

ISU's Bioeconomy Initiative

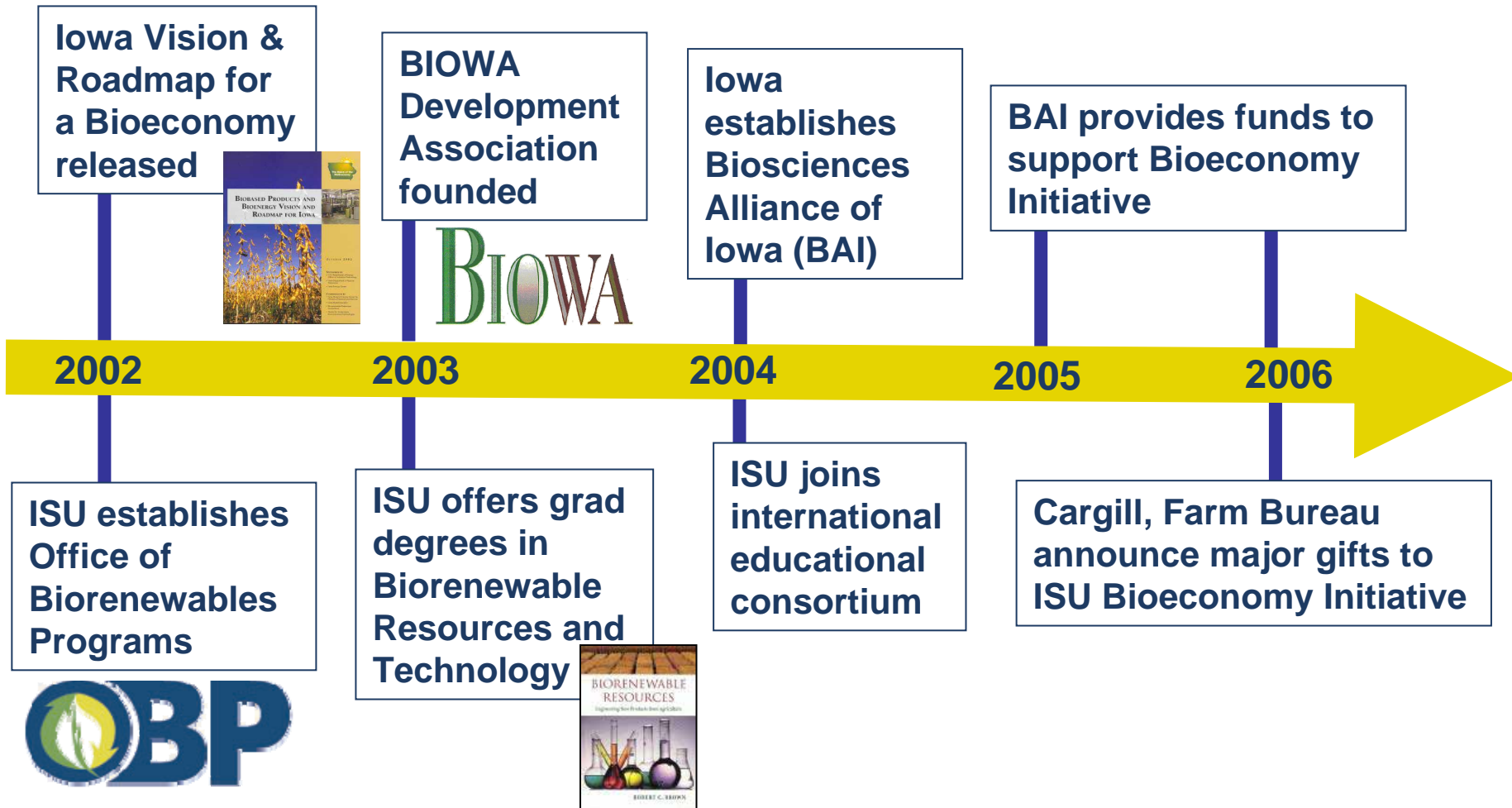
Robert C. Brown

Department of Mechanical Engineering

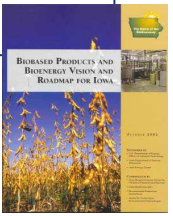
Office of Biorenewables Programs

Iowa State University

Iowa's Efforts to Build a Bioeconomy



Iowa Vision & Roadmap for a Bioeconomy released



BIOWA Development Association founded



Iowa establishes Biosciences Alliance of Iowa (BAI)

