

Plant Sciences Institute UPDATE

Institute and Pioneer exchange scientific ideas

More than 50 faculty and student researchers affiliated with the Plant Sciences Institute participated in a scientific exchange with scientists from Pioneer Hi-Bred International, Inc., at the company's Johnston, Iowa, headquarters in April.

The joint poster session was organized to familiarize the two groups of scientists with ongoing research and to encourage continuous dialogue. A total of 50 posters presented work from Pioneer and Iowa State, including research from each of the institute's nine research centers.

"It was an enormously successful event. We look forward to participating in regular scientific exchanges with Pioneer scientists. Collaborations of these kinds benefit everyone involved, particularly our students," said Stephen Howell, institute director.



Some participants at the April scientific exchange included (left to right): Tony Cavalieri, Pioneer; Dermot Hayes, Diane Birt and Robert Jernigan, Iowa State.

"We believe it's important that public and private scientists share research results. Our work is often complementary," said Tony Cavalieri, trait and technology director for crop genetics research at Pioneer. "Many ISU graduates have contributed to the success of Pioneer as employees. We think the visit gave students an opportunity to learn more about working for a company."

A tour of Pioneer facilities was a highlight for the graduate students, Howell said.

Institute awards start-up funds

The Plant Sciences Institute has awarded start-up funding to six Iowa State research projects. They were selected for their excellent science, probability for continued funding and potential to foster long-term collaborations. Each received \$25,000 for one or two years. The projects are described below.

Development of Laser Raman Spectroscopy as a Facile Tool for Maize Metabolomics, Gene Discovery and Nutrient Extraction

G. Schrader, chemical engineering; P. Scott, agronomy; S. Rodermel, botany

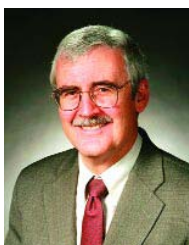
Contemporary metabolic research seeks to provide a comprehensive analysis of metabolites. The researchers will develop laser raman spectroscopy (LRS) as a metabolomics tool, to study carotenoid metabolism in maize. If LRS technology can be successfully applied to this model system, it will be a breakthrough in the new field of metabolomics and lead to several opportunities for future research.

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Putting the 2,000-pound gorilla to rest

One of the few blessings of changing economic times is the opportunity to rethink our priorities. Since I



assumed the director's role a year and a half ago, we have seen a downswing in our booming economy and watched state governments tighten their belts.

One silver lining in this otherwise gloomy picture has been the changing tenor of discussions about agricultural biotechnology. Ag biotech is no longer the 2,000-pound gorilla it was when I started here, but rather it's become the technology with the greatest promise to revitalize our region's economy. The developers of ag biotechnology have worked hard to change its practices and adopt a "greener" image. Because of that, government and business leaders in the Midwest are "talking up" agricultural biotechnology as our best hope to energize state economies and to create career opportunities for the young people.

We agree! It's time to move forward and exploit the opportunities that agricultural biotechnology offers. We cannot tarry in this task, because our neighboring states are also jumping on the biotechnology bandwagon. For Iowa to be competitive in this area, we simply cannot wave the biotechnology banner—instead, we need to lay out a road map focusing on our strengths and articulate that plan to our decision-makers.

Stephen Howell
Director

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News Briefs

Dates to note

This year's World Food Prize Laureate Ceremony will be held at Iowa State University, Thursday, October 24, at C.Y. Stephens Auditorium. The elegant event features the presentation of the \$250,000 World Food Prize to the 2002 laureate before an audience of an estimated 2,600. The 2002 symposium, "Managing Freshwater Shortages and Regional Water Security," will take place in Des Moines, October 24-25.

In recognition of the strength of Iowa State's plant metabolomics research and the plant science community's high regard for the annual Plant Sciences Institute Symposium, the 2004 International Congress on Plant Metabolomics will be in Ames. The scientific conference will be in May or June 2004 in conjunction with the annual symposium.

New insights

An Iowa State plant science team's 10-year investigation of recombination events on a section of a maize chromosome has provided new insight into the basic cellular machinery that generates the genetic diversity central to evolution. The research led by Patrick Schnable, director of the Center for Plant Genomics and the Center for Plant Transformation and Gene Expression, was published in April in the *Proceedings of the National Academy of Sciences, USA*. Their study showed that not all recombination occurs in genes and not all genes are active sites for recombination. By advancing the understanding of recombination in plants, the research could lead to more precise control of gene integration in both traditional and biotech methods of plant breeding. Schnable's

team is currently investigating what controls where recombination events occur.

