

# Plant Sciences Institute UPDATE

## GeneChip technology gives Iowa State scientists an edge

After only three months in operation, the Affymetrix GeneChip® Instrumentation System has placed Iowa State researchers on the cutting edge of gene research. The facility allows researchers to investigate a variety of plant, microbial, animal and human research projects, such as molecular characterization of genes in disease, responses to biotic or abiotic stresses and cellular development. It will increase data accuracy and reliability of genomics technology on campus.

Steve Whitham, assistant professor of plant pathology and a researcher in the Center for Plant Responses to Environmental Stresses (CPRES), said research projects that use the facility bring together bioinformatics specialists, genomic researchers and other scientists to collaborate. This gives Iowa State the ability to acquire and analyze GeneChip microarray data on campus—something crucial for top

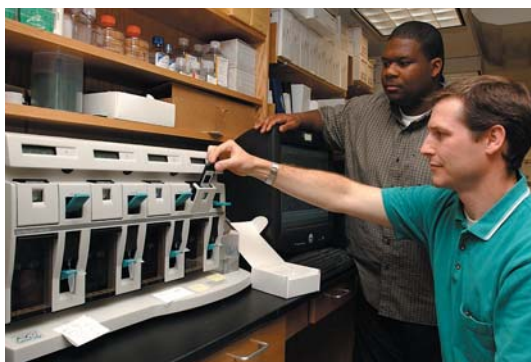
research universities, Whitham said.

“The complexity of microarray experiments and the massive quantities of data generated create problems that require expertise of people from a variety of disciplines,” Whitham said. A microarray group, led most recently by Dan Nettleton, associate professor of statistics, provides a forum for researchers from

various disciplines to share interests, technologies, resources and results.

Having the facility on campus also helps faculty compete for federal research funding. Data generated will be a springboard for new or continued funding opportunities.

“The facility demonstrates that Iowa State is experienced with and committed to using and developing state-of-the-art technologies to examine the functions of genes,” he said. “It complements technologies used in the Center for Plant Genomics for making and analyzing microarrays printed on glass slides.”



Monsanto Fellow Tyrell Carr (left) and Iowa State plant pathologist Steve Whitham are loading an Arabidopsis GeneChip into the fluidics station for washing in the new campus GeneChip facility.

## New facility strives to strengthen Iowa's economy

When the Roy J. Carver Co-Laboratory opens in October, it will be home to the Innovations Development Facility (IDF), a productive research environment where scientists from academe and industry can work together to advance the mission of the institute and promote economic development in Iowa.

“It will provide targeted opportunities for partnerships that solve industry problems, meet consumer demands for improved products and services, and provide ongoing technical education for students, faculty and industry researchers,” said institute director Stephen Howell.

The Iowa Department of Economic Development (IDED), an important partner, is helping to launch the innovative facility.

“IDED looks forward to the opportunity to work closely with the Plant Sciences Institute to develop and nurture new businesses in the area of plant biotechnology,” IDED director Michael Blouin said. “We also support the effort of the institute to collaborate with established businesses within the state on research projects that can contribute to the mission of the university and to

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## Fascinating science

There are many exciting things happening at the Plant Sciences Institute to cover in this column, particularly with the opening of the Roy J. Carver Co-Laboratory and the inauguration of the



Innovations Development Facility. We hope to see you at the October 18th building dedication and show you around our marvelous new facility.

I want to recap one scientific event that highlighted the year—the Plant Sciences Institute Symposium on transposons, or what are sometimes called “jumping genes.” The symposium showcased Iowa State’s scientific pioneers in this area, Donald Robertson and Peter Peterson, and its future leaders, such as the program organizers, Tom Peterson and Dan Voytas.

The topic was particularly fascinating because the big international genomics projects have revealed that more than half of the corn genome is made of transposons, and nearly half of our own (human) genomes are made of transposons, too! These transposons have shaped and molded the genomes of plants and animals over evolutionary time.

Transposons have deployed some of the most elegant molecular mechanisms for multiplying and jumping around the genome, and genomes have countered with other grand mechanisms to keep these elements at bay. (It was most interesting to learn that these elements are largely “sleeping” in the genome, but will awaken and move to action when a plant faces stress.) Most exciting was the report that jumping genes can be captured in a test tube and studied under carefully controlled conditions.

Institute scientists are interested in understanding the molecular machinations of these little beasts and harnessing them for agriculture. Already, institute scientists have employed transposons for genetic engineering purposes to refine ways for improving crops.

Stephen Howell  
Director

## Institute funds promising research

Six research projects with promising futures have received start-up funding from the Plant Sciences Institute. They were selected for their excellent science, probability for continued funding and potential to foster long-term collaborations. Grants ranged from \$10,000 for one year to \$60,000 for two years. The research projects and Iowa State faculty investigators are listed below.

