

Contact: Diana Gonzalez

**REQUEST TO ESTABLISH NEW CENTER AT IOWA STATE UNIVERSITY**  
**CENTER FOR BIORENEWABLE CHEMICALS**

**Action Requested:** Consider approval of the request by Iowa State University to establish a Center for Biorenewable Chemicals in the College of Engineering.

**Executive Summary:** The proposed Center for Biorenewable Chemicals (CBiRC) will transform the chemical industry by integrating biological and chemical catalysis systems to produce biorenewable chemicals. The proposed Center will bring together biocatalyst and chemical catalyst research communities with extensive experience in converting bio-based feedstocks and connect them with the industrial and innovation partners from the petrochemical, agricultural processing, chemical catalysis, biocatalysis and process licensor commercial sectors that are needed for successful technology translation. This proposal was reviewed by the Board Office and the Council of Provosts and is recommended for approval. Creation of the Center requires Board of Regents approval, as stated in the Board of Regents Policy Manual §6.08, because the Center will require an annual institutional commitment of \$250,000 or more. This request addresses the Board of Regents Strategic Plan priorities (2.0) to “provide needed service and promote economic growth” and (3.0) to “discover new knowledge through research, scholarship, and creative activities.”

**Background:**

- ◇ **National Science Foundation (NSF) Engineering Research Centers Program.** The goal of the Program is to create a culture of innovation in engineering research and education that links scientific discovery to technological innovation through transformational engineered systems research which advances technology and produces engineering graduates who will be creative innovators in a global economy.
- ◇ **NSF Grant Program.** After passing the agency’s rigorous application, site visit, and merit review processes, the proposal submitted by Iowa State University for a Center for Biorenewable Chemicals was one of five selected for funding. Upon execution of a cooperative agreement with NSF, \$18.5 million in federal funds will be awarded to ISU in September, 2008. The Center will initially be funded for a five-year period, with the opportunity to renew for another five years of NSF support.
- ◇ **Description of Center.** The proposed Center will develop technology and academic and industrial partnerships needed to transition from the current petroleum-based chemical industry to a renewable carbon-based industry. The unique focus of the proposed Center will be exploiting the integration of biocatalytic and chemical catalytic technologies to produce biorenewable chemicals efficiently. The proposed Center will develop a new paradigm for producing biorenewable platform chemicals based on the combinatorial metabolic processes of the polyketide biosynthetic pathway.
- ◇ **Need for the Center.** Creating a sustainable chemical industry is a vital societal goal. The proposed Center will provide a novel multidisciplinary environment for the research, training, and education of engineers and scientists needed to advance biorenewable chemical technology.

- ◇ Center Goal and Vision. The goal of the proposed Center is to create a broad-based technological framework that can establish the engineering and intellectual infrastructure to generate a flexible system for producing a range of biorenewable chemicals. To achieve this goal, the proposed Center has identified the following vision:
  - 📖 Transform the chemical industry by integrating biological and chemical catalysis systems to produce biorenewable chemicals.
  - 📖 Provide educational programs which attract a diverse set of students into the engineering field, and produce globally-competitive college graduates capable of designing integrated chemical/biological processing systems.
  
- ◇ Relationship of the Center to ISU's Strategic Plan. The proposed Center will address ISU's institutional mission in the following manner:
  - 📖 Create knowledge through world-class scholarship in teaching, research, and creative endeavors.
  - 📖 Share knowledge through outstanding undergraduate, graduate, professional, and outreach programs.
  - 📖 Apply knowledge to improve the quality of life for current and future generations.
  - 📖 Increase and support diversity in the university community and beyond.
  - 📖 Translate discoveries into viable technologies, products, and services to strengthen the economies of Iowa and the world.
  
- ◇ Relationship of the Center to the College of Engineering Strategic Plan. The College of Engineering has focused its strategic plan on addressing the "2050 challenge." This means investigating and finding solutions to many of society's most important questions:
  - 📖 How do we provide clean water?
  - 📖 How do we provide universal access to information, health care, and robust economies for 9+ billion people?
  - 📖 How do we restore our crumbling infrastructure and build a new, more sustainable infrastructure, especially in developing countries?
  - 📖 How do we sustain our agriculture and manufacturing?
  - 📖 How do we address climate change while developing non-polluting, renewable sources of energy, fuels, chemicals, and other materials?

In the United States, production of industrial chemicals is a \$400 billion-plus enterprise that affects all aspects of society from personal care products to building materials. Unfortunately, this vital industry is not self-sustaining; its long-term future is predicated on transitioning from current non-renewable, petroleum feedstocks to renewable bio-based feedstocks. The focus of the proposed Center is the development of conversion technologies needed to facilitate this transition. Therefore, the proposed Center is committed to meeting the "2050 challenge."