BAI provides funds to support Bioeconomy Initiative

2002

2003

2004

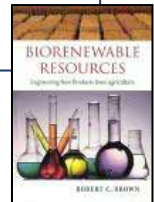
2005

2006

ISU establishes Office of Biorenewables Programs



ISU offers grad degrees in Biorenewable Resources and Technology



ISU joins international educational consortium

Cargill, Farm Bureau announce major gifts to ISU Bioeconomy Initiative

Research / Discovery

- Over 60 faculty and scientific staff involved in R&D activities
- Research activities currently organized around five technology platforms
- Incremental ISU funding helped leverage over \$38 million in extramural funding over the last four years

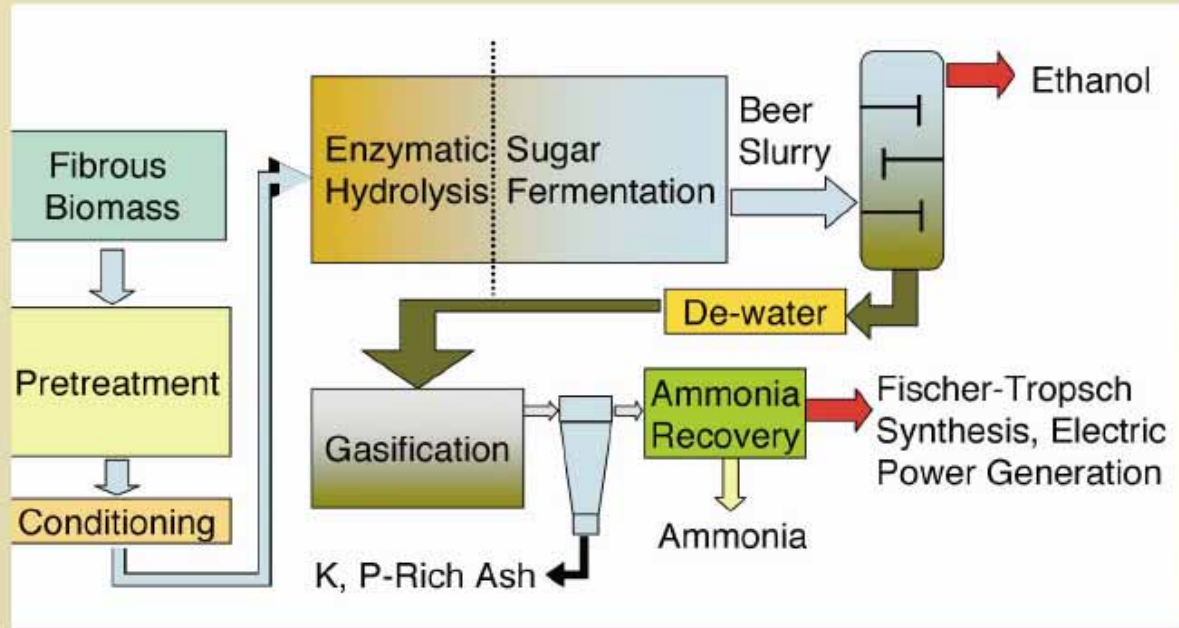
Research Platforms at ISU

- Oleochemicals
- Carbohydrates
- Corn-to-Alcohols
- Biocomposites
- Thermochemical
- Cross-cutting



Platform Teams: Integrated Approaches to Research

Nutrient Recycling Between Production and Processing Systems



Systems Integration
R. Anex



Agroecology
M. Liebman



Fermentation
A. Pometto



Biomass Pretreatment
R. Raman



Nutrient Recovery
R. C. Brown



Perennial Agriculture
K. J. Moore

ISU Advances in Biorenewables

PLANT SCIENCE

- Genetically engineered plants that produce polymers
- Maize breeding for improved cellulose conversion
- Elucidation of carbon flux in soybean metabolism
- Modification of lignocellulose synthesis to simplify fractionation of biomass