**Organ-specific Determiners of Abscission Competence**  
Coralie Lashbrook, horticulture

**Structure-function Analyses of the Phytophthora Resistance Gene Rps 1-k Relating to Cell Death**  
Madan Bhattacharyya, agronomy

**Using Genetics and Proteomics to Localize Oxidative Damage within Arabidopsis Cells**  
David Oliver, botany

**Metabolomics Analysis of acyl-CoA Pools in Plants**  
Basil Nikolau, biochemistry, biophysics and molecular biology; and Edward Yeung, chemistry

**Systems Biology: Genome, Genetic Network and Evolution**  
Xun Gu, zoology and genetics; and Hailiang Liu, mathematics

**Identification of Varieties and Transgenic Events with Spectroscopy**  
Charles Hurburgh, agricultural and biosystems engineering

## Rao mixes industry with academia

Some scientists in industry are fortunate to take sabbaticals, much like their counterparts in academia.

Guru Rao, with Pioneer Hi-Bred International, Inc., is doing just that. Rao spent the last five months as an adjunct faculty member in the biochemistry, biophysics and molecular biology department. He leads seminars and collaborates with top scientists at Iowa State.

Pioneer encourages its senior scientists to take sabbaticals to spend up to a year in a laboratory of interest and work on a relevant research problem, free of routine administrative responsibilities.

“It is an excellent opportunity to acquire new skills, read, make new contacts, build relationships and soak up

knowledge in a more relaxed frame of mind,” Rao said. “It has been a thrilling experience for me to be here.”

Rao works in the laboratory of associate professor Amy Andreotti. They are tackling a problem in protein structure and function using Phage Display, a technology neither had used before.

Through informal, bimonthly seminars, Rao also has provided the Iowa State community a different perspective on Pioneer’s biotechnology research.

“I thought presentations from Pioneer scientists

would dispel myths concerning corporate research. They could educate students on how science can be applied in creative ways to improve the quality of life—in Pioneer’s case, as value-added crops,” he said.



Pioneer Hi-Bred scientist Guru Rao is making the most of his sabbatical at Iowa State.

## Two students named Borlaug Interns

The Plant Sciences Institute and the World Food Prize awarded Borlaug Internships to Iowa State students Jenny Hawkins and Arlene Lee. Both are spending eight weeks working at the International Maize and Wheat Improvement Center (CIMMYT) in Mexico.

Hawkins, a State of Iowa Scholar, is a senior in agronomy and environmental science from Adel, Iowa. She is working in the soils lab with Larry Harrington. Hawkins is interested in pursuing a career studying the fertility and sustainability of tropical soils. This is her first experience in the tropics.

Honors student Lee is a senior in ag biochemistry from Fertile, Iowa. She's working in the applied biotechnology center under Alessandro Pellegrinishi. She has traveled in Mexico and hopes to pursue a missionary career in international agricultural research, working on



From left, institute director Stephen Howell; Borlaug Interns Jenny Hawkins and Arlene Lee; and Eduarda Becerra, program assistant in Global Agriculture Programs, College of Agriculture.

world hunger issues.

Offered annually, the internship introduces students to real-world research, community or field experiences that are involved in international development and food production. The internship is named for Nobel Laureate Norman Borlaug, who is an Iowa native and a member of the Plant Sciences Institute Board.

## Research could lead to Bt in stalk, not seed

Patrick Schnable, Iowa State professor of agronomy, has developed a new technique for assessing genes in plants. LaserCapture Microdissection can identify and retrieve individual cells from specific tissues. These cells can be used for RNA, DNA and protein research. Schnable's findings could give researchers the power to force the *Bacillus thuringiensis* (Bt) protein to be expressed in the stalk, not the seed. If Bt is not expressed in the seed, it may meet all USDA safety regulations. His research may also allow seed scientists to develop new ways to make plants sterile, thus reducing the need for detasseling in the production of hybrid seed. His research was published in the March issue of *The Plant Cell*.

Schnable is director of the Center for Plant Genomics and the Center for Plant Transformation and Gene Expression.

### New facility/CONTINUED

the economic well-being of the business sector.”

IDF, which will be integrated into the academic research activities of the co-lab, will have two interactive business innovation components—the Co-Laboratory Business Incubator (CoBI) and the IDF Public/Private Partnership Program.

### Co-Laboratory Business Incubator

Intended to encourage creation of start-up companies, CoBI will provide technical and financial resources and business advising as an incentive for faculty and students to develop commercial applications for their research.

CoBI's activities will include the following:

- Provide laboratories and common equipment for biotech research
- Help university researchers identify potential products, processes and systems that can be aggressively “grown” and commercialized through the incubator
- Coordinate with the Pappajohn Center for Entrepreneurship to provide legal and business advising, and oversee the

implementation of research, development and business plans

### Public/Private Partnership Program

The partnership program will encourage exchange and interaction between university faculty, staff and students and private sector scientists to promote public (university)/private partnerships that lead to economic development in the area of plant biotechnology.