- ◇ Relationship of the Center to other ISU Centers. In 2002, ISU developed interdisciplinary research programs in biorenewables through its Bioeconomy Initiative, which evolved into the Bioeconomy Institute with 160+ affiliated faculty members from 29 different academic departments. To accomplish its goals, the proposed Center will need to develop partnerships with faculty who are affiliated with other centers on campus, including those under the umbrellas of the Plant Sciences Institute and the Institute for Physical Research and Technology. The research objectives of the proposed Center are complementary to these centers and synergies can be realized through collaboration and recruitment of researchers and students.
  
- ◇ Center Uniqueness. The University of Iowa was a partner university with an NSF Engineering Research Center led by the University of Kansas. The focus of the Center of Environmentally Beneficial Catalysis, which is reaching the end of its support from NSF, is on pharmaceuticals and fine chemicals biotechnology. It does not focus on the production of industrial chemicals from biorenewable feedstocks, which is the unique emphasis of the proposed Center.
  
- ◇ Collaboration with other Partners. The National Science Foundation expects the Generation-3 ERC programs to have a multi-institutional configuration comprised of a lead university and partners in research, education, and innovation. The lead and partner institutions must be committed to a shared configuration to fulfill the research, education, and innovation goals of the proposed Center. As lead institution, ISU has identified its partner and affiliate institutions, which have been approved as subcontractors by NSF. They include the following institutions:
  - 📖 University of New Mexico (Minority Serving Institution)
  - 📖 Rice University
  - 📖 University of Wisconsin
  - 📖 University of Virginia
  - 📖 University of California, Irvine
  - 📖 Salk Institute
  - 📖 University of Michigan
  
- ◇ Perceived Benefits. The proposed Center has the potential to address global competitiveness, climate change, and to transform rural economies.
  - 📖 The substitution of indigenous agricultural and forestry resources for imported petroleum will improve national security by reducing dependence on resources from politically unstable regions of the world.
  - 📖 New and existing feedstocks can be produced in sustainable ways that enhance the environment and protect land and water resources.
  - 📖 The manufacture of biobased products will improve environmental quality by reducing pollutant emissions associated with fossil fuel usage, such as sulfur, heavy metals, and greenhouse gases.
  - 📖 The bioeconomy will diversify markets for crops, improving the profitability of farming and reducing the need for agriculture subsidies.

- 📖 The manufacture of biobased products will transform rural America by creating jobs and economic opportunities in rural communities where biomass crops are grown and processed.
- ◇ Staff. ISU has committed to hiring five new faculty members over the life of the proposed Center. These faculty will contribute to the research and educational programs of the proposed Center and will hold tenured or tenure-eligible lines in traditional academic departments. They will work collaboratively with the proposed Center and its affiliates to advance the Center's vision.
  - ◇ Facilities. ISU has agreed to provide substantial space for the proposed Center. Construction will begin in Fall 2008 on the new Biorenewables Research Laboratory building as a result of \$32 million in funding from the Iowa Legislature. The proposed Center has been guaranteed 1,000 square feet of office space in the new building. The proposed Center will also have access to a conference room with telecommunication capabilities. The proposed Center will also have activities in at least 9,000 square feet of the new building through central use reactor, fermentation, and metabolomics facilities and new faculty laboratories. This new space will be complementary to the extensive space available in the individual faculty laboratories. Until construction of the new building is complete, the proposed Center will be housed in the Lab of Mechanics building on the ISU campus.
  - ◇ Expected need. The proposed Center will be supported under a cooperative agreement between ISU and NSF with a potential duration of 10 years. The first award is for five years. If an annual or renewal review is not successful, NSF support is phased down for up to two years. NSF support for successful Centers is phased down in years nine and ten to prepare the Center for self-sufficiency. It is expected that at least the domestic lead and partner universities will provide core support to sustain the administrative, pre-college educational, and industrial collaboration functions during the Center's to self-sufficiency after NSF support ceases.
  - ◇ Costs and funding sources. The cost of the proposed Center is expected to be \$4,300,000 during Year 1 with an increase to \$5,250,000 by Year 5. Approximately 75% of the yearly cost of the proposed Center will be supported by the NSF grant; approximately 14% (\$600,000/year) will be provided by the University through department, college, and administrative unit reallocations; and approximately 11% will be provided by anticipated receipts from membership fees. Expenditures beyond Year 5 will depend to a large extent on the continued availability of NSF funds and the agency's approval of a renewal application, which will be submitted in the third year of the project.