CCUR Affiliates Awarded Grow Iowa Values Fund Grants

Mike Krapfl, Iowa State University News Service

CCUR affiliated researchers will use $262,695 in state economic development dollars to research and develop new technologies that could create or boost Iowa businesses. This is the third time Iowa State has been awarded the competitive grants. Across the university the grants in this round of awards totaled $1,000,050 and ranged from $150,444 to $18,954.

“This state funding is helping to move Iowa State University research from the laboratory into the marketplace,” said John Brighton, Iowa State’s vice president for research and economic development. “The Grow Iowa Values Fund has helped several university researchers develop technologies and establish startup companies. And it has helped Iowa State make progress toward its goal of encouraging university researchers to be entrepreneurs.”

The grants received by CCUR affiliates will support the following projects:

$149,233 to Jay-lin Jane, a professor of food science and human nutrition; Sathaporn Srichuwong, a post-doctoral research associate in food science and human nutrition; Charles Hurburgh, a professor of agricultural and biosystems engineering; Tony Pometto, a professor of food science and human nutrition; Larry Johnson, director of the Center for Crops Utilization Research; and Jacek Koziel, an associate professor of agricultural and biosystems engineering. They’ll develop a technique for converging uncooked dry-grind corn into ethanol. The technique reduces the energy required to produce ethanol while boosting fuel production. Eliminating the heat treatment also allows processors to extract a high-value protein that can be used to make biodegradable plastics.

$113,462 to Tong Wang, an associate professor of food science and human nutrition; Johnson of the Center for Crops Utilization Research; and Pometto of the department of food science and human nutrition. They are looking for effective ways to remove oil from the co-products of corn fermentation for ethanol production. The oil could be used to produce biodiesel. And reducing the oil in the co-product would improve the quality of livestock feeds made from it.

In 2005, Iowa lawmakers agreed to appropriate $5 million per year for 10 years to support research projects at Iowa's Regent universities. The money is to be matched by the universities. And the research is to focus on projects with high potential to boost the state's economic development efforts.

Iowa State establishes Bioeconomy Institute to advance biorenewable research

Mike Krapfl, Iowa State University News Service

Iowa State University is establishing a Bioeconomy Institute to help the university and state maintain their leadership in biorenewable fuels, chemicals and technologies.

The Board of Regents, State of Iowa, approved the new institute at its meeting in Iowa City on October 31. The institute will be directed by Robert C. Brown, the Iowa Farm Bureau Director of Biorenewables Programs at Iowa State. The institute will replace Iowa State’s Office of Biorenewables Programs. It will eventually be housed in the new Biorenewables Laboratory Building planned for the west side of campus. CCUR is an affiliated center of the Bioeconomy Institute.

“The new Bioeconomy Institute is extremely important to Iowa State, to Iowa and to our nation,” said Iowa State President Gregory Geoffroy. “By developing technologies that depend on agricultural resources instead of imported petroleum, the institute can help improve our national security, transform rural economies and counter global climate change. This institute will also help the state remain a leader in meeting the country’s needs for renewable...
From the presidential candidates who shared their views on the future of the biobased industry to the throngs of biobased vendors, economic development professionals and biorenewables technology experts who networked in the corridors of Iowa State University’s Hilton Coliseum, the fifth annual 2007 Biobased Industry Outlook Conference held November 5 and 6 had something for everyone.

The two-day conference, themed Science and Policy for Next Generation Biorefining, kicked off with a virtual groundbreaking for the New Century Farm – the nation’s first integrated, sustainable biofuel feedstock demonstration site, which will be located at Iowa State. Iowa Lieutenant Governor Patty Judge was on hand for the groundbreaking ceremony and U.S. Senator Tom Harkin (D-Iowa) addressed the crowd of over 700 participants via a video recording.

Presidential hopefuls Joe Biden (D-Del.), Dennis Kucinich (D-Ohio), John McCain (R-Ariz.) and Chris Dodd (D-Conn.) took part in a forum on Monday evening. Each candidate presented their views for 15 minutes and then answered questions pertaining to agriculture, education and the bioeconomy. The forum was co-sponsored by the Iowa Farm Bureau Federation, the Iowa State Education Association and Iowa State.

Keynote speakers at the conference were Aristides Patrinos, president of Synthetic Genomics, Inc.; prominent venture capitalist Vinod Khosla, co-founder of Sun Microsystems and founder of Khosla Ventures; Stephen Brand, senior vice president of Technology for ConocoPhillips; Doug Berven, Director of Corporate Affairs at POET, LLC; and Suzanne Hunt, former director of the Worldwatch Institute’s bioenergy program.

Patrinos spoke about developing commercial, genomic-driven solutions that address global energy and environmental challenges.

This was Khosla’s second year in a row delivering the keynote address at the Biobased Industry Outlook Conference, and he was just as enthusiastic about the future of biofuels this year as he was last year.

Earlier this year, ConocoPhillips established an eight-year, $22.5 million research program at Iowa State dedicated to developing technologies that...

Larock Named Distinguished Professor

CCUR affiliate Richard Larock, Chemistry, was one of four Iowa State University faculty members awarded the title of Distinguished Professor. Larock is an internationally recognized expert in organometallic chemistry, particularly involving the element palladium. He developed a palladium catalysis reaction, which has broad applications in both medicine and the effort to replace petroleum-based rubbers and plastics with plant oil-based composites. He has published more than 300 papers and book chapters, 124 in the last five years alone.

The title of Distinguished Professor, first awarded in 1956, is the highest academic honor bestowed by Iowa State. It recognizes faculty members for exemplary performance in at least two of the following areas: teaching and advising; research, scholarship, or artistic creativity; and extension, university service or professional practice. Each recipient receives a $3,000 increase in base salary. Larock was honored at the university convocation and awards ceremony on September 10.
Kim Joins Iowa State University

Tae Hyun Kim has joined Iowa State University as an assistant professor in the Department of Agricultural and Biosystems Engineering. He is a new CCUR affiliate and has joined the Biopolymer and Biocomposites Research Team.

Kim’s main research interests are in the bioconversion of biomass (i.e., crops, agricultural residues, and cellulosic wastes) for the production of fuels and chemicals. His current research includes developing an efficient integrated bioconversion process for lignocellulosic materials (e.g., switchgrass, corn stover) to ethanol. This unique process includes biomass pretreatment, enzyme hydrolysis and modified fermentation. The research focuses on achieving high ethanol yield and concentrations using a novel fermentation process that would add efficiency and productivity to xylan-rich pretreated lignocellulosic materials.

Another phase of Kim’s research is development of a new process for pretreatment/delignification of biomass that soaks the biomass in aqueous ammonia for enzymatic saccharification and simultaneous saccharification and co-fermentation, two-stage fractionation of biomass, and ammonia recycle percolation.

Kim also developed a consolidated conversion process of hulled grains (i.e., barley) into fermentable sugars using chemo-thermo-enzymatic (CTE) treatment. This one step conversion process using CTE treatment can resolve several problems in the conventional barley ethanol process. The intention of this research is to convert both the lignocellulose and starch in hulled grains into ethanol simultaneously without any hull separation or grinding steps.

Kim’s research is also focused on lowering the cost of fuel ethanol production from corn. Typically, this involves improvement of dry milling processes and evaluation of effectiveness in terms of fermentation efficiency and economics.

Kim received his Ph.D. in Chemical Engineering from Auburn University and B.S. in Chemical Engineering from Han Yang University, Seoul, South Korea.

Biorefining of corn brings gelatin production into the 21st century

American Chemical Society

Scientists are reporting an advance toward turning corn plants into natural factories for producing gelatin to replace animal-sourced gelatin widely used by the pharmaceutical industry for manufacturing capsules and tablets. The advance, described at the 234th national meeting of the American Chemical Society, may lead to a safe, inexpensive source of this protein for manufacturers who now rely on material obtained as a byproduct of meat production.

Today, production of gelatin, a jelly-like substance, relies on the same fundamental methodology employed since commercial production began in the 17th century: Gelatin is derived from the breakdown of collagen, which is a component of skin, tendon, bone, cartilage and connective tissue of animals. While there are no naturally occurring plant sources of gelatin, scientists have successfully modified plants, such as corn, to have a gene that results in the production of “recombinant” gelatin.

About 55,000 tons of animal-sourced gelatin are used every year to produce capsules and tablets for medicinal purposes. Plant-derived recombinant gelatin would address concerns about the possible presence of infectious agents in animal by-products and the lack of traceability of the source of the raw materials currently used to make gelatin. However, finding ways to recover and purify recombinant gelatin from plants has remained a challenge because only very low levels accumulate at the early stages of the development process.

Now, scientists at Iowa State University and FibroGen, Inc., in South San Francisco say they have developed a purification process to recover these small quantities of recombinant gelatin present in the early generations of transgenic corn. The method uses a four-step recovery system to separate the recombinant protein from other corn proteins with sufficient purity that its structure and composition can be verified, says Charles Glatz, professor, Chemical Engineering and CCUR affiliate who directed.
A more effective method of purifying alcohol—turning poor whisky into a smooth, well-rounded drink, and converting fuel-grade ethanol into food-grade products—has earned national recognition for two Iowa State University researchers.

The American Academy of Environmental Engineers recently awarded Hans van Leeuwen, professor, Civil, Construction and Environmental Engineering and Jacek Koziel, assistant professor, Agricultural and Biosystems Engineering the Grand Prize for University Research. The award recognizes the best research being done in environmental engineering in the United States. In particular, it honors researchers for their innovation, performance and client satisfaction, and contribution to an improved quality of life and economic efficiency.

The process van Leeuwen and Koziel developed and refined is based on the removal or conversion of impurities using ozone and activated carbon. As a result of this process, the researchers found they could convert fuel-grade ethanol into a food-grade alcohol to be used in products such as alcoholic drinks, cough medicines, and mouthwashes.

This new alcohol purification process could save the United States’ billion dollar alcohol industry an estimated $100 million per year, which in turn, could lower the costs of certain medications that use alcohol, researchers say.

According to van Leeuwen, high value and government excise income make this product as important economically as the much larger volumes of fuel ethanol produced.

van Leeuwen and Koziel lead a team of researchers including Lingshuang Cai, an analytical chemist and postdoctoral researcher, Agricultural and Biosystems Engineering and Shinnosuke Onuki, graduate student, Agricultural and Biosystems Engineering. They have also teamed with entrepreneur Rick Wood in Cedar Rapids, Iowa, and Mayberry, LLC, in Vinton, Iowa, to form a company called Mell O3z LLC. The group has three patents pending. They eventually hope to license their technology to industry to share the benefits with the community and possibly making U.S. alcohol exports more competitive in international markets.

Koziel and van Leeuwen receive national research prize

Dana Schmidt, Department of Civil, Construction and Environmental Engineering
Alex Wymore, Department of Agricultural and Biosystems Engineering

Hans van Leeuwen, left, and Jacek Koziel developed a process to quickly and cheaply convert fuel ethanol into the purer alcohol used in beverages, mouth washes and cough syrups.

Johnson filmed for television documentaries on pigs, corn and food project

A television crew interviewed Larry Johnson for Robert Kenner, an Emmy Award winning director who creates programs for American Experience and other PBS series. Johnson demonstrated wet corn milling and also talked about changing trends in food products. The interview was for a documentary tentatively called “The Food Project.”

Another crew recently shot footage of Johnson and Steve Fox, research technician, for a Modern Marvels episode about corn that first aired on the History Channel on November 19. Johnson is director of CCUR and professor in food science and human nutrition.
This spring farmers responded to the ethanol industry’s demand for grain by increasing their corn acreage by 19 percent over last year, according to U.S. Department of Agriculture estimates.

What if that happens again next year?
What if farmers decide against crop rotations and plant corn on the same fields, year after year? Or, what if farmers begin growing biomass crops such as switchgrass for the production of ethanol from plant fiber?

Will soil lose fertility? Will erosion increase? Will the amount of energy needed to produce biofuels go up or down? Will farm income increase or decrease? Will the bioeconomy be sustainable?

Robert Anex, an Iowa State associate professor of agricultural and biosystems engineering and associate director of Iowa State’s Office of Biorenewables Programs, is working to answer those and other questions about the transition to an agriculture that produces biomass as well as food and fiber.

One answer is that American agriculture is likely to change.

“It may well be that the development of biomass-based crops production systems can have as profound an impact on agriculture and its environmental footprint as it does on energy security and the global climate,” Anex and co-authors Andrew Heggenstaller and Matt Liebman of Iowa State’s agronomy department and Lee Lynd and Mark Laser of Dartmouth College wrote in a recent paper. “Whether this is a positive impact or a negative impact will depend largely on how biomass feedstocks are produced and converted, and the extent to which these two activities are integrated.”

Their paper, “Potential for Enhanced Nutrient Cycling through Coupling of Agricultural and Bioenergy Systems,” was recently published online by Crop Science, the official publication of the Crop Science Society of America.

The paper reports that as much as 78 percent of the nitrogen fertilizer needed for crops could be recovered from an integrated biological and thermochemical process that converts switchgrass to ethanol. The study says such nutrient recovery and recycling could significantly improve the sustainability of biomass production and the amount of energy required to produce ethanol from plant fiber.

The researchers say the nutrient recovery could happen this way: Plant fiber would be converted to liquid fuels by pre-treatments and fermentation. The co-products of fermentation would be dried and heated to turn the solids into gases. The gasification would leave plant nutrients in the resulting ash and ammonia. The nutrients in both streams could be recovered and returned to the fields that produced the biomass.

Robert Anex, an Iowa State associate professor of agricultural and biosystems engineering, examines a plot of hybrid sorghum-sudangrass. The plant is a high-yielding biomass crop that’s being studied as a possible biomass source for the production of cellulosic ethanol.

Larry Johnson was recently featured in a BioFuels Journal article. The story discussed his research on the sequential ethanol extraction process and how it could provide many high value ethanol co-products.

To read the full article go to www.biofuelsjournal.com
Bioeconomy Institute

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fuels and products.”

The institute is expected to build on the success of Iowa State's Office of Biorenewables Programs. Since the office was launched in 2002, it has attracted more than 150 faculty affiliates. Those affiliates won more than $43 million in sponsored funding through June 30, 2006. They generated more than $17 million in fiscal year 2006 alone.

Brown said the new institute’s general goals include reducing the country’s dependence on imported petroleum, developing sustainable biomass production practices that protect land and water resources, improving environmental quality by reducing the use of fossil fuels, diversifying markets for farmers’ crops and creating jobs and opportunities for rural communities where biomass crops are grown and processed.

Brown also said the institute’s initial work will focus on six program areas: corn to biofuels; biorenewable chemicals; thermochemical technologies such as gasification and fast pyrolysis; harvest, storage and transportation of biomass; feedstock production; and biorenewables education.

Contracts and Grants

Biobased product testing, USDA, $72,127, D. Grewell.

Enhance ethanol yield, Grow Iowa Values Fund, $37,023, D. Grewell.

Scale-up and technology transfer of protein based plastic products, Soy Works Corp. $109,000, D. Grewell.


Measuring field performance for combine clean-outs and developing test protocol. AGCO, Inc. $25,000, M. Hanna and D. Jarboe.

Measuring field performance for combine clean-outs and developing test protocol. Deere and Co. $25,000, M. Hanna and D. Jarboe.

Development of resistance and low-calorie maltodextrins from cornstarch, Grain Processing Corp., $20,000, J. Jane and S. Hendrich.

Enzyme hydrolysis of uncooked dry-grind corn for ethanol production. Grow Iowa Values Fund, $149,560, J. Jane, S. Srichuwong, C. Hurburgh, A. Pometto, L. Johnson, and J. Koziel

Enzyme hydrolysis of uncooked dry-grind corn for ethanol production. POET LLC, $284,000, J. Jane, S. Srichuwong, C. Hurburgh, A. Pometto, L. Johnson, and J. Koziel

Biorenewable Composites Reinforced with Under-Used Co-Products from Ethanol Production, University of Northern Iowa, $15,000, M. Kessler and R. Larock.

Biobased adhesives, Avery Dennison, $74,473, R. Larock.

A proposal on biorefinery ash utilization as a soil amendment, Tate & Lyle Ingredients, $504,911, A. Mallarino, M.A. Tabatabai, R. Anex, and M. Liebman.


Oil recovery from corn fermentation by-products, Grow Iowa Values Fund, $113,462, T. Wang, L. Johnson, and A. Pometto.

B-Glucan structure and interactions modulate physicochemical, physiological and sensory functions of oats, USDA-NRI, $495,229, P. White, J.-L. Jannink, and N. Yao.

A key to advancing that research is growing administrative and staff support for the research programs.

“Establishing the Bioeconomy Institute gives us an opportunity to set up an administrative team that has the time and resources to help us accomplish even more,” Brown said.

The institute, for example, will support faculty who lead major grant applications. It will also add a staff person to help prepare proposals and administer large contracts. And it will add a staff person to work as a liaison with federal agencies and companies.

Brown said faculty in the past struggled to find time to help administer the program, pursue large grant proposals, travel to funding agencies and coordinate visits from companies interested in supporting research.

All of the support made possible by the new institute will help Iowa State advance the science and engineering behind the emerging bioeconomy.

“The institute will build upon a five-year initiative at Iowa State that has brought us to national prominence in the field of biofuels and bioenergy,” says the proposal for the institute. “The establishment of the institute will help assure Iowa State's continued prominence in this rapidly advancing field.”
produce biorenewable fuels. Brand spoke of the importance of investing in promising research.

Berven outlined POET’s work with the U.S. Department of Energy on a venture called Project LIBERTY. POET hopes to be the first to operate a commercially viable cellulosic ethanol plant through an expansion of its Emmetsburg, Iowa, facility.

While at the Institute, Hunt coordinated the landmark study, Biofuels for Transportation: Global Potential and Implications for Sustainable Agriculture and Energy in the 21st Century. During Hunt’s address, she said that, “although technologies are being developed to improve the sustainability of the bioeconomy, policy decisions and the actions of those involved in the biobased industry will play a large role in how quickly, or if at all, these technologies are implemented.”

Between keynote addresses, conference participants were able to attend dozens of breakout sessions that featured over 100 speakers. The sessions were organized into five conference tracks: plant sciences; feedstock production; conversion; utilization and energy efficiency; conservation and sustainability; and economics and policy. Over the course of the conference, speakers covered topics as diverse as the harvesting and transporting of biomass, the implementation of policies to mitigate global climate change, the importance of nutrient recycling, and the status of ongoing efforts to replace petroleum-based products with biobased products.

In addition to attending the breakout sessions, conference participants were able to network with 48 biobased product and service vendors. “This is great,” said vendor Norman Reese, General Manager of biomass technology company Frontline Bioenergy. “We have gotten a lot of attention here. There are so many people from various backgrounds. This conference has really covered a lot of bases in terms of bringing people together who share an interest in the future of the bioeconomy.”

To learn more about the 2007 Biobased Industry Outlook Conference and view speakers’ presentations, please visit www.bioeconomyconference.org.
Giant soybean artwork on display in CCUR

The College of Agriculture and Life Sciences purchased a piece of soybean artwork that was part of the Iowa Soybean Association’s Soy on Parade promotion. It is on display outside the main office in the Center for Crops Utilization Research in the Food Sciences Building. The giant soybean is titled “History of Soy” and features Iowa State’s George Washington Carver and entrepreneur Henry Ford.

The artwork was on display over the summer in Dean Wendy Wintersteen’s office. The auction raised more than $20,000 for the Iowa Soybean Association’s agricultural scholarship fund.

Biorefining

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the work.

“Protein production from transgenic plants is a challenging process, with potential pitfalls all along the way,” Glatz says. “It is important to develop methods in the early stages of the development program to purify gelatin to demonstrate that it can be produced properly.”

The studies establish transgenic corn as a viable way to produce gelatin and potentially other products, Glatz says. In time, researchers may also be able to develop a variety of “designer” gelatins, with specific molecular weights and properties tailored to suit various needs of products containing gelatin.

“Corn is an ideal production unit, because it can handle high volumes at a low cost,” he says. In addition, the recombinant gelatin is free from the safety concerns of using meat byproducts.

The purification process relies on chromatographic and filtration techniques, building upon methods developed by FibroGen to recover recombinant gelatin produced in yeast.

Glatz says ultrafiltration allowed the group to take advantage of the size difference between the recombinant protein and other corn proteins.

“This step greatly reduced the process volume for later chromatographic steps, and was crucial to achieving a high purification factor.”

The group is now working to refine the method and boost the overall recombinant protein yields in corn, he says. Though the procedure requires more testing, Glatz says the technique could someday be used to produce high-grade gelatin in a safe and inexpensive manner.

Overall costs could be further reduced by combining the production of gelatin in corn with the extraction of non-protein parts of the grain — such as oils and starches — that are now grown and harvested for biodiesel and ethanol production, he adds.

“Corn wouldn’t be planted for its gelatin alone, but those products could help off-set the cost of biorefineries that use corn to produce other products,” he says.

Cheng Zhang, a doctoral student at Iowa State, presented details of the new purification process at the American Chemical Society meeting.

Myers leaves Iowa State

Deland Myers, professor, Food Science and Human Nutrition and CCUR affiliate left Iowa State University at the end of August. He accepted the positions of chair, Cereal and Food Sciences; director, School of Food Systems; and director, Great Plains Institute of Food Safety at North Dakota State University. Myers will continue to collaborate on projects with CCUR.
CCUR Visitors

Feed Energy Co., Des Moines, Iowa, May 7.
VeraSun Energy, Brookings, South Dakota, May 9.
Buehler Company, June 8.
Kemin Industries, Des Moines, Iowa, July 9.
Ajinomoto USA, Eddyville, Iowa, July 20.
Mid Iowa Growth Partnership, Fort Dodge, Iowa, July 23.
Cooperativa, Agricola Sul Matogrossense Tour, Brazil, August 1.
Iowa Community College Collaborators for CIRAS, August 7.
DuPont, Wilmington, Delaware, August 30.
Charoen Pokphand Group, Bangkok, Thailand, August 31.
Modern Marvels, History Channel, September 4.
Ilankovan (Ilanko) Paraman, University of Arkansas, Fayetteville, Arkansas, September 10.
Genencor, Cedar Rapids, Iowa, September 11.
David Weiss, September 13.
Renewable Energy Group, Ames, Iowa, September 17.
ISU Women’s Club, Ames, Iowa, September 26.
World Food Prize Borlaug Prize visitors, October 16.
Phil Nelson, Purdue University and World Food Prize Laureate, October 16.
General Motors, Detroit, Michigan, November 15.

Bioeconomy

And that potential for nutrient recycling means there’s potential for a new kind of agriculture feeding a sustainable bioeconomy.

“By creating a large, new domestic demand for agricultural products, the advent of commercial-scale conversion of biomass into ethanol and other industrial chemicals is likely to have a strong influence on the design of agricultural systems,” the researchers wrote. “The possibility of recycling nutrients from the biorefinery to the agricultural system that produces the feedstock may allow substantial improvements in both sustainability and production efficiency.”

But, sustaining biomass production is a complex system that depends on many variables such as soil type and slope, soil organic matter and the amount of biomass actually harvested.

To help farmers begin to understand how collecting biomass from their fields may affect soil fertility, erosion, energy needs, labor and the bottom line, Anex and a team of Iowa State researchers have added bioeconomy elements to I-FARM, a Web tool that helps farmers simulate and plan various changes to their operations.

I-FARM is free and can be found at http://i-farmtools.org/. Its focus is on the upper Midwest but weather and soils data from 28 states are accessible from its database.

In one simulation, the I-FARM research team (Anex, Ed van Ouwerkerk, an Iowa State research associate in agricultural and biosystems engineering; Tom Richard, an associate professor of agricultural and biological engineering at Penn State University; Amritpal Kang, an Iowa State graduate student; and Brian Gelder, an Iowa State postdoctoral research associate) studied the effects of harvesting corn stalks and leaves on three farms in northwest Iowa's Palo Alto County. One grain farm harvested no stover, one harvested 1,809 dry tons of stover a year and the other harvested 3,077 dry tons a year.

The simulations found the farm that harvested the most stover also needed the most fertilizer, had the most erosion and barely returned sustainable levels of organic matter to the soil. That farm also recorded the highest net farm income before taxes.

Anex’s study of the sustainability of the bioeconomy is being supported, in part, by grants from the U.S. Department of Agriculture, the U.S. Department of Energy and the National Science Foundation.

The studies are helping researchers answer some questions about the sustainability of agriculture in a bioeconomy, Anex said. But there are still lots of questions about how everything in a new agricultural system would fit together.

“Despite the promise of alternative crops and cropping systems as well as the nutrient recovery and recycling concepts examined here, there are still many questions that remain about their practical implementation,” Anex and the other researchers wrote in their paper. “The issues that have been addressed here and the questions that have been raised are only a small subset of those that must be addressed if we are to usher in a new and beneficial agricultural revolution.”
CCUR participates in VEISHEA celebration

A photographic tour of CCUR’s display at this year’s VEISHEA and Iowa State’s 150th birthday celebration.

Nicolas Deak, former CCUR post doctoral research associate, explains his research on soy fractionation.

Tammi Martin, CCUR administrative specialist, gives away soy crayons to kids that visited the tent.

Yongshang Lu, chemistry post doctoral research associate (left) and Dan Pfister, chemistry graduate student, explain and show samples of their work on soy plastics.

Darren Jarboe, CCUR program coordinator, discusses biomass ethanol and fermentation.

Thomas Brumm, associate professor of agricultural and biosystems engineering, is setting up his biodiesel display.

Valerie Krumm, Iowa Soybean Association, gives away tasty treats made from soy.