PRODUCTION

- New crops and cropping systems for improved biomass yield
- Integrated wet storage and biological pre-treatment of stover
- Feedstock supply systems for large-scale bioenergy production
- Green mulching systems to reduce soil loss under cultivation of biomass crops
- Agronomic systems that sequester carbon from the atmosphere
- Recycling of nutrients between biorefineries and fields

PROCESSING

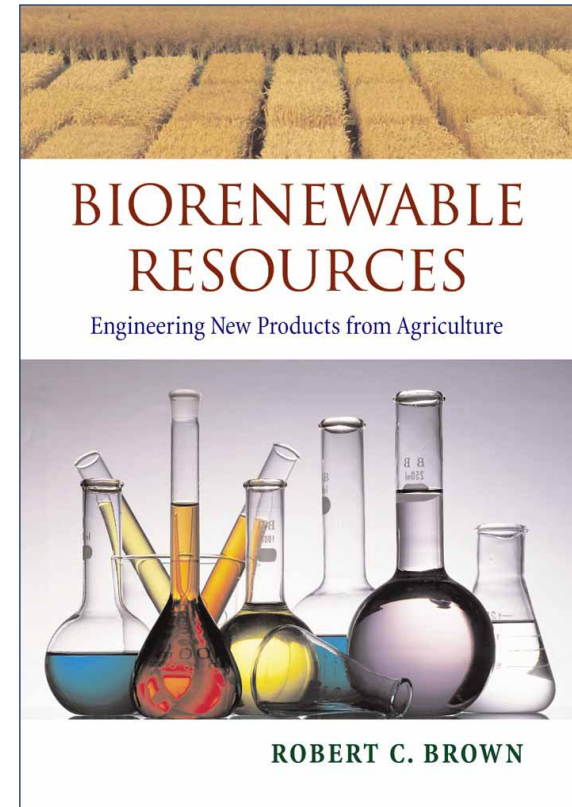
- Determination of substrate/cellulase structures
- Conversion of glycerol into 1,3 propanediol
- Catalysts that hydrolyze oligosaccharides to fermentable sugars
- Sonification to increase starch conversion rates
- Isoamylase conversion of starch to increase yield of fermentable sugars and ethanol
- Enzyme-assisted, water-based process to recover oil from soybeans
- Heterogeneous catalysts to convert soybeans to biodiesel
- Thermochemical alternatives to enzymatic hydrolysis

UTILIZATION

- Soybean oil with superior cold-tolerance and tribological characteristics for fuels
- Plastics from vegetable oils with shape-memory and noise-dampening properties
- Soy protein-based adhesives and plant-derived biocomposite materials
- Analysis of changing markets as a result of biofuels production

