

Plant Sciences Institute UPDATE

Vitamin A project tackles life-threatening deficiency

Two Iowa State scientists affiliated with the Plant Sciences Institute say a new project has given their research even more significance.

Wendy White, an associate professor of food science and human nutrition, and Steve Rodermel, professor of genetics, development and cell biology, are part of an international effort to improve nourishment in sub-Saharan Africa. Their job is to help develop corn with increased vitamin A—a nutrient lacking in many Third-World diets.

An estimated 250,000 to 500,000 children go blind each year because of vitamin A deficiency. Another 1.2 million to 3 million die because the deficiency weakens their immune systems.

“We’re talking about life and death,” White says. “It’s giving my work a whole new level of meaning.”

White and Rodermel share a \$1.6 million, three-year grant from the U.S. Agency for International Development with partner institutions in the United States, Europe, and Africa. The goal is to develop corn high in beta-carotene, a chemical the body converts into vitamin A. Kan Wang, director of the Center for Plant Transformation, also is participating.

The grant is linked to HarvestPlus, a global partnership formed to breed crops with increased vitamin and mineral content.



Wendy White, associate professor of food science and human nutrition and principal investigator on a U.S. Agency for International Development–funded vitamin A project, will apply her scientific skills to an important international effort to improve nutrition.

White and her research group will use a sensitive process they developed to measure the amount of beta-carotene the body absorbs from enriched corn. Her research will help guide fortified corn development.

Strains of beta-carotene–enriched corn are available, but the kernels are “super-yellow, almost orange,” Rodermel says. White corn is preferred in many parts of Africa.

Rodermel is collaborating with the Monsanto Company to develop “orange dot” maize—white kernels with an

orange embryo high in beta-carotene.

The research “offers us a nice paradigm at Iowa State as a way to look at other problems,” Rodermel says. “There are a lot of other areas on campus we could take advantage of and make this a center for research on biofortification.”

White believes the research will have impact.

“There are so many people in this project chosen for their experience and dedication, you know something good is going to come out of it,” she said.



Pumping Ethanol

The contribution of Iowa's biorenewable sources to our well-being has been lost in the political wrangling over the nation's new energy bill.



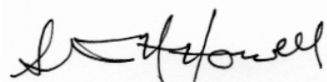
A November 23, 2003, *New York Times* article denounced the energy bill on several counts including the following: "To its critics the stalled energy bill is merely a

'porkfolio' of special-interest spending that, among many expensive provisions, doubles the amount of ethanol produced from corn, a process that uses far more energy than it provides."

I don't think fair-minded Iowans would be buying ethanol-blended gas if they did not believe they were helping the environment. Yet studies such as a recent one from the Department of Civil and Environmental Engineering at UC Berkeley conclude that "The amount of fuel and oil needed to use ethanol is greater than the value of energy ethanol provides."

Where's the truth? The *Des Moines Register* hit it on the button in a November 20 editorial when it said the claims of detractors—that ethanol consumes more energy than it provides—is based on old information. Greater corn yields, increased energy efficiency in distillation and utilization of co-products have changed that equation. New studies from the United States Department of Agriculture and Department of Energy support that view—that ethanol now provides 30 percent more energy than is required to make it.

The Plant Sciences Institute will support energy-efficient ethanol production through its research programs—by improving starch production, increasing the amount of fermentable carbon in corn kernels, and finding ways to better utilize lignocellulosic materials in corn stover and waste products.



Stephen Howell
Director

Facility director helps researchers get down to business

Iowa State faculty sometimes are uncertain about turning their research into a business, Cheryl Kamman said.



Cheryl Kamman (left), newly appointed director of the Innovations Development Facility in the Roy J. Carver Co-Laboratory, discusses the opportunities for occupants of the business incubator modules with PSI director Steve Howell (right).

Kamman, director of the Innovations Development Facility, is here to help. The facility's business incubator and public-private collaboration program are designed to translate plant biotechnology research into companies and jobs.

"Faculty want to publish. They want to focus on academic research," said Kamman, who took the job in September. "This is a good space for them to try out the business side."

