

OBP RESOURCE

From the Director...

The four pillars of the biobased products industry are plant science, production, processing, and utilization. The first three years of the OBP focused heavily on issues related to processing and utilizing biomass. More recently, plant science and production related to biobased products are garnering increased interest among Iowa State University faculty. To help build linkages with faculty in the College of Agriculture who are working in these areas, Steve Fales has agreed to serve as the Associate Director with responsibilities in plant science and production. Fales, who is currently chair of the Department of Agronomy, will officially assume his duties with the OBP in January. He will be profiled in a future newsletter. Opportunities to work with industry are also increasing and the OBP has recruited Jill Euken, an extension field specialist at Iowa State, to serve as Assistant Director of the OBP in charge of Industrial Outreach and Extension. This newsletter profiles Jill and her activities with the OBP. The newsletter also profiles Robert Burns, our newest faculty affiliate, describes our international student exchange program, and announces the newest research award to the Bioeconomy Initiative.



Robert C. Brown, Director
Office of Biorenewables Programs

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Iowa State Wins USDA/DOE Funding



Robert C. Brown is leading a research project in investigating new uses of corn stover.

The USDA and the Department of Energy recently notified Robert C. Brown, director of the Center for Sustainable Environmental Technologies and the Office of Biorenewables Programs, of their intent to fund his project, Environmental Enhancement through Corn Stover Utilization. The pending award totals nearly \$1.9 million with an additional \$500,000 in matching funds being provided by the Iowa Energy Center, Iowa State University, and industry partners. This project, which features research in the area of bio-oils, is one of eleven funded through the Biomass Research and Development Initiative, a joint effort of the USDA and the Department of Energy.

Through this research, Brown and his team hope to use corn stover for sequestering carbon and improving soil fertility. Goals for the project include controlling pyrolysis conditions to achieve optimum mass fractions

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Exchange Students Study Biorenewables

Three students from the University of Ghent in Belgium are enrolled for the fall semester in the Biorenewable Resources and Technology (BRT) graduate program at Iowa State University. Dirk Aerts, Elke Vermoesen, and Miet de Baere are enrolled at Iowa State in conjunction with the EU/US Renewable Resources and Clean Technology exchange program, which was created as a result of a grant from the U.S. Department of Education's Fund for the Improvement of Postsecondary Education (FIPSE).

Upon their arrival in August, the students were welcomed into laboratories at Iowa State that best suited their research interests. Aerts and de Baere are conducting research in plant genetics and molecular biology, while Vermoesen is focusing on research in environmental engineering. Aerts' is conducting research with Basil Nikolau, professor in the Department of Biochemistry, Biophysics, and Molecular Biology. De Baere is working with Eve Wurtele, professor in the Department of Genetics, Development, and Cell Biology, and Vermoesen is working with Tim Ellis, associate professor



Larry Johnson (left) and his wife Bernice enjoy dinner with the exchange students from Belgium. The students (from left) are Miet de Baere, Elke Vermoesen, and Dirk Aerts.

in the Department of Civil, Construction, and Environmental Engineering.

All three students are taking courses in addition to their research projects. "The education system is different in Belgium," de Baere said. "We usually take our classes and then spend a year in a laboratory at the university." Each of the students is a candidate for the Master's degree.

Vermoesen, de Baere, and Aerts all believe what they are learning about biorenewable

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International Opportunities

The Biorenewable Resources and Technology (BRT) Graduate Program at Iowa State University continues to expand while broadening students' opportunities for research and education. The program, which was the first in the nation to offer graduate degrees in biorenewable resources, is currently offering students two separate opportunities to study abroad. The funding for the exchange program is provided by a Department of Education FIPSE grant which was awarded in 2005.

Applications are being accepted for a two-week intensive program in biorenewable resources to be held in Ghent, Belgium, in January 2006. This program will feature lectures from international experts, cultural excursions, and industry tours. Lectures this year will likely cover specialty crops and utilization, theory, separations/processing, and applications.

The program in 2005 was hosted by the National Polytechnic Institute of Toulouse in Toulouse, France. The Office of Biorenewables Programs (OBP) at Iowa State University sponsored five students and five professors to attend the program. The professors gave lectures during the program. Students toured facilities at Cognis and Pierre Fabre for industry tours and visited the medieval walled city Carcassonne.

In addition to the upcoming two-week intensive program, the OBP is also accepting applications for BRT students to travel abroad for a semester. Students have the opportunity to study at one of three universities: University of Ghent in Belgium, Technical University of Graz in Austria, or the National Polytechnic Institute of Toulouse in France. Each university has a specialty in renewable resources.

