IOWA STATE UNIVERSITY

Plant Sciences Institute UPDATE

April 2003, Volume 3, Number 3

Researchers developing science-based risk assessment model for pharmaceuticals in corn

Iowa State University researchers are leading a project to develop a science-based risk assessment tool that public policymakers can use when making decisions about safely containing genetically modified agricultural products not intended for food or feed, such as crops producing biopharmaceuticals.

The tool can be used to identify potential containment risks in the many steps from growing a biopharmaceutical-producing crop to its end use.

Iowa State is leading a project to develop a scientific tool to assess the risk of growing biopharmaceutical crops in food-producing states. Manjit Misra, left, director of the Seed Science Center and professor of agricultural and biosystems engineering, will lead the team of researchers, including Alicia Carriquiry, associate provost and professor of statistics, and Dermot Hayes, Pioneer Chair in Agribusiness and professor of economics.

The research team will use the tool to assess the risk of safely containing the production of two pharmaceuticals that could be produced in corn, said project leader Manjit Misra, professor of agricultural and biosystems engineering and director of the Seed Science Center.

"We want to develop a framework to instill public confidence in the safe production of biopharmaceutical crops in Iowa," he said. "To this end, we will use science to determine which crops are safe to grow in food producing areas, which ones should be grown in other states and which ones should not be grown in open environment at all."

The Iowa State team—along with scientists from the University of Iowa and Montana State University—will follow the

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International symposium honors Hallauer

To honor one of the most accomplished plant breeders of our time, Iowa State and the International Maize and Wheat Improvement Center (CIMMYT) are sponsoring the Arnel R. Hallauer International Symposium on Plant Breeding, August 17-22, in Mexico City. The event will bring together leading plant breeding experts from throughout the world to assess the current art and science and future prospects of plant breeding.

Invited speakers will present a range of topics, including participatory plant breeding, genotype by environment, breeding for stress tolerance, the genetics of yield potential in wheat and hybrid and open-pollinated cultivars in modern agriculture. Research posters also will be presented. One session will be devoted to scientific talks on Hallauer's contributions, and a special ceremony will honor his 42-year career.

Hallauer, Charles F. Curtiss Distinguished Professor Emeritus of Agriculture at Iowa State, and former director of the Raymond F. Baker Center for Plant Breeding, has influenced plant breeders worldwide

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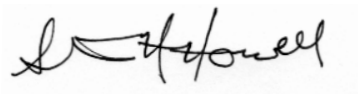
Strengthening Iowa's economy

The governor has rolled out a plan to make Iowa a leader in the life sciences, and the Plant Sciences Institute will play a major role. The plan calls for an Iowa Values Fund of which $50 million would be directed toward activities involving the Plant Sciences Institute. At the time of this writing, it's not clear how that plan will fare with the legislature. Nonetheless, the governor has expressed great confidence in how the Plant Sciences Institute can contribute to strengthening Iowa's economy.

The governor's plan calls for a "new mindset" to coordinate the efforts of government, university and business in attracting economic opportunity to Iowa. It also provides the infrastructure needed to lure new companies, including business incubators and facilities for supporting genetic transformation research, transgenic plant growth and processing biopharmaceutical crops.

Two major institute initiatives support the governor's plan. The Roy J. Carver Co-Laboratory business incubators (called CoBI), slated for opening in fall 2003, will be a stimulating research environment where faculty can develop businesses in a university setting. The Roy J. Carver Co-Laboratory will also be home to a Public/Private Partnership Facility to encourage technology transfer between Iowa State scientists and scientists from Iowa industries. CoBI and the Partnership Facility could fuel the development of the next generation of life science industries in Iowa.

The second Plant Sciences Institute initiative, still on the drawing board, is an exciting partnership with the ISU Research Park and other Iowa economic development groups to develop a cluster of facilities supporting emerging plant science industries. These will extend the activities of the Plant Sciences Institute into a commercial environment.



Stephen Howell
Director

Summer institute offers training through research

The Laurence H. Baker Center for Bioinformatics and Biological Statistics (LHBCBBS) has received funding from the National Science Foundation to develop and conduct a Summer Institute in Bioinformatics and Computational Biology at Iowa State. The institute will be June 1 to August 8. The program is for students and professionals with new interest in these fields.

"The summer institute aims to provide students with the skills they'll need to identify and tackle important research problems in bioinformatics and computational biology. We want to encourage students to pursue careers in these fields," said Robert Jernigan, LHBCBBS director. "There's a real need to increase the number of trained scientists in order to shorten the time between biological data acquisition and practical application. The pace of data accumulation is quickly outrunning the rate of data processing and comprehension."