Kamman will help researchers apply for grants, find financing and write business plans. Degrees in chemistry and business administration—both from Iowa State—and grant-writing experience prepared her for the job.

Kamman also will meet with Iowa companies. She'll match their research with Iowa State scientists so industry and academia can collaborate to commercialize their research.

New center director puts premium on service

Kan Wang says she learned a few things while researching biotechnology for industry.

"I'm very focused; very strong in problem-solving," says Wang, an associate professor of agronomy. Those skills have helped make the Iowa State Plant Transformation Facility the world's largest public-sector transgenic corn producer. They'll also help Wang in her new job as the director of the Center for Plant Transformation.

The Plant Sciences Institute center develops more efficient methods to safely produce transgenic plants. To that end, Wang's group has perfected using *Agrobacterium tumefaciens* bacteria to insert genes into maize. The facility also progressed toward making soybean transformation procedures more reproducible. Researchers have expanded the *Agrobacterium* technique to a greater variety of germplasm, including in-bred maize seed lines and rice.

The facility also teaches researchers plant transformation procedures. Twenty



Kan Wang, newly appointed director of the Center for Plant Transformation and associate professor of agronomy at Iowa State.

scientists from seven countries attended one workshop last year, Wang said.

Wang said superior service and products will keep the facility busy. She hopes to improve that by using robotics for repetitive and labor-intensive plant transformation procedures.

New researcher assesses life cycles

At first, Robert Anex's research sounds like wrestling an octopus. Anex, an associate professor of agricultural and biosystems engineering, specializes in life cycle assessment, a discipline which considers the environmental, technological and economic impact of

extracting a resource, processing it and using it. That seems to involve pinning down a lot of disparate threads, but Anex says it's more just describing them all.

Anex came to Iowa State from the University of Oklahoma in August as part of President Gregory Geoffroy's Bioeconomy Initiative. The Plant Sciences Institute supported the start-up of Anex's program. Besides doing research, he will teach in the ag and biosystems engineering department and in the biorenewable resources and technology graduate program.

Anex says Iowa State is an exciting place to use his skills, because he can help researchers evaluate plant-based products and processes as they create them.

"It's really about environmental impact and resource use," he says. Life cycle assessment measures the cradle-to-grave impact of a product or process: from the point materials are harvested, through processing, use and disposal.

"We track everything that goes in, what's produced, and the impact," Anex says. "That seems really simple, and it is," but it gets complicated. Biorenewables, for instance, need gasoline, fertilizer and pesticides to grow, so they are intertwined with petrochemicals.

Life cycle assessment can improve the economic efficiency and environmental sustainability of industrial processes. It can help determine the viability of new biobased products and can help improve processes at plants making biobased products, Anex said.

The time is right to analyze those areas, Anex says, because "We haven't yet locked ourselves into one form of processing or one feedstock." If an assessment finds problems, "We can fix them. We can design the systems differently."



Rick McConnell (left), president of Pioneer Hi-Bred International, Inc. and chair of the PSI Board, and Rob Anex (right), associate professor of agricultural and biosystems engineering, get acquainted at a break during the October board meeting.

Dedication of Roy J. Carver Co-Laboratory held on October 18

The Roy J. Carver Charitable Trust was established in 1982 through the will of Roy J. Carver, an Iowa industrialist and philanthropist. The Roy J. Carver Co-Laboratory, a proud new symbol of Iowa State's leadership in establishing world-class science and translating that science into promising new industries, was made possible by the Carver Trust's \$3 million lead gift.

The 45,000-square-foot facility is the administrative home to the Plant Sciences Institute and houses the Innovations Development Facility, the Pioneer Hi-Bred International Genomics Laboratory, a proteomics laboratory and environmentally-controlled plant growth facilities.



Speaking at the building dedication, Ericka Havecker, a member of Dan Voytas's laboratory, describes opportunities for graduate students in the new Roy J. Carver Co-Laboratory.