The program partially sponsors the longer exchange. Additionally, the exchange program offers stipends for language training and student mobility.

For more information about the BRT program at Iowa State, please visit www.biorenew.iastate.edu. To learn more about studying abroad through the BRT program, please visit www.crrct.iastate.edu.

Exchange Program Broadens Study of Biorenewable Resources

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resources will take them far. "Biorenewable resources are very important with the coming end of oil," Vermoesen said. "We have known in Europe for some time that the end of oil is coming. Therefore, biorenewable resources are going to become very important in the near future to provide energy, fuels and products," de Baere said.

Upon finishing their degrees in Belgium, these three students have big plans for the future. De Baere is interested in possibly working toward a Ph.D. or studying abroad in France or Brazil. Aerts hopes to work with cell and gene technology either at a Ph.D. level or for a corporation. Vermoesen also hopes to possibly study or work abroad after she finishes her degree. They all hope to continue their studies and research in biorenewable resources.

Aerts, Vermoesen, and de Baere enrolled at Iowa State for reasons as varied as they are. "I really wanted to improve my English skills," Aerts said. De Baere decided immediately when approached

Spotlight: Jill Euken



Jill Euken, Iowa State University Extension Field Specialist for biobased products, tells her children that she is a "missionary and a matchmaker."

"I am a matchmaker because I work at finding ways for different groups to mutually benefit. I am a missionary because I work at helping people understand their

biorenewables opportunities," Euken said.

Her work is divided among many different groups with many different tasks. She works with the BioEconomy Working Group, the Office of Biorenewables Programs at Iowa State, the BIOWA Development Association and the College of Engineering at Iowa State.

Euken's task list ranges from helping link industry partners with researchers to assisting companies with the commercialization process for new products or services. In addition, she leads numerous education activities including serving as the conference chair for the 2005 Biobased Industry Outlook Conference.

"This growing industry is a fun place to be right now. There is a lot of excitement and a lot of resources being directed to biobased products from the state and federal level and also from producers," Euken said.

Jeff Stroburg, CEO of West Central Cooperative, has worked with Euken on numerous projects. "She helped us understand what people judging grants were going to be looking for," Stroburg said. "She knows our company well and helped us talk about ourselves."

Euken received her B.S. and M.S. degrees from Iowa State. She and her husband Randy, a full-time farmer, have two children who are both currently attending Iowa State.

with the idea of studying abroad. "I have always wanted to study abroad and this was a great opportunity to attend school in the United States," she said. For Vermoesen, studying in Iowa has fulfilled her dreams of experiencing life in the United States and making new friends.

In addition to working closely with their supervising professors, the students meet with Larry Johnson, director of the Center for Crops Utilization Research (CCUR) and the program contact person at Iowa State. "We really appreciate Larry Johnson. He has worked so closely with us to ensure we have everything we need while we are at Iowa State," de Baere said. Vermoesen and Aerts echoed de Baere's sentiments. "Larry has been really good to us. We are very lucky to have him here supporting our semester abroad," Aerts said.

"This has been a really good experience for both the students and our BRT program," Johnson said. "We have been fortunate to have these three outstanding students come to Iowa State this semester and we are looking forward to future exchanges."

Research of Manure Could Lead to Better Fertilizers

The land application of manure helps farmers to fertilize their soil; however, over-application of manure nutrients can add too many nutrients to certain croplands. Research has found that swine manure slurries designed to meet crop nitrogen needs can over-apply phosphorous. To combat this problem, Robert Burns, Iowa State University associate professor of agricultural and biosystems engineering, is leading research on using a struvite process to remove the excess phosphorous from swine slurries to reuse where phosphorous is needed. Burns came to Iowa State in August 2004 from the University of Tennessee, where he specialized in the design of animal waste management systems and nutrient management for livestock and poultry applications.

While at the University of Tennessee, Burns received a \$168,000 grant for his phosphorous research. The grant, *Concentration and Extraction of Phosphorous from Swine Manure Slurries*, was awarded by the USDA National Research Initiative through December 2006.

The focus of this particular research project is to examine the eutrophication and subsequent ecological harm that occurs when the excess phosphorous moves to surface water. "We need to move the phosphorous where there is too much to areas where there is not enough," Burns said.

Burns said it is too expensive to simply move the manure itself, because of the weight caused by moisture content. However, a scale-like chemical called struvite naturally occurs inside of the manure slurries. Struvite is a build-up of phosphorous, magnesium, and ammonium, and can be a problem to farmers if it occurs in manure transfer piping. Burns explained that struvite can be used and has already been proven to be a successful fertilizer.