The institute offers a two-week short course and an eight-week summer internship. The short course, an intensive instructional program, will review fundamental methods in bioinformatics and computational biology, describe applications to prominent research problems and discuss recent accomplishments in genomics and genome informatics.

During the internship, students will work with individual Iowa State faculty and their groups on specialized research projects to learn in depth a specific area of integrated bioinformatics and computational biology.

The institute is awarding 10 scholarships that will provide a stipend of $4,000 and living expenses. Students interested in attending only the two-week short course may do so by paying their own tuition and expenses. Additional information is available on the Web at http://www.bioinformatics.iastate.edu/BBSI. LHBCBBS bioinformaticist Volker Brendel, professor of zoology and genetics and statistics, will be responsible for the overall coordination.

Researchers developing/CONTINUED

National Research Council's established risk analysis procedures to develop the model within a year.

About 35 to 40 plant-made pharmaceuticals and industrial products are nearing commercialization. Guidelines proposed by the FDA and USDA for raising genetically modified crops for pharmaceuticals are based on a zero tolerance for the inadvertent introduction of these products in food or feed supplies.

"Our project will take the approach that tolerance levels should be defined for each pharmaceutical or industrial product and those tolerance levels should relate to any potential health or environmental risk the product might pose. The tolerance standard should be based on the risk as established through scientific methods," Misra said.

The Iowa State-led team will classify each protein as harmful, less harmful or benign, based on published scientific information.

They will develop a systematic flow diagram of each step of production. Faculty experts in fields such as plant transformation, seed production, pollen flow, grain harvest and distribution, food quality and risk calculation will quantify the probability of contamination for each step. For some operations, they will assign different probabilities based on different management practices. Then they will statistically calculate an overall risk for each of the production management pathways.

The risk assessment project is coordinated by a university-funded program, "Risks and Benefits of Genetically Modified Agriculture Products," involving the Plant Sciences Institute, the Colleges of Agriculture and Veterinary Medicine, the Office of Biotechnology and ISU Extension.

Speakers bureau open for business

Civic groups, businesses, high schools, colleges, commodity groups and other interested organizations in Iowa can learn firsthand about the exciting research and programs of the Plant Sciences Institute. Thirteen faculty affiliated with the institute are available to speak on a variety of topics through the institute's new speakers bureau. Topics include:

- Risks and Benefits Associated with Biotechnological/ Pharmaceutical Crops
- Property Rights in the Seed Industry
- GMOs—Who Put the Genes in My Beans?
- Molecular Machines from Genomes
- Optimizing Health and Economic Benefits through Nutritional Research in Iowa
- Spinning Advances in Plant Sciences into Economic Gold
- Contamination from Pollen Movement in Corn
- Molecular Mechanisms of Starch Biosynthesis
- How Can We Make Iowa Corn and Soybeans More Valuable?
- Molecular Machines from Genomes

A complete listing of topics and speakers, along with details on making arrangements, is on the Web at http://www.plantsciences.iastate.edu.

Plant scientists meet with legislators

In January, the Plant Sciences Institute shared research updates and plans for building Iowa's plant bioeconomy with members of the Iowa legislature. Senator Amanda Ragan, Mason City, discussed ways to transform Iowa's economy with Madan Bhattacharyya, assistant professor of agronomy and a researcher in the Center for Plant Responses to Environmental Stresses and the Laurence H. Baker Center for Bioinformatics and Biological Statistics.

News Briefs

Kudos!

Lawrence Johnson has been elected vice president of the American Oil Chemists' Society (AOCS) and will run unopposed for the presidency next year. Johnson is director of the Center for Crops Utilization Research and professor of food science and human nutrition. He joined the Iowa State faculty in 1985 and conducts research on the development of value-added products and processes for corn and soybeans. AOCS is an international society with 4,500 members who work with fats and oils and other related materials used for both edible and non-edible purposes.

D. Lee Alekel has received the American Society for Nutritional Sciences' (ASNS) 2003 Mead Johnson Award. Alekel is associate professor of food science and human nutrition and a researcher in the Center for Designing Foods to Improve Nutrition. The prestigious honor is awarded to a researcher for a single outstanding piece of nutrition research or a series of papers on the same subject accomplished within 10 years of postgraduate training. Alekel was honored for her multidisciplinary, collaborative approach to research on the effect of isoflavone-rich soy in perimenopausal women.

Hot topics

In February, **Steve Whitham** gave an invited talk, "Microarray Analysis of the Response in Arabidopsis to Five RNA Viruses," at the Plant-Virus Interactions Symposium, International Congress for Plant Pathology in New Zealand. Whitham's research, "Diverse RNA Viruses Elicit the Expression of Common Sets of Genes in Susceptible *Arabidopsis thaliana* Plants," was published in the January issue of *Plant Journal*. Whitham and his co-authors used microarrays to monitor the expression levels of about 8,200 genes in Arabidopsis, in response to infection by five different plant RNA viruses. They found that these viruses cause many common changes in gene expression demonstrating that diverse viruses elicit similar responses in host cells and tissues. They show that the different viruses can induce virus-specific responses. Whitham is assistant professor of plant pathology and a researcher in the Center for Plant Responses to Environmental Stresses (CPRES).

