Engineer Taps Heat-Loving Bacteria for Hydrogen

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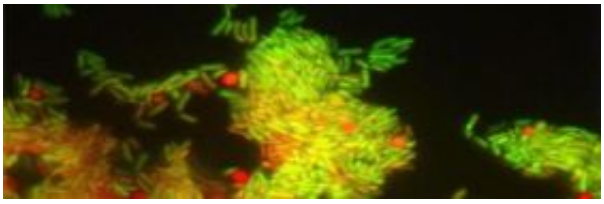

Thermotoga maritima (green/yellow rods) growing in co-culture with Methanococcus jannaschii (red spheres). T. maritima ferments sugars to hydrogen and M. jannaschii converts hydrogen to methane.

A North Carolina State University engineer has been awarded a $1.6 million grant from the U.S. Department of Energy to learn more about the microbiