

Plant Sciences Institute UPDATE

From the interim director

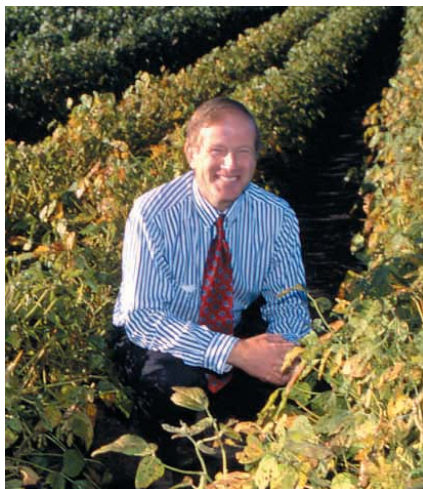
As we complete this semester at Iowa State, we're pleased to share news of the Plant Sciences Institute's most recent activities in this issue of *Update*.

Please take a few minutes to read about the unique mapping array under development here, the undergraduate students who are conducting research, progress on our new building and recent research grants.

Many accomplishments during the institute's first year would not have been possible without the support and partnering of our stakeholders. For example, both the Iowa Soybean Promotion Board and the Iowa Corn Promotion Board have partnered with the institute, funding critical research projects with producer check-off dollars. In addition, the United Soybean Board is supporting research in genomics and biotechnology.

The cooperation and support of the Iowa Department of Economic

Development has been essential, as well. Their forgivable loan of \$500,000 will be instrumental in providing incubator space in the Roy J. Carver Co-Laboratory.



As my tenure as interim director comes to an end, I want to thank all of our generous donors and industry friends along with our faculty collaborators, staff and students for your remarkable support and hard work during the institute's start up. You have built a strong foundation for future success.

On January 1, Stephen Howell assumes the position of director of the Plant Sciences Institute. I wish the best for Dr. Howell and all of my colleagues in the institute.

Colin G. Scanes,
Interim director

A new way to map

Plant genomics researchers at Iowa State are preparing to use their DNA microarray in a revolutionary way. They plan to use the high-throughput technology not only to study gene expression, but also to map the locations of genes on chromosomes.

Their idea is so innovative that it attracted a \$2.9 million grant from the National Science Foundation's Plant Genome Project to fund its development. If successful, the genetic mapping tool could improve understanding of the molecular nature of complex genetic traits, said Patrick Schnable who directs the Center for Plant Genomics and the Center for Plant Transformation and Gene Expression.

DNA microarray technology is fast becoming standard equipment in plant genomics laboratories. Until a few years ago, molecular biologists generally worked on one gene at a time, making it difficult to understand the interactions among genes. "A researcher using

CONTINUED ON PAGE 2



Plant Sciences Institute

Center developing standardized test to verify seed genetic purity

Each year, the United States exports more than \$1 billion worth of seed. With the development of transgenic crops, maintaining the identity and purity of seed is increasingly important in the global seed industry.

Under the auspices of the International Seed Federation (FIS), scientists at Iowa State's Seed Science Center are leading efforts to develop a standardized test that will verify the genetic purity of seeds at the DNA level.

The center is working in collaboration with other seed testing laboratories throughout the world to develop the testing protocol. "We provide the third-party, unbiased, public sector verification of the testing protocol," said Manjit Misra, director of the Seed Science Center.

Center scientists use PCR (polymerase chain reaction) assay to detect the presence of genetically modified organisms or biotech seeds, said Reva Bhushan, lead scientist. They are conducting tests with five other labs in three countries to determine which protocol, including sample size, produces the highest rate of accuracy. When an acceptable protocol is developed, 22 laboratories from six countries will be included in the second phase of testing. As soon as the protocol checks out, FIS will adopt it as the standard.

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New building progresses

Plans are advancing for the Plant Sciences Institute's Roy J. Carver Co-Laboratory. In October, the Board of Regents approved the schematic design. The Des Moines architecture/engineering firm, Brooks Borg Skiles, is proceeding with design development and construction drawings. Construction begins this summer and will take about 18 months. The two-story, 29,975 gross-square-foot building will be northwest of the Molecular Biology Building.

The Carver Co-Laboratory will provide a place where plant scientists from Iowa State, private industry and universities worldwide can meet in a collaborative and interactive environment



Roy J. Carver Co-Laboratory

to conduct plant research. The building will consist of state-of-the-art laboratories, research space for visiting scientists and small laboratories for industry incubators. It will include the director's office and laboratory, a large conference/seminar room, a genomics center laboratory with seed analysis and plant growing rooms, biochemistry laboratory suites, laser laboratories, a computer laboratory and research offices.

A new way to map/CONTINUED

traditional technology to study gene expression could do one or two genes per week," Schnable said. "With the microarray, we can do 10,000 genes in one experiment that takes only a couple of days."

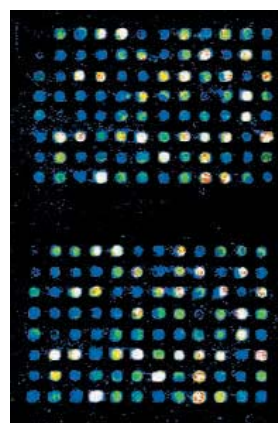
While microarray technology has revolutionized the study of gene expression, the innovative use for the technology developed by Schnable and his research team could have a similar impact on gene mapping. Schnable and graduate student Xiangqin Cui have applied for a patent for the mapping array, which they believe could be used for any organism that undergoes meiotic recombination and exhibits a high degree of genetic variation.

The traditional method used for gene mapping—RFLP mapping—is very low throughput, slow, expensive and space consuming, Schnable said. Whereas

RFLP mapping can produce only a few gene determinations per week per researcher, the mapping array is anticipated to map 10,000 genes in a matter of a few months.

The mapping array will give researchers a high-throughput method to find candidate genes that are important for traits, such as stalk strength, yield and quality. With appropriate experimentation, researchers can identify precisely which gene is responsible for the trait. At that point, they can use either traditional plant breeding or genetic modification techniques to create plants with the improved characteristics desired.

"No one else is using the microarray in this way," Schnable said. "It's an innovation, but it's also high risk. It may not work. We should know in the next 12 months."



Expressed genes are indicated by fluorescent signals on a microarray.

characteristics desired.

News Briefs

Symposium scheduled

A Plant Sciences Institute symposium, "Post-transcriptional Control of Gene Regulation in Plants," will be held May 10-13 at Iowa State. Until recently, post-transcriptional events, such as mRNA processing, mRNA decay and translation had not been studied intensively in plants. However, exciting new discoveries have revealed a plethora of post-transcriptional control events ranging from subtle tweaking of transcribed genes to entirely new processes that modify the central dogma of molecular biology. This symposium will focus on regulation of and by mRNA, from the moment it has been transcribed, until its encoded information has been converted to protein via translation. The symposium is sponsored by the institute and the biochemistry, biophysics and molecular

biology department at Iowa State. More information is available on the Web at <http://molebio.iastate.edu/~gfst/phomepg.html>. Or contact Plant Sciences Institute Symposia: pbmb@iastate.edu; 3208 Molecular Biology Building, Iowa State University, Ames, Iowa 50011-3260 USA; 515 294-7978.

Ag biotech's economic, ethical issues

As part of the U.S. Department of Agriculture's Initiative for Future Agriculture and Food Systems grant program, Iowa State is a collaborator on a four-year, \$3.7 million biotechnology project. Iowa State faculty and staff will address economic, ethical and social aspects of agricultural biotechnology in a consortium of nine institutions led by South Dakota State University. Iowa State will play a major role in economics research,

bioethics and extension and educational programs under the direction of Walter Fehr, professor of agronomy and director of the Office of Biotechnology, and Gary Comstock, professor of philosophy and religious studies and coordinator of the Bioethics Program. Iowa State's share of the grant is \$907,000.

Current searches

During the next few years, Iowa State is seeking to add about 20 new faculty positions to the Plant Sciences Institute, including director of the Laurence H. Baker Center for Bioinformatics and Biological Statistics. Positions may be filled at the assistant, associate or full professor level and are tenured or tenure-track with competitive start-up packages. Complete information is available on the Plant Sciences Institute's Web page at <http://www.plantsciences.iastate.edu/searches.html>.

Undergraduates learn through plant science research

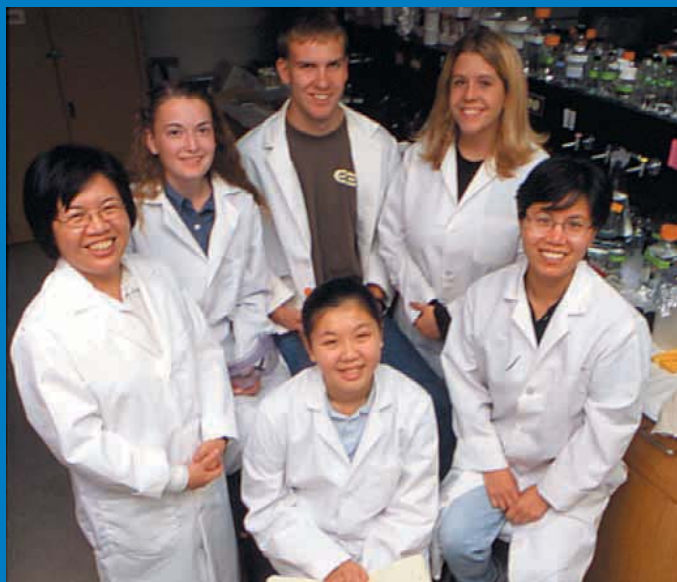
In the laboratories of carbohydrate biochemist Jay-lin Jane, six students from five majors work on both fundamental and applied research. They are among the estimated 110 undergraduate students who gain valuable learning experience working on research in the laboratories of the Plant Sciences Institute.

"Some of the students working in my laboratories are continuing on to graduate school, so they're very interested in gaining more research experience. Some just want to find out if they would like doing research," said Jane, professor of food science and human nutrition.

The students work on a variety of projects. Brent Volker, chemical engineering freshman, is getting practical engineering experience. Working in the pilot plant of the Center for Crops Utilization Research, Volker does extrusions and processing of soy protein-based biodegradable plastics.

Biology student Seema Halani and two biochemistry students, Kai-Lin Chew and Pit-Wei Leu, conduct basic research, helping characterize starch structure and properties. Eventually, their work could lead to transgenic corn breeds designed for desirable properties for particular applications.

Nicole Waterland, horticulture, and Jenny McMenemy, microbiology, are studying the growth rate and glycogen produced in cyanobacteria to determine the optimal conditions for glycogen production. Eventually, the research they're working on will



Learning from research
Clockwise from left: Jay-lin Jane, Nicole Waterland, Brent Volker, Jenny McMenemy, Kit-Sum Wong (research scientist) and Kai-Lin Chew.

develop a model system to study the mechanism of starch granule formation.

"I like doing research," said Waterland. "A lot of what I've learned in the lab is part of the core biology course. It's one thing to learn from the textbook and another to actually do it. This helps me really learn the concepts I get in class."

2001 colloquium scheduled

The second Plant Sciences Institute Colloquium will be held at Iowa State University on February 17, 2001. The colloquium will feature prominent speakers who will discuss leading-edge plant science research and its impact on societal issues. The colloquium also will provide a forum for newly appointed director Stephen Howell to present his vision for the future of the plant sciences at Iowa State and beyond. For more information, call the institute at 515 294-5255; or visit the institute's Web page at <http://www.plantsciences.iastate.edu/>.

Seed genetic purity/CONTINUED

A standardized test that validates the genetic identification of seeds will significantly benefit the U.S. seed industry, Misra said. "Having the ability to verify the genetic identity of seed will reduce the likelihood of our seed being rejected overseas," he said. "And it will increase consumer and producer confidence by helping ensure that the farmers are planting what they think they are planting."

The Seed Science Center also will provide training on the molecular techniques for genetic testing of seeds for scientists, technicians and students from throughout the world, Misra said.

A gift from an anonymous donor and funding from the Plant Sciences Institute helped the center establish the new program.

Recent research grants

Parallel Algorithms and Software for Steepest Descent Fast Multipole Method
National Science Foundation—\$377,306
(S. Aluru, electrical and computer engineering)

Impact of Endosperm Lipids on Dry Milling and Extrusion of Dried and Stored Corn
Department of Agriculture—\$241,790
(P. White, food science and human nutrition)

Starch Debranching Enzyme Activity in an Allelic Series of Sugary 1 Mutants
Department of Agriculture—\$240,000
(M. James, biochemistry, biophysics and molecular biology)

An Aldehyde Dehydrogenase Required for Male Fertility in Maize
Department of Agriculture—\$176,000
(P. Schnable, agronomy)

Manipulation of Starch Debranching Enzyme Activities in Transgenic Plants
Department of Agriculture—\$150,000
(M. James, biochemistry, biophysics and molecular biology)

Carotenoid Bioavailability and Metabolism
Department of Agriculture—\$145,000
(A. Barua, biochemistry, biophysics and molecular biology)

A Functional Genomics Program for Soybean
University of Illinois/NSF—\$136,180
(R. Shoemaker, agronomy)

An Integrated Program to Improve the Composition and Value of Iowa Soybeans
Iowa Soybean Promotion Board—\$124,592
(M. Westgate, agronomy)

Soybean Transformation Program
Iowa Soybean Promotion Board—\$122,295
(K. Wang, agronomy)

Molecular Regulation of Soybean Seed Composition
United Soybean Board—\$119,232
(B. Nikolau, biochemistry, biophysics and molecular biology)

Analysis of a Signal Transduction Pathway Involved in Maize Epidermis and Aleurone Differentiation
Department of Energy—\$94,000
(P. Becraft, zoology and genetics)

Regulation of Carotenoid Biosynthesis: The Immutans Mutant of Arabidopsis
Department of Energy—\$90,000
(S. Rodermel, botany)

Comparison of Screening Methods for the Selection of BSR-Resistance in Soybean Breeding
Iowa Soybean Promotion Board—\$71,346
(S. Cianzio, agronomy)

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.

Prepared by University Relations, Teddi Barron, editor.

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

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

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