

# Plant Sciences Institute UPDATE

## Faculty develop metabolic mapping tool

Faculty researchers in the Center for Designing Foods to Improve Nutrition and the Center for Crops Utilization Research have developed a metabolic mapping technique to track the conversion of nutrients used to make protein in a soybean seed.

They intend to use the findings to optimize nutrients found in soybeans that are used in livestock feed.

The scientists developed the mapping technique to apply to living soybean seeds as they grow. The map allows scientists

to track the flow of sucrose, an essential nutrient for the seeds, through the myriad chemical reactions that convert it into protein, which the seeds store until germination.

“This technique will enable scientists to determine how changes in genetics or environmental conditions can alter seed metabolism in favor of making more valuable products, like protein,” said Mark Westgate, associate professor of agronomy.



**Plant Sciences Institute researchers (from left) Martin Spalding, Jacqueline Shanks and Mark Westgate developed a metabolic mapping tool that allows them to track protein production in living plants. They will use this information to optimize a soybean plant's production of protein.**

Westgate produced soybean lines and methods to culture the seeds for testing. Botany professor Martin Spalding and his team laid out the map of metabolic pathways. Jacqueline Shanks, professor of chemical engineering, developed the technology for tracking the nutrients through the pathways.

“We were all amazed how well the metabolic map described how the seed

## Monsanto funds fellowships

Two promising graduate students studying plant genetics with researchers affiliated with the Plant Sciences Institute are recipients of Monsanto Diversity Graduate Research Fellowships.

Tyrell Carr and Latrice Swain were selected in January after their research topics captured the interest of Ted Crosbie, Monsanto vice president for global plant breeding.

With a gift of \$40,000, Monsanto established two one-year fellowships to help outstanding minority students develop careers in science, Crosbie said.

“The institute offers remarkable expertise and opportunities for graduate student research. Monsanto wants to ensure those opportunities are available to underrepresented students who want to pursue research careers in the plant sciences,” Crosbie said.

Latrice Swain, who earned her bachelor's degree in environmental science from Alabama A & M University, conducts research in the lab of Paul Scott, a USDA collaborator in agronomy. Her

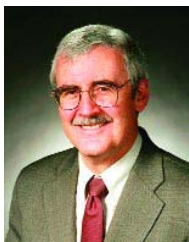
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## From the director

Iowa has an excellent chance to take the lead in capitalizing on opportunities in plant biotechnology. One such opportunity



is the development of a "biologics facility" in the state—a production facility for the extraction and isolation of high-valued products from biotech crops. The Plant

Sciences Institute is a major proponent for the development of such a facility, which would work closely with the Center for Crops Utilization Research.

It has been the dream of scientists for years to produce high-valued products, such as useful pharmaceuticals and nutraceuticals in plants. Producing crops for this purpose—"biopharming"—may seem futuristic, however, groups of Iowa farmers already grow these new generation of biotech crops. It is the hope that biopharming and the development of a biologics facility will benefit them, as well as processors.

A biologics facility should help attract and catalyze the development of other ag-related biotechnological efforts in the state. It also could serve as a training ground for young people looking for challenging high-tech careers in Iowa.

Biopharming poses new challenges for scientists, producers and processors because the products are not handled like typical commodities. There are still challenges to be met in containment, farming practices, industrial handling and marketing. However, many new agricultural and medical products face these challenges.

The prospect for biopharming holds great promise for Iowa and the biologics facility deserves our support!

Stephen Howell  
Director

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## Monsanto funds fellowships/CONTINUED

research involves characterizing the inheritance of transgenes in corn, specifically the 1Dx5 gene from wheat.

"Iowa State is a great school and I couldn't have made a better decision than to attend school here," said Swain, who plans to pursue a Ph.D. in genetic engineering. "The Monsanto Fellowship gives me the opportunity to obtain a higher level of education so that one day I can do something I love doing!"

Tyrell Carr is investigating plant viruses with Steve Whitham, assistant professor of plant pathology. A

graduate of Elizabeth City State University (part of the University of North Carolina system), Carr earned his B.S. in biology with concentrations in cellular biology and biotechnology.

While completing a summer internship in molecular biotechnology at Iowa State in 1999, Carr became interested in Iowa State's interdepartmental genetics

graduate program. "Most graduate programs that I was interested in at other universities were the traditional departmental programs, which offered limited research and training," he said. "The decision to come to Iowa State has been a great step for me!"

Carr's research focuses on understanding how plant cells change when viruses

infect them. "I'm studying a set of stress genes, termed heat shock genes, that become activated by viral infection as well as other plant stresses," he said. "I'm using genetic and molecular



**Monsanto Fellows Tyrell Carr (left) and Latrice Swain (right) with Ted Crosbie, Monsanto vice president for global plant breeding.**

biology approaches to determine when heat shock genes become activated during viral infection and if the activation of these genes is involved in viral diseases."

Carr plans on an academic career. "The Monsanto Fellowship will be a motivating factor in my studies. I am truly honored to receive this fellowship!"

## Symposium on proteomes set for June

The third Plant Sciences Institute symposium, "Proteomes: Structures, Changes, Interactions and Functions," will be June 20-23 at Iowa State University, Ames. The symposium will bring together computational and experimental proteomics researchers with plant scientists who apply proteomics technology in their research. Speakers include Dagmar Ringe, Brandeis University; Chris Somerville, Carnegie Institution of Washington at Stanford University; Michael Snyder, Yale University; and Marc Vidal, Dana-Farber Cancer Institute at Harvard Medical School.

Presentations will focus on function from structure, computational proteomics and genome-wide predictions, membrane proteins, expressed proteomes, functions of protein families and emerging frontiers. The symposium will foster an informal atmosphere to promote discussions, interactions and new collaborations. Students and postdoctoral fellows will be able to interact with leading researchers. Additional information is available at <http://www.plantsciences.iastate.edu>; via e-mail to [pbmb@iastate.edu](mailto:pbmb@iastate.edu); or phone 515 294-7978.

# News Briefs

## Top citations

Patricia Murphy, professor of food science and human nutrition, has been recognized by the Institute for Scientific Information (ISI) as one of the top 15 most-cited authors in agriculture and plant and animal sciences. Murphy's research focuses on the health benefits of soy. ISI based its findings on total citations from papers indexed from 1991 through October 2001. ISI is a Web-based information resource for researchers in many fields. Murphy is affiliated with the Center for Designing Foods to Improve Nutrition and the Center for Crops Utilization Research.

## Cover story

Research by Iowa State plant pathology professor Roger Wise was featured on the cover of *Molecular Plant Microbe Interactions* in December. Wise, a USDA-ARS research geneticist, is affiliated with the Center for Plant Responses to Environmental Stresses. The research focused on the mechanisms of resistance to fungal pathogens of cereal crops, particularly oat crown rust. Wise's team discovered two new oat genes that

regulate hypersensitive cell death, a key component of disease defense in oats. Their discovery reveals that hypersensitive cell death is not necessary for crown rust resistance. It is the first description of the separation of gene-for-gene resistance from hypersensitive cell death in a fungal disease response in grain crops.

## Way to go

The December issue of *Plant Physiology* reported on a workshop on sequencing the maize genome, which the National Science Foundation sponsored last year. Patrick Schnable co-organized the workshop, which brought together the nation's maize geneticists to discuss technical approaches for a Maize Genome Sequencing Project. Schnable, director of the Center for Plant Genomics and the Center for Plant Transformation and Gene Expression, said workshop recommendations were given to NSF. "Almost all participants agreed that the best strategy would be to use a gene-enriched sequencing approach, focusing on the gene-rich, low-copy fraction of the genome," Schnable said. Such a strategy would use cutting-edge technologies to concentrate sequencing resources on the genic regions

(about 50,000 genes or 10 to 15 percent of the genome). Workshop participants estimated it would take about three years and \$52 million to sequence and map all of the identified genes in a comprehensive database. Last fall, NSF requested proposals to develop technologies for identifying and sequencing gene-rich regions of large genomes.

## Seed money

Peterson Genetics, Cedar Falls, Iowa, gave a generous gift of \$25,000 to the Seed Science Center to support graduate research fellowships. "The Seed Science Center is such a great steward and the whole industry relies on them," said Mike Peterson, president of the company, who presented the gift at the 24th annual Seed Technology Conference in February. The donation is the lead gift in a campaign by the Iowa Seed Association to raise \$500,000 for graduate fellowships in seed science. Peterson previously led a campaign for undergraduate seed scholarships that raised an endowment of \$290,000. Peterson said the center's role in coordinating the American Seed Trade Association's conference is one of the many ways it advances the industry.