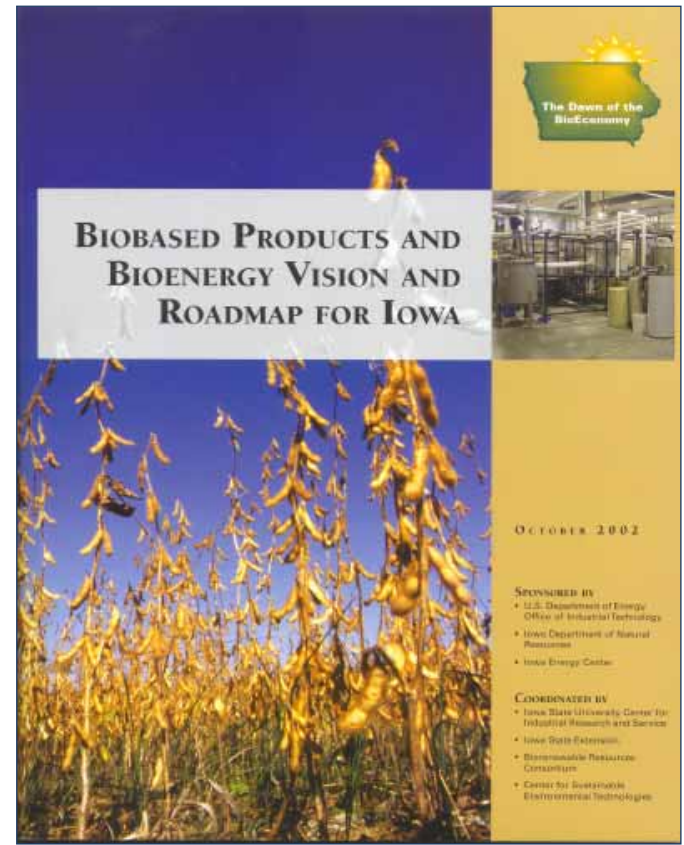
Learning: ISU Program

- Established the Biorenewable Resources and Technology graduate program
 - Ph.D. and M.S. degrees offered (plus Ph.D. minor)
 - 24 students currently enrolled
- Textbook published April 2003 by Blackwell Publishing
- Offering fundamentals course through Engineering Distance Education
- www.biorenew.iastate.edu (follow the Graduate Program link)



Engagement/Outreach

- Assisted in development of Iowa Vision and Roadmap
- Helped found the industry-led BIOWA Development Association
- Co-sponsor of an annual industry outlook conference
- Managing Federal Biobased Products Preferred Procurement Program



Program Development

DOE GTL Bioenergy Center

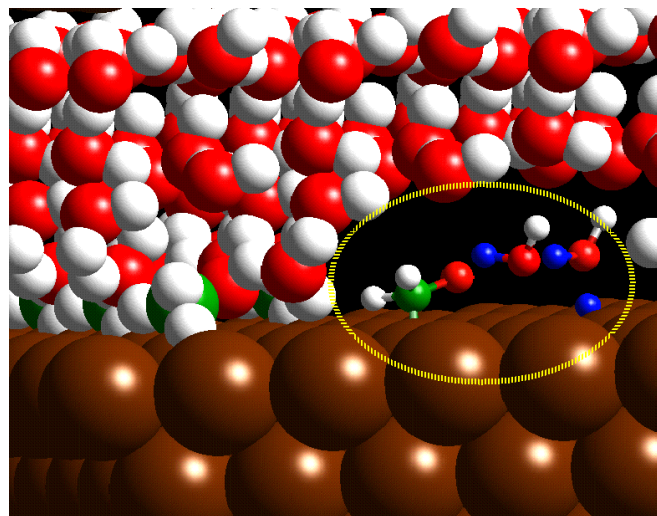
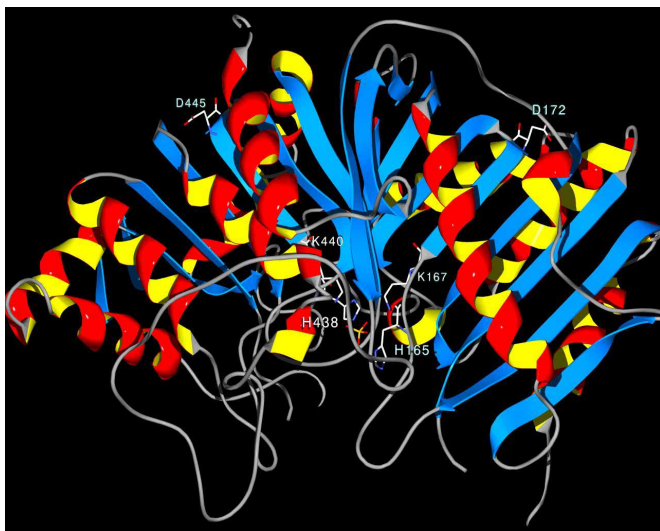
- Focus on basic research in plant science and microbial science
- Up to \$125 million over 10 years for each of two center
- Proposal due in February
- Teamed with Venter Institute, UC San Diego, and Battelle Institute