To force the formation of struvite, Burns adds magnesium. However, in a continuous system a method is needed to help estimate how much magnesium to add to form the struvite. Currently, research is being done to determine if *Visual Minteq* software will provide accurate estimations.

"We visited swine farms and manually added the chemical [magnesium] to test the effect in the field," Burns said. "We are currently in the process of building a bench-scale reactor, which would run the manure through a reactor and extract the struvite continuously."



Robert Burns shows a struvite formation made out of magnesium, ammonia and phosphorous.

Once this research is complete, the struvite extraction process can benefit states where the amounts of excess manure phosphorous are highest, such as North Carolina. Iowa, Burns said, is not land-limited. There are more crops than manure in Iowa as a whole, but there might be counties within Iowa that are unbalanced and this process could help. He also stated that situations could arise where one farm has too much phosphorous and a nearby farm has too little, and a partnership between the farms can be met.

USDA/DOE Awards Grant for Corn Stover Research

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of bio-oil, char, and gas; improving steam reforming of bio-oil to obtain hydrogen for synthesis of anhydrous ammonia; synthesizing ammonium bicarbonate-impregnated char with desirable agronomic properties; establishing the carbon sequestration potential of the proposed N-rich char fertilizer; evaluating the corn yield response to the application of different amounts of nitrogen-char fertilizer to soils; and evaluating the economic performance of the proposed fertilizer system.

In order to meet these goals, Brown and his colleagues propose a new system for maintaining soil fertility that employs corn stover or corn fiber for production of nitrogen-rich, biologically active char that both enriches the soil and sequesters carbon from the atmosphere. In this system, corn stover or corn hulls are collected and preprocessed locally to yield fine, porous char and energy rich bio-oil.



Corn stover and pyrolysis are the foci of a new project at Iowa State.

The bio-oil, which can be thought of as densified biomass, is transported by tanker truck to a central facility for steam reforming to hydrogen

followed by some part of it being converted to anhydrous ammonia. The process yields excess hydrogen which can be used for other applications. Using existing infrastructure of the agricultural fertilizer industry, anhydrous ammonia is transported back to the distributed preprocessing facilities where it is reacted with carbon dioxide, water, and char, which are byproducts from pyrolysis of biomass, to yield ammonia bicarbonate precipitated within the pores of the char. The nitrogen-rich char is injected into the soil where it serves three purposes: nitrogen fertilizer, biologically-active soil amendment, and a means for sequestering carbon from the atmosphere.

Brown, the principal investigator of this project, is joined by researchers from Iowa State, Cargill, Inc., Eprida, Inc., Demonstratives, Inc., the National Renewable Energy Laboratory, Oak Ridge National Laboratory, and the USDA-ARS North Central Soil Conservation Research Laboratory in Morris, Minn. "Each team member brings unique capabilities to the project," Brown said.

The Biomass Research and Development Initiative is jointly coordinated by USDA's Natural Resources Conservation Service and Department of Energy's Office of Energy Efficiency and Renewable Energy. The Initiative was formed through enactment of the Biomass Research and Development Act of 2000 and the 2002 Farm Bill, which set the framework for interagency cooperation and joint solicitations. More than 670 applications, divided into four unique technical topic areas, were submitted in response to the FY06 call for proposals.

News, Notes, and Honors...

Correction...

In the 2004/05 OBP Annual Report, two individuals were incorrectly identified due to editing errors.

Floyd Barwig is the director of the Iowa Energy Center. John Van Gerpen is currently Head of the Biological and Agricultural Engineering Department at the University of Idaho.

Biobased Industry Outlook Conference

Held August 29-30, 2005
Iowa State University

For presentations given during the conference, visit the Web site at www.valuechains.org/bewg/Conf2005

Charles Hurburgh

Professor
Dept. of Food Science & Human Nutrition

Invited to serve on TRACE, a European Commission that addresses issues related to food products moving through the supply chain

For more information about news and events, visit www.biorenew.iastate.edu.

Basil Nikolau

Professor
Dept. of Biochemistry, Biophysics & Molecular Biology

Co-Principal Investigator, *Mass Spectrometric Imaging of Plant Metabolites*, Dept. of Energy grant, \$1.02 million

George Kraus

University Professor
Dept. of Chemistry

College of Liberal Arts and Sciences
Graduate Teaching Award

Jay-Lin Jane

Professor
Dept. of Food Science & Human Nutrition

Awarded the Alsbury-French-Schoch Award from the American Association of Cereal Chemists

Joe Colletti

Professor
Dept. of Natural Resource Ecology & Management

Named Interim Associate Dean for the College of Agriculture at Iowa State



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IOWA STATE UNIVERSITY

OF SCIENCE AND TECHNOLOGY

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