Synthetic biology research on biofuels has a mathematical angle

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Qing Lin and colleagues are using a common mathematical concept to develop 'nano-reactors' designed to generate much higher yields of biofuels.

(PhysOrg.com) -- A University at Buffalo chemist is applying a common mathematical concept to synthetic biology research aimed at finding ways to boost biofuels production.

Synthetic biology is a rapidly growing field in which microorganisms are engineered to produce novel chemicals, such as pharmaceuticals or fuels.

Qing Lin, PhD, assistant professor of chemistry at the University at

Buffalo, and Miguel Fuentes-Cabrera, a computational scientist at Oak Ridge National Laboratory, have been awarded a Keck Foundation grant to develop a robust yeast strain capable of generating significantly higher yields of biofuels than are now possible.

To do so, they will be using the idea of orthogonality, a common mathematical concept, in a new way.

"In mathematics, the idea of orthogonality is to intercept without disrupting the system as a whole," explains Lin. "In our research we want to use it to conduct selective reactions in microorganisms without disrupting the organism's native function."

Lin will be genetically constructing protein-based compartments within cells, segregated spaces inside of cells where selective, carbon-carbon bonds present in fuel molecules can be carried out via a series of metabolic cascade reactions. The result, they hope, will be a much more efficient method of converting carbohydrates to biofuel molecules, including ethanols and other long chain hydrocarbons, that will result in far higher yields.

"This is a brand new concept," says Lin. "We are trying to engineer a living 'factory,' a compartmentalized reaction vessel inside living cells. By putting all the necessary fuel-producing enzymes into this single, compartmentalized space in yeast, we hope that this engineered yeast strain can start to churn out biofuels without in any way interfering with the yeast's native metabolic pathway."

Lin was awarded the Keck grant following his invitation to a National Academies Keck Futures Initiative conference on synthetic biology in which top researchers are brought together from around the U.S. to explore ways to advance interdisciplinary research. His initial work in this area was supported by the UB Interdisciplinary Research

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Provided by University at Buffalo