoctoral fellow at Harvard Medical School, he used single cell transcriptional profiling to examine the gene networks involved in retinal cell fate determination.

In his laboratory at ISU, Trimarchi’s research is focused on characterizing the networks of genes that govern the differentiation and maturation of retinal ganglion cells. Glaucoma, the second leading cause of blindness, is characterized by the progressive degeneration of these ganglion cells. Understanding the gene programs responsible for the production of ganglion cells is essential for researchers to become able to generate a large number of them from stem cells to be potentially used for cell replacement therapy in glaucoma.

Trimarchi can be reached by telephone at (515) 294-7059 or e-mail at jtrimarc@iastate.edu. His office is located in 2114 Molecular Biology Building.

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**Zhiyou Wen** joined the department of food science and human nutrition in August 2010 as an associate professor. Wen earned his Ph.D. in Biochemical Engineering at the University of Hong Kong with an emphasis on engineering design of microalgae culture process for developing various value-added products.

He expanded his expertise in biomass and bioenergy during postdoctoral training at Washington State University. After postdoctoral training, he took a faculty position in Biological Systems Engineering at Virginia Tech.

The focus of Wen’s research program at Iowa State University is the development of various biological conversion processes to convert agricultural and other low-value byproducts into bioenergy and/or value-added products, such as syngas fermentation for biofuel production, heterotrophic algal fermentation for production of high value omega-3 polyunsaturated fatty acids, and phototropic algal culture for production of biofuel feedstocks.

Wen can be contacted by telephone at (515) 294-0426 or by e-mail at wenz@iastate.edu. His office and lab are located in 2312 Food Science Building.
The following are a subset of the grants recently awarded for biotechnology-related research at ISU. For more information about establishing research relationships with ISU biotechnology researchers, you are invited to contact Lisa Lorenzen at llorenze@iastate.edu.

Mallapragada, S., Narasimhan, B., Pohl, N., Wannemuehler, M., Carpenter, S.; Chemical and Biological Engineering, Chemical and Biological Engineering, Chemistry, Veterinary Microbiology and Preventive Medicine, Animal Science. Targeted nanovaccine platforms against respiratory pathogens. United States Department of the Army, MRA

Hannapel, D., Rao, A.; Horticulture, Biochemistry, Biophysics and Molecular Biology. Transferring research from a model system to uncover the network that regulates long-distance signalling in Potato. National Science Foundation

Bogdanove, A., Yang, B.; Plant Pathology; Genetics, Development and Cell Biology. GEPR: Transcription profiling and functional analyses of bacterial disease susceptibility pathways of rice. Kansas State University

Narasimham, B. Wannemuehler, M, Bellaire, B.; Chemical and Biological Engineering, Veterinary Microbiology and Preventive Medicine. Impact of polymer adjuvant chemistry on adaptive immune mechanisms. National Institutes of Health


Miller, C., Veterinary Microbiology and Preventive Medicine. Virus and cell regulation of reovirus escape from translation inhibition. National Institutes of Health

Vollbrecht, E., Brendel, V.; Genetics Development and Cell Biology. Genetic mechanisms regulating inflorescence architecture in maize and related cereals. University of California, Berkeley

Mallapragada, S., Narasimhan, B., Peters, R.; Chemical and Biological Engineering, Chemical and Biological Engineering, Biochemistry, Biophysics and Molecular Biology. Molecular design of nano-carrier materials for reactions catalyzed by multi-enzyme complexes. National Science Foundation


Huang, X. Computer Science. Improvements to the PCAP genome assembly program. Monsanto Company

Nettleton, D., Statistics. Genomic analyses of shoot meristem function in maize. Cornell University

Bloedel, J., Biomedical Science. Use of beta-glucuronides of Vitamin D to treat inflammatory bowel disease. Glycomyr, Inc.


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