On the west side of the Roy J. Carver Co-Laboratory after the dedication ceremony (left to right): Dan Saftig, president, ISU Foundation; Troy K. Ross, executive administrator, Roy J. Carver Charitable Trust; Gregory L. Geoffroy, president, Iowa State; Stephen H. Howell, director, Plant Sciences Institute; Owen Newlin, Board of Regents, State of Iowa; Lynn Sasmazer, program director, Roy J. Carver Charitable Trust.

Recent research grants

The following 21 new grants totaling \$5.6 million were awarded recently to plant science researchers at Iowa State.

VCA—A High-Density Genetic Map of Maize Transcripts

National Science Foundation—\$1,213,492

(P. Schnable, agronomy)

Visual Data Extraction and Conversion

Programming Tool

National Institutes of Health—\$200,824

(H. Chou, genetics, development and cell biology)

Molecular Genetics of Cyst Nematode—Arabidopsis

USDA—\$175,000

(T. Baum, plant pathology)

Breeding General-Use and Specialty Soybeans for Iowa

Iowa Soybean Promotion Board—\$150,000

(W. Fehr, agronomy)

Acetyl-CoA: Precursor for an Alternative, Biotic

Source of Hydrocarbons

Department of Energy—\$105,999

(B. Nikolau, biochemistry, biophysics and molecular biology)

Comparative Evolutionary Genomics of Cotton

National Science Foundation—\$1,020,523

(J. Wendel, ecology, evolution and organismal biology)

Biomass-Derived Hydrogen from a Thermally

Ballasted Gasifier

Department of Energy—\$481,000

(R. Brown, mechanical engineering)

Enzyme Soy Protein Ingredients in Food and Industrial

Products Using Enzymes and Aqueous Processing of Soybeans

USDA—\$394,705

(L. Johnson, food science and human nutrition)

Food Technology Commercial Space Center

National Aeronautics and Space

Administration—\$250,000

(A. Pometto, food science and human nutrition)

Methods to Increase Rates of

Homologous Recombination

Pioneer Hi-Bred International, Inc.—\$235,152

(P. Schnable, agronomy)

Development of Analytical Techniques for Environmental Detection and Quantification of the Bt Toxin from Transgenic Corn

USDA—\$221,000

(J. Coats, entomology)

Estimation of Free Energies and Docking of Carbohydrates to Proteins

National Science Foundation—\$211,360

(P. Reilly, chemical engineering)

Technologies to Purify Recombinant Proteins from Plants for Use as Therapeutics and Industrial Enzymes

USDA—\$185,744

(L. Johnson, food science and human nutrition)

Translational Genomics to Decipher Resistance Signaling Pathways

USDA—\$162,027

(S. Whitham, plant pathology)

Tilling in Maize: A Reverse Genetics Resource for Point Mutants

National Science Foundation—\$132,661

(P. Schnable, agronomy)

Harnessing the Genetic Diversity Engendered by Alternative Gene Splicing

Binational Agricultural Research and Development

Fund (BARD)—\$130,000

(V. Brendel, genetics, development and cell biology)

Combinatorial Partitioning Method Analysis of Pioneer's Mars Data for Improved Detection of Quantitative Trait Loci

Pioneer Hi-Bred International, Inc.—\$101,506

(K. Lamkey, agronomy)

Legume Information System

National Center for Genome Resources

(NCGR)—\$67,870

(V. Brendel, genetics, development and cell biology)

Seed Quality Evaluation of Corn Germplasm Selected for Adaptation to Sustainable Agriculture Production Practices

USDA—\$51,371

(S. Goggi, agronomy)

Science-Based Risk Assessment for Approval of Genetically Engineered Non-Food Crops

Iowa Cooperative—\$50,000

(M. Misra, agricultural and biosystems engineering)

Managing Stress Tolerance and Seed Composition of Glyphosate-Resistant Soybeans

Iowa Soybean Promotion Board—\$41,667

(M. Westgate, 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, 1060 Roy J. Carver Co-Laboratory, Ames, Iowa 50011-3650; phone 515 294-5255.

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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