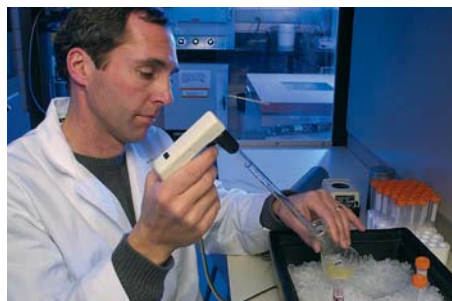
## Discovery could lead to plant virus control

**A** researcher in the Center for Plant Responses to Environmental Stresses may have found a way to control plant viruses by figuring out the molecular mechanisms of the virus replication cycle.

Allen Miller, professor of plant pathology, has been studying the replication of barley yellow dwarf virus. BYDV is widespread and causes substantial yield losses in wheat, barley and oats.

Miller's research focuses on the mechanism by which the virus genetic code is translated in plants during the process of protein synthesis. "Our research provides the first example that shows translation processes can be regulated by base-pairing between nucleotides in each end of a viral mRNA instead of protein-mediated interaction," Miller said.

In the genetic translation, messenger RNA (mRNA) specifies the sequence of amino acids that make up a protein. During translation, the mRNA directs the addition, one by one, of amino acids to protein molecules growing on ribosomes, the protein-making machinery in plant cells.



**Allen Miller's research on the molecular mechanisms of virus replication could have important implications for the survivability of plants, the sustainability of crop production and the transfer of genetic material between organisms.**

"The arrangement of genes in BYDV suggested that it has unusual translation mechanisms," Miller said. "We have learned new ways by which mRNAs interact with the translation machinery in a cell."

The sequence in BYDV mRNA that interacts with the ribosomes may be useful in genetic engineering of crops by increasing the efficiency of protein synthesis. Miller and former student Shanping Wang have patented this sequence.

Miller's research was funded by the National Science Foundation and published last May in the journal *Molecular Cell*. He presented it recently to applied biologists at an international conference on plant virology advances in Cambridge, England.

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converts sugars into protein,” Westgate said.

Westgate said this research reveals which genes actually control protein production in soybean seeds.

“Changing the genes in plants is one thing,” Westgate said. “Making those changes work for you in the manner intended is quite another.”

The research is funded by a \$25,000 grant from the Plant Sciences Institute’s competitive grants program. The program provides start-up funds to innovative projects with promising futures to stimulate excellence in plant science research.

## Recent research grants

The following 10 new grants totaling \$800,000 were awarded recently to plant science researchers at Iowa State.

### Increased Soybean Profitability Through Soybean Disease Biotechnology

Iowa Soybean Promotion Board – \$180,000  
(J. Hill, *plant pathology*)

### Collaborative Project for Identifying and Characterizing Corn Lines for Commercial Applications

Iowa Corn Promotion Board – \$175,000  
(J. Jane, *food science and human nutrition*)

### Discovery of Novel Developmentally and Environmentally Regulated Corn Promoters

Iowa Corn Promotion Board – \$68,202  
(P. Schnable, *agronomy*)

### Maize Genetic Transformation Methods

Iowa Corn Promotion Board – \$48,216  
(K. Wang, *agronomy*)

### Functional Genomics of Endosperm Development in Maize

University of Florida – \$95,948  
(P. Bcraft, *zoology and genetics*)

### The Corn Proteome

Iowa Corn Promotion Board – \$26,000  
(D. Oliver, *botany*)

### Regulation of Inflorescence Architecture in Maize

University of California at Berkeley – \$82,982  
(V. Brendel, *zoology and genetics*)

### Manipulation of Starch Debranching Enzyme Activities in Transgenic Plants

Department of Agriculture – \$75,000  
(M. James, *biochemistry, biophysics and molecular biology*)

### An Integrated Strategy for Management of Disease Caused by Bean Pod Mottle Virus

Iowa Soybean Promotion Board – \$25,000  
(J. Hill, *plant pathology*)

### A DNA Sequence Assembly Program

National Institutes of Health – \$22,660  
(X. Huang, *computer science*)

## Watch us grow!

**C**onstruction of the Roy J. Carver Co-Laboratory is under way. You can watch it progress on our Web cam. Go to the Plant Sciences Institute homepage at <http://www.plantsciences.iastate.edu>, click on “Watch us grow” in the right margin and see the construction in real time. There’s also a photo archive, a daily movie archive and a movie showing each day since construction began. The Carver Co-Laboratory is the first building of the Plant Sciences Institute. When completed in the spring of 2003, it will provide



a collaborative environment in which university and industry plant scientists generate ideas and products useful to agriculture and business.

## Plant Sciences Institute UPDATE

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Prepared by University Relations, Teddi Barron, editor; Bridget Bailey, writer.

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](mailto:psidir@iastate.edu).

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