Another CPRES researcher, botany assistant professor **Ron Mittler,** published in the November 2002 issue of *Plant Physiology*. His paper, "The Effect of Multiple Abiotic Stresses (Drought and Heat Shock) on Plants," shows that when a plant is subjected to a combination of stresses as they occur in the field, its physiological and molecular response is distinct from that of a plant subjected to only one stress. "We hypothesize that the response of plants to the stress combination is controlled by a set of regulatory genes specifically induced or activated during a combination of drought stress and heat shock," Mittler said. "We are identifying different regulatory genes specifically involved in the response of plants to this stress combination, and testing their function with knockout plants and overexpressors. It is important to understand that our attempts to improve stress tolerance in crops should be based upon studies that mimic, as best as possible, the conditions in the field."

Patented success

Patrick Schnable, Feng Liu and Yan Fu have been awarded a patent for "Nucleic Acid Molecules Encoding Histidine Tags in Three Reading Frames." Schnable is professor of agronomy and zoology and genetics, and director of the Center for Plant Genomics and the Center for Plant Transformation and Gene Expression. The technology makes it possible to efficiently identify the protein-coding regions of complex genomes like maize and other crops.

International symposium/CONTINUED

through his research and teaching. His book, *Quantitative Genetics in Maize Breeding*, is a standard text. Maize inbred lines derived from his research produce an estimated $1 billion annually for U.S. farmers, and are used in all major temperate climate countries where corn is grown.

Complete information is available on the Web at www.cimmyt.org under events.

Mark your calendar!

The dedication of the new Roy J. Carver Co-Laboratory will be Saturday, October 18, during Iowa State's Homecoming weekend. The ceremony will feature tours of the $13 million, 45,000-square-foot facility, which will serve as a center for biotechnological research and administrative home to the Plant Sciences Institute. The Co-Laboratory will include the Pioneer Hi-Bred Genomics Laboratory, a proteomics facility and environmentally controlled plant growth facilities.

Recent research grants

The following 14 new grants totaling $2.1 million were awarded recently to plant science researchers at Iowa State.

Bone Response to Soy Isoflavones in Women
National Institutes of Health—$524,330
(L. Alekel, food science and human nutrition)

A Transposon-based System for Site-specific Recombination in Arabidopsis
National Science Foundation—$295,807
(T. Peterson, zoology and genetics)

Maize Gene Discovery, Sequencing and Phenotypic Analysis
Stanford University—$249,062
(V. Brendel, zoology and genetics)

Synthesis and Characterization of New Bioplastics from the Thermal Polymerization of Agricultural Oils
Department of Agriculture—$230,000
(R. Larock, chemistry)

Genetic and Biochemical Basis for the Transformation of Energetic Materials (RDX, TNT, DNTs) in Plants
Department of Army, Corps of Engineers—$201,000
(J. Shanks, chemical engineering)

Structure and Function of Nonsymbiotic Plant Hemoglobins
Department of Agriculture—$140,000
(M. Hargrove, biochemistry, biophysics and molecular biology)

Acetyl-CoA: Precursor for an Alternative, Biotic Source of Hydrocarbons
Department of Energy—$104,000
(B. Nikolau, biochemistry, biophysics and molecular biology)

A Functional Genomics Program for Soybean
University of Illinois—$92,702
(R. Shoemaker, agronomy)

Coordinated Expression of Multiple Anti-Pest Proteins
Dow Agrosciences—$73,000
(M. Spalding, botany)

Data Uniformity and Interpretation for Soybean Composition, Yr 2
Iowa Soybean Association—$64,000
(C. Hurburgh, agricultural and biosystems engineering)

Construction of a Soybean Yeast Artificial Chromosome Laboratory
Iowa Soybean Promotion Board—$50,000
(M. Bhattacharyya, agronomy)

Analysis of Oligosaccharides
Innovase, LLC—$36,000
(J. Jane, food science and human nutrition)

Formulating Soy/Melamine-Urea-Formaldehyde Resins and Such Resins Containing Preservatives
Iowa Soybean Promotion Board—$34,556
(D. Myers, food science and human nutrition)

Establishment of a Soybean Molecular Marker Laboratory
Iowa Soybean Promotion Board—$30,000
(M. Bhattacharyya, agronomy)

Plant Sciences Institute UPDATE

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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.

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

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