



## CABBI Progress in 2020-21

Between July 2020 and June 2021, the \$115M Center for Advanced Bioenergy and Bioproducts Innovation, led by the University of Illinois Urbana-Champaign:

- Added Jennifer Pett-Ridge at Lawrence Livermore National Lab and Daniel Voytas at University of Minnesota as new partners, making the total number of CABBI partner institutions 23.
- Saw several successful transitions on its leadership team. Andrew Leakey, Professor and Head of Plant Biology at Illinois, took over in September 2020 as Director for the retiring Evan H. DeLucia, now the Arends Professor Emeritus of Plant Biology who will remain a Sustainability researcher in the Center. Emily Heaton, who moved in early 2021 from Iowa State University to become a Professor of Crop Sciences at Illinois, replaced Leakey as Feedstock Production theme leader; she also remains a Sustainability researcher. Anthony Studer, an Assistant Professor of Crop Sciences, replaces Matthew Hudson as the deputy leader in that theme; Hudson, a Professor of Crop Sciences, becomes CABBI's Science Integration Head in place of Ximing Cai, a Professor of Civil & Environmental Engineering who will remain a Sustainability researcher.
- Hosted its fourth annual science retreat online due to the COVID-19 pandemic. It was attended by more than 220 people including members of the CABBI Strategic Advisory Board (representatives from the other three national Bioenergy Research Centers as well as academic, government, and industry experts in the bioenergy and bioproducts).
- Expanded the internal research data and project website — and more than 60 shareable research datasets on its public website.
- Held Centerwide trainings on creating an anti-racist lab environment and bystander intervention tactics.
- Implemented the Research Internship in Sustainable Bioenergy (RISE) program exposing undergraduates currently underrepresented in STEM to a 10-week research experience mentored by a CABBI postdoc or graduate student and supported the Pollen Power camp for middle school girls.
- Dealt with COVID-19 pandemic delays, and ensured the safety and productivity of CABBI scientists with thoughtful planning for a return to necessary field and lab work.
- Initiated a multi-institutional Feedstocks to Fuels project (*photo above*), bringing “oilcane” from fields for multiple processing efforts in the Integrated Bioprocessing Research Laboratory at Illinois. Partners on the project including Illinois, Florida, Mississippi State, Nebraska, Brookhaven National Laboratory, and the USDA.

Research progress in the Sustainability Theme included:

- Developing ecosystem models to provide insights about lands that could be used for growing bioenergy crops and the soil health and greenhouse gas implications of different

crops and management practices. These models are based on field-scale data collected in Illinois, Iowa, and other field sites, along with remote-sensing data. From these models, scientists can better understand how energy crops contribute to ecosystem carbon, nitrogen, and water cycling and generate ecosystem services, such as preventing nitrogen losses to air and water. Coupled with economic models and new breakthrough work that examines the effects of the Renewable Fuel Standard and the examination of using marginal lands for bioenergy feedstocks, these tools allow researchers to assess the impact of policies promoting biofuels on food and fuel consumers, agricultural producers, climate, and water quality.

Research progress in the Conversion Theme included:

- New CABBI tools to improve the efficiency of metabolic engineering in yeasts, paving the way for novel strains to enhance bioproduct production. Researchers created a comprehensive toolkit for genetic manipulation of *Issatchenkia orientalis*, a low-pH tolerant yeast used to produce organic acids. We developed a genome-scale metabolic model for *Yarrowia lipolytica* to simulate new ways to make products before initiating lab experiments. Beyond microbes, chemical and biological catalysis techniques were developed to upgrade CABBI bioproducts to valuable industrial end products. To streamline work at the iBioFAB biofoundry, researchers designed quick methods to find engineered strains with more free fatty acids than the wild type. And new web-based software has improved the efficiency of Golden Gate assembly, a fundamental tool for synthetic biology and genetic engineering.

Research progress in the Feedstock Production Theme included:

- An international research team that included researchers from several of the Center's partner institutions has sequenced the full genome of an ornamental variety of miscanthus, a wild perennial grass emerging as a prime candidate for sustainable bioenergy crops. Additionally, CABBI researchers have demonstrated the first precision breeding of the highly complex sugarcane feedstock with the CRISPR/Cas9 genome editing.

As of mid-June, the Center now employs about 340 people, including 63 faculty-level researchers nationwide, 145 postdocs and technicians, 87 graduate students, more than 42 undergraduates, and nine support staff.

CABBI scientists disclosed four new inventions during the past year (two of which have received provisional patents), bringing the total to 19 over 3.5 years. They also published 72 papers in scholarly journals — bringing the 3.5-year total to 172.