Center for Biorenewable Chemicals

NSF Engineering Research Center

- Focus is application of engineering science to develop combined biocatalyst/chemical catalyst systems
- Up to \$20 million from NSF to support center



Sloan Center for Biobased Products Industry

Goal: interdisciplinary research and education programs in support of biobased industries

- economic analysis
- marketing
- policy
- infrastructure
- workforce



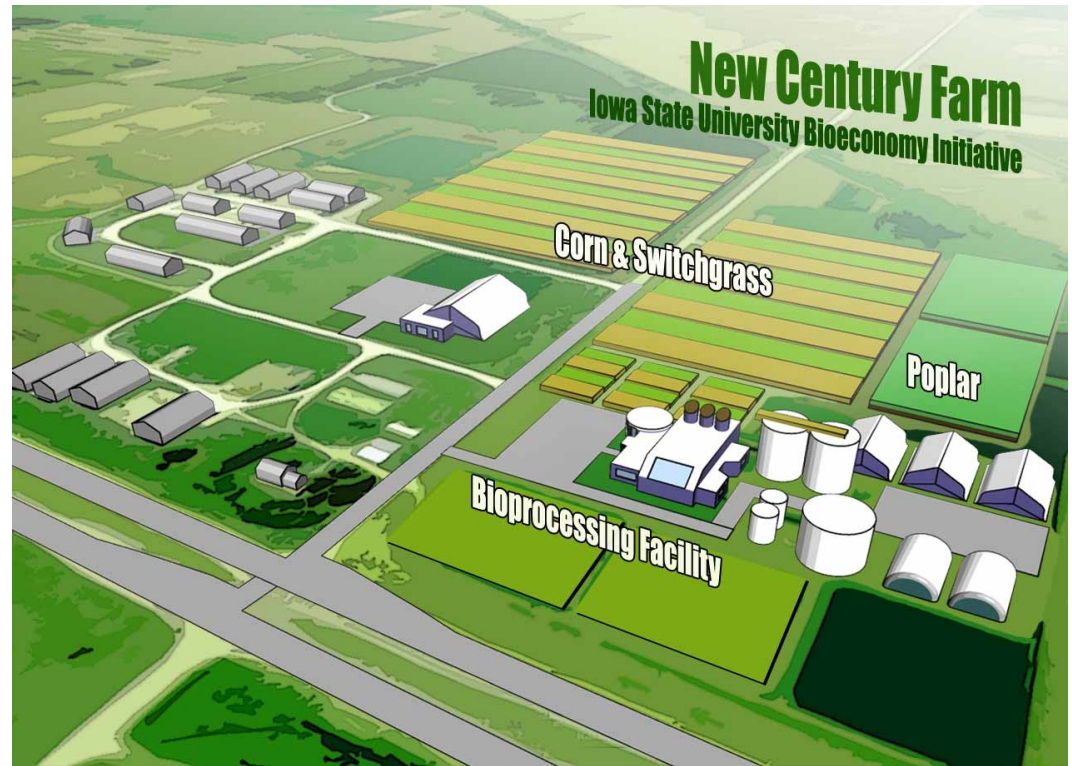
Transforming Agriculture to be Feedstock Ready...

...by establishing a New Century Farm

Research: biomass cropping, biofuel processing, the logistics of biomass supply, and recycling nutrients back to the land

Teaching: Laboratory and extension resource for training future scientists, producers, and extension experts

Extension: Demonstrate the economic, social and environmental viability of bioenergy production to producers, publics, and policy makers



“The New Century Farm (NCF) would be the first integrated, sustainable biofuel feedstock production farm in the USA.”

ABE/OBP Complex



- Houses Agricultural and Biosystems Engineering Department
- Headquarters for the campus-wide Bioeconomy Initiative
- Contiguous office and laboratory space for biorenewables research, education, and outreach
- 166,000 ft² building

Join the Bioeconomy Initiative

By becoming an affiliate of the
Office of Biorenewables
Programs



<http://www.biorenew.iastate.edu/who-we-are/join-obp.html>