UCI and CODA Genomics collaborate to re-engineer yeast for biofuel production

September 4 2007

Scientists from UC Irvine and CODA Genomics are partnering on new research aimed at turning a common strain of yeast used in the production of beer, wine and bread into an efficient producer of ethanol.

Researchers at UCI's Institute for Genomics and Bioinformatics (IGB) are using CODA Genomics' patented gene-protein-production algorithms to tweak the genetic structure of a yeast strain called Saccharomyces. It has the potential to efficiently turn switchgrass, hemp, corn, wood and other natural materials into ethanol – a clean and environmentally safe fuel that could help meet the nation's increasing thirst for "green" energy.

The $1.67 million collaboration, which began Sept. 1, is funded by CODA Genomics, an Orange County synthetic biology company, and a UC Discovery Grant that provides matching funds for innovative industry-university research partnerships.

Saccharomyces produces ethanol as a byproduct when it ferments sugars found in plant materials. In its natural state, the yeast processes the glucose that grows in these materials, but does not contain the necessary enzymes to process other sugars, such as xylose and arabinose, that are components of biomass. The bio-engineered version of the yeast will produce enzymes that can help it digest these and other sugars with equal ease, maximizing its ethanol production.

Scientists believe the bio-engineered yeast could use 80-90 percent of

the sugars in biomass for ethanol production, up from about 20 percent with current technologies.

“Ethanol could be an answer to the U.S.’s dependence on fossil fuels,” said G. Wesley Hatfield, principal investigator on the grant, a UCI professor emeritus and co-founder of CODA Genomics. “While there currently are yeast strains that can make ethanol from biomass, the existing process is very expensive and inefficient. We’re trying to build a better yeast strain – one that can produce more ethanol from the same amount of biomass by breaking it down naturally.”

The multidisciplinary research project involves UCI researchers in the schools of information and computer sciences, engineering and medicine, as well as researchers at CODA Genomics, which spun off in 2005 from UCI research.

CODA’s patented technology uses computer algorithms to design synthetic genes that self-assemble easily and generate protein in large amounts. This allows genes that occur naturally in certain organisms to be re-engineered to meet the needs of different organisms. When applied to Saccharomyces, the technology modifies the yeast so it can manufacture enzymes to break down a wider variety of sugars.

Even when the yeast is producing the necessary enzymes, inefficiencies in its metabolic pathways can slow the process. Pierre Baldi, IGB director and one of the project’s co-principal investigators, is computationally “optimizing” key enzymes to increase their efficiency. With computer algorithms, he is engineering compatibility of these key enzymes with various co-factors – the small molecules that help the enzymes work.

“Given the current energy crisis and global warming concerns, we are particularly pleased with this award,” said Baldi, who is also Chancellor’s

Professor in UCI's Donald Bren School of Information and Computer Sciences.

Also involved in the multidisciplinary project are researchers from IGB's Computational Biology Research Laboratory (CBRL) in the California Institute for Telecommunications and Information Technology, and the labs of professors Suzanne Sandmeyer (biological chemistry) and Nancy Da Silva (biochemical engineering).

CBRL scientists perform the computation, gene design and gene assembly of the yeast proteins using CODA's technology. Sandmeyer, a yeast molecular biologist, inserts the proteins into the yeast genome, ensuring the enzymes' stability and their ability to function. Da Silva, a chemical engineer, ensures that fermentation conditions are optimal to maximize ethanol production.

"The CODA technology is already showing commercial success in therapeutic protein markets," said CODA Genomics CEO Robert Molinari. "Now we are going to apply the unique approach to a large national problem."

Source: University of California - Irvine

Citation: UCI and CODA Genomics collaborate to re-engineer yeast for biofuel production (2007, September 4) retrieved 23 April 2024 from https://phys.org/news/2007-09-uci-coda-genomics-collaborate-re-engineer.html