Accolades

Pamela White, a professor of food science and human nutrition who conducts research in the Center for Designing Foods to Improve Nutrition, has received one of the most prestigious awards of the American Oil Chemists' Society (AOCS). White is the 2002 Alton E. Bailey Award winner for Outstanding Research Accomplishments in Fats and Oils. White's research includes the oxidation of edible oils and their sensory and chemical changes, the uses of antioxidants in oils, and lipid-carbohydrate interactions.

The public good

This spring, institute director Stephen Howell spoke on the role of public institutions in "biopharming," the production of pharmaceuticals and nutraceuticals in plants. Addressing the Federal Reserve Bank conference in Kansas City, he stated that biopharming is a great opportunity to add significant value to farm production in the Midwest, citing predictions that the market for crops producing protein-based biopharmaceuticals will increase from \$26 billion in 2000 to \$100 billion by 2010. Like plant biotechnology—which largely grew out of the efforts of basic research in both the public and private sectors—the development of biopharming requires productive public/private partnerships. "A strong motivation for support of biopharming is the prospect for economic development, but that goal has to stand up to other challenges. The technology must be conducted in ways that are safe, environmentally friendly and consistent with the goals of sustainable agriculture," Howell said. "Land-grant universities need to keep a clear focus on the public good."

Structure and Processing of the Arabidopsis thaliana Pro-phytosulfokine-a

R. Thornburg and A. Andreotti, biochemistry, biophysics and molecular biology

In this project, the researchers will determine the structure and examine how a novel plant peptide hormone controls plant growth. The hormone is unusual because sulfates groups are attached and the researchers are interested in determining what role they play in the biological activity of the hormone, such as in the formation of the nectar gland in flowers.

Identifying Developmental Pathways Affected by Interacting Transcription Factors through an Innovative Microarray Analysis

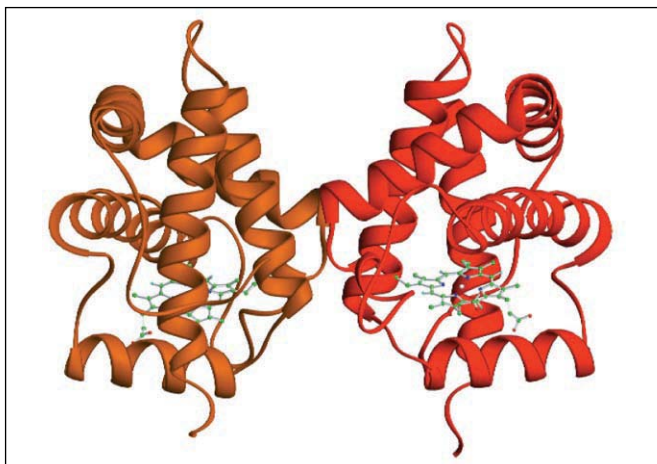
D. Hannapel, horticulture; H. H. Chou, zoology and genetics

To better understand the control of potato development, the researchers will study two transcription factors that interact with each other to control growth. The researchers will alter the expression of these two proteins and use microarray analysis to scan thousands of genes to find those that might be affected by the transcription factors.

Hemoglobin-based Nitric Oxide Scavenging in Plants

M. Hargrove, biochemistry, biophysics and molecular biology

Wounding and a number of other stimuli set off hypersensitivity responses that involve the production of nitric oxide and other reactive oxygen species. Hargrove is investigating whether or not the ubiquitous class of proteins, called “nonsymbiotic hemoglobins,” scavenge nitric oxide and other reactive oxygen species minimizing damage to neighbor-



Molecular structure of rice nonsymbiotic hemoglobin, featured in the research proposal from Mark Hargrove, described below. This class of hemoglobin is expressed in all plants and is thought to play a role in minimizing nitric oxide toxicity during hypoxia.

ing tissues during the plant hypersensitive response.

The Roles of Salicylic Acid and Camalexin in the Arabidopsis Defense Response against a Root-parasitic Cyst Nematode

T. Baum, plant pathology

Arabidopsis will be used to study plant defenses against root pathogens. Baum will clarify the roles of salicylic acid, a signaling molecule, and camalexin. Both

molecules are involved in shoot defenses but not known to be active—or even to be present—in Arabidopsis roots. The knowledge gained in this novel project will be used to help solve the most serious pathogen problem in world soybean production—the soybean cyst nematode.

Development of a High-throughput Screen for Plant Receptor Kinase Ligands

P. Becraft, zoology and genetics and agronomy; M. Nilsen-

Hamilton, biochemistry, biophysics and molecular biology

Little is known about the signaling mechanisms involved in many plant processes like pollination and pathogen defense. The researchers will develop a high-throughput assay to identify the signaling molecules (ligands) for receptor kinases. The novel assay involves the construction of chimeric receptor kinases consisting of plant ectodomains fused to animal cytoplasmic domains.

Lamkey will lead plant breeding center

Kendall Lamkey has been named Pioneer Hi-Bred International

Endowed Chair in Maize Breeding and director of the Raymond F. Baker Center for Plant Breeding.

Lamkey is research geneticist with the USDA-ARS and a professor of agronomy at Iowa State.

He specializes in the development of quantitative and statistical genetic models. His research is focused in the areas of germplasm enhancement, selection, heterosis, and genetic diversity in maize.

As director of the plant breeding center, Lamkey will lead research in modern plant breeding at Iowa State, which integrates basic research on breeding methods and

germplasm enhancement with the development of improved cultivars. Researchers in

the center are enhancing plant breeding in corn, forages, soybeans, popcorn, small grains and potential new crops.

Lamkey earned his doctorate in plant breeding and cytogenetics from Iowa State in 1985. He has

been with the USDA since 1984 and joined Iowa State's faculty as a collaborator in 1985. He is editor of *Journal of Heredity* and technical editor of *Crop Science*. Lamkey has published more than 50 research publications.

The Pioneer Maize Breeding Chair was created earlier this year through a gift from Pioneer, given via the ISU Foundation.



High-tech gene chip machine will advance research at Iowa State

New state-of-the-art genomics instrumentation at Iowa State University will provide researchers with the ability to pursue a variety of plant, animal and human research projects, such as molecular characterization of genes in disease, responses to biotic or abiotic stresses, and cellular development.

Roger Wise, USDA-ARS research geneticist and professor of plant pathology, and a team of researchers received a three-year, \$250,000 grant from the National Science Foundation (NSF) for an Affymetrix GeneChip®

Instrumentation System.

The fully integrated instrument system will allow researchers to analyze the expression profiles of more than 20,000 genes at the same time via DNA oligonucleotide microarrays (tiny displays of chemical DNA data in a computerized form). In addition, the gene chip instrument will facilitate studying how various genes contribute to complex phenotypes.

Because the new oligonucleotide array system is not dependent upon access to gene cloning libraries and gene sequence

verification, it is expected to increase data accuracy and reliability of existing technology at Iowa State.

One goal of the NSF grant is to strengthen research and graduate programs in animal and plant networks and bioinformatics/computational biology, Wise said. The gene chip machine will be available for graduate student research in a wide range of university departments and to undergraduates conducting research in molecular biotechnology and genomics in an NSF-funded program.

Recent research grants

The following nine new grants totaling \$1.19 million were awarded recently to plant science researchers at Iowa State.

An Integrated Physical and Expression Map of the Barley Genome Triticeae Improvement

Washington State University—\$305,379
(E. Braun, plant pathology)

Parallel Algorithms and Software for Gene Identification and Annotation from EST Collections

National Science Foundation—\$150,000
(S. Aluru, electrical and computer engineering)

A DNA Sequence Assembly Program

National Institutes of Health—\$136,696
(X. Huang, computer science)

Aphid Control Using Luteovirus Structural Proteins

Iowa State University Research Foundation (Aventis/Syngenta)—\$135,033
(W. A. Miller, plant pathology)

Studies on the Mechanism and Control of Enzyme Action

National Science Foundation—\$134,000
(H. Fromm, biochemistry, biophysics and molecular biology)

Structural Determinants of Leghemoglobin Reactivity

National Science Foundation—\$120,000
(M. Hargrove, biochemistry, biophysics and molecular biology)

Functional Analysis of Plant MAPK Cascades in Stress and Hormonal Signaling

Massachusetts General Hospital—\$106,555
(K. Wang, agronomy)

Bioinformatic Tools for Extraction and Modeling of Signal Transduction Networks

The Procter & Gamble Fund—\$92,680
(D. Ashlock, mathematics)

International Collaborative Investigation of Polyploid Genome Evolution

National Science Foundation—\$16,875
(J. Wendel, botany)

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The Plant Sciences Institute at Iowa State University is dedicated to becoming one of the world's leading institutes for plant science research, education and unbiased research-based information. Researchers in nine centers of the institute seek fundamental knowledge about the functioning of plants and are developing ways 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 institute is supported through public and private funding. The work of the Plant Sciences Institute is expected to have economic benefits in Iowa and around the world.

To be added to our mail list, e-mail psidir@iastate.edu.

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

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