Title: Center for Advanced Bioenergy and Bioproducts Innovation - CABBI

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https://cabbi.bio/
http://sustainability.illinois.edu/
https://www.igb.illinois.edu/

Project Goals:

The mission of CABBI is to meet a major challenge facing the world: how to provide sustainable sources of energy for societal needs as the population continues to grow and global change accelerates. CABBI will develop efficient ways to grow, transform, and market biofuels and other bioproducts. The vision of CABBI is to integrate recent advances in genomics, synthetic biology, and computational biology to increase the efficiency, sustainability and value of biomass crops. This holistic approach will help reduce our nation's dependence on fossil fuels thereby increasing sustainability and national security.

Abstract Text:

The Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) will develop efficient ways to grow, transform, and market biofuels, generating new products directly from biomass — thus reducing our nation's dependence on fossil feedstocks, increasing sustainability and decreasing dependence on overseas oil. CABBI will conduct innovative research in biofeedstock development, conversion, and sustainability that integrates recent advances in genomics, synthetic biology, and computational biology to increase the efficiency and value of biomass crops. The Center represents a transformative research model designed to accelerate bioproduct development while retaining the flexibility to assimilate new disruptive technologies.

CABBI is founded on the "plants-as-factories" paradigm (Figure 1), in which biofuels, bioproducts, high-value molecules, and foundation molecules for conversion are synthesized directly in plant stems. This plants-as-factories approach represents value added to efforts of developing efficient lignocellulose deconstruction methods, while retaining residual biomass for deconstruction by traditional or emerging methods. CABBI will focus on sorghum, energycane, and Miscanthus, which are high-yielding throughout the rain-fed eastern U.S., including on marginal soils.

Foundation molecules produced in plants will be efficiently converted to diverse, high-value molecules such as biodiesel, organic acids, jet fuels, lubricants, and alcohols using technologies developed in a versatile and automated biofoundry for rapidly engineering microbial strains. Using the design-build-test-learn framework, CABBI research will overcome the challenges associated with driving biological systems to produce non-naturally occurring compounds.

The Center will employ a data-driven and integrated modeling framework to develop predictive capability on which feedstock combinations, regions and land types, market conditions, and bioproducts have the capacity to support the ecologically and economically sustainable displacement of fossil fuels. Key areas of emphasis will be to obtain a mechanistic understanding of the plant, soil, microbe, and climate interactions that underlie the productivity and delivery of ecosystem services of different feedstocks, and on investigating the technological and economic pathways to a sustainable and resilient bioeconomy. This work will result in an overarching framework for viewing the research through an environmental and economic lens — and for designing a closed-loop and integrated program for CABBI.

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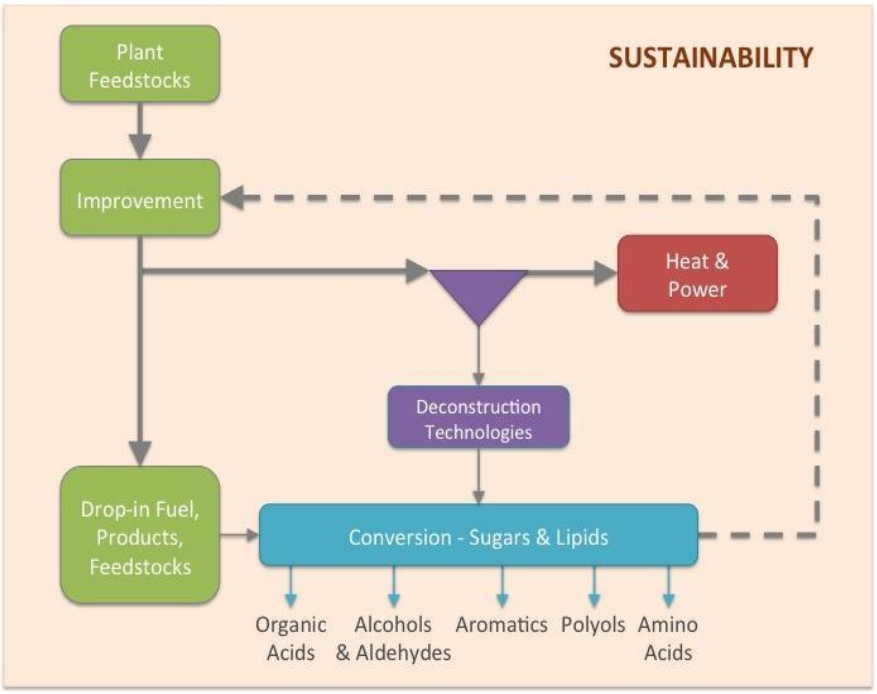

Figure 1. The Center for Advanced Bioenergy and Bioproducts Innovation (CABBI) science model highlights the *plants as factories* concept, in which direct production of drop-in fuels and bioproducts through plant engineering using coupled systems and computational biology approaches employing microorganisms to convert either plant-derived foundation chemicals or sugars and lipids derived from existing deconstruction technologies to produce valued added products. *The CABBI biofoundry* is depicted by solid lines representing the flow of biomass and dashed line representing the application of new knowledge and techniques discovered by the Conversion Theme, to novel engineering approaches to improve plant production and efficiency.