Program activities will include the following:

- Seek out promising business/industrial partnerships that complement and advance the interests of all parties
- Negotiate collaborative project goals and objectives, intellectual property agreements, royalties, publication activities, etc.
- Oversee IDF collaborative projects to ensure their successful and timely completion
- Implement ongoing evaluation of IDF activities through internal and external review
- Participate in state-level initiatives to promote biotech research

A search is under way for a director for IDF.

### GeneChip/CONTINUED

The facility also allowed CPRES researcher Roger Wise to lead a nationwide collaboration to test and validate the first barley GeneChip array, which is the first publicly available GeneChip for cereals. Wise is a USDA-ARS research geneticist and plant pathology professor.

The facility is funded in part by the National Science Foundation.

## Dedication set for Oct. 18

The dedication of the new Roy J. Carver Co-Laboratory will be Saturday, October 18. The ceremony will include tours of the \$13 million, 45,000-square-foot facility. The building will be administrative home to the Plant Sciences Institute and house the Innovations Development Facility, the Pioneer Hi-Bred Genomics Laboratory, a proteomics laboratory and environmentally controlled plant growth facilities.

## Recent research grants

The following 15 new grants totaling \$1.2 million were awarded recently to plant science researchers at Iowa State.

### High B-Carotene Maize to Alleviate Vitamin A Deficiency in Sub-Saharan Africa: Generation and Characterization of Maize Transgenics with Enhanced Provitamin A Content in the Kernel

U.S. Agency for International Development  
—\$209,440  
(S. Rodermel, botany)

### Methods for Functional-Comparative Genomics

National Institutes of Health—\$144,500  
(X. Gu, zoology and genetics)

### A DNA Sequence Assembly Program

National Institutes of Health—\$140,658  
(X. Huang, computer science)



## Scientific leadership

The Plant Sciences Institute's fifth annual symposium in June brought together many of the world's foremost scientists on plant transposable element research—an area in which Iowa State has produced scientific leaders. From left, Nina Fedoroff, Pennsylvania State University, who spoke on "Transposon-based Deletional Mutagenesis"; Tom Peterson, Iowa State, symposium program committee chair; and Tom Brutnell, a Cornell University plant biologist.

### A Potentially Cheaper Route to Soy Methyl Ester

United Soybean Board—\$99,715  
(J. Verkade, chemistry)

### Comparative Evolutionary Genomics of Cotton

National Science Foundation—\$95,617  
(J. Wendel, botany)

### Increasing Marketability of Corn Distillers' Grain

Illinois-Missouri Biotechnology Alliance—\$75,256  
(C. Hurburgh, agricultural and biosystems engineering)

### Conjugation of Soybean Oil for Use in Ink and Alkyd Resin Drying Oils

United Soybean Board—\$75,000  
(J. Verkade, chemistry)

### Soy Isoflavones and Cardiovascular Disease Risk

American Heart Association—\$60,500  
(M. Reddy, food science and human nutrition)

### Managing Stress Tolerance and Seed Composition of Glyphosate-Resistant Soybeans

Iowa Soybean Promotion Board—\$58,333  
(M. Westgate, agronomy)

### A Comparative Developmental Analysis of the Floral Nectaries of the Annual Cultivated and Wild Soybean with the Perennial Glycine Species

USDA—\$51,750  
(H. Horner, botany)

### Biotechnology of Acetyl-CoA Metabolism in Seeds

Consortium for Plant Biotechnology Research, Inc.—\$50,000  
(B. Nikolau, biochemistry, biophysics and molecular biology)

### Database of Maize Genome Information (DBMGI): A New Generation Maize Genome Database

USDA, ARS—\$48,780  
(V. Brendel, zoology and genetics)

### Microarray Analysis of Rice Deletion Lines

International Rice Research Institute—\$44,000  
(P. Schnable, agronomy)

### Coordinated Expression of Multiple Anti-Pest Proteins

Consortium for Plant Biotechnology Research, Inc.—\$37,000  
(M. Spalding, botany)

### Iowa Grain Quality Initiative

Iowa Corn Promotion Board—\$25,000  
(C. Hurburgh, agricultural and biosystems engineering)

## Plant Sciences Institute UPDATE

The Plant Sciences Institute Update is published four times each year by the Plant Sciences Institute at Iowa State University, 112 Office and Laboratory, Ames, Iowa 50011; phone 515 294-5255.

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The Plant Sciences Institute at Iowa State University is dedicated to becoming one of the world's leading plant science research institutes. More than 200 faculty from the College of Agriculture, the College of Liberal Arts and Sciences, the College of Family and Consumer Sciences, and the College of Engineering conduct research in nine centers of the institute. They seek fundamental knowledge about plant systems to help feed the growing world population, strengthen human health and nutrition, improve crop quality and yield, foster environmental sustainability and expand the uses of plants for biobased products and bioenergy. The Plant Sciences Institute supports the training of students for exciting career opportunities and promotes new technologies to aid in the economic development of agriculture and industry throughout the state. The institute is supported through public and private funding.

To be added to our mail list, e-mail [psidir@iastate.edu](mailto:psidir@iastate.edu).

On the Web at <http://www.plantsciences.iastate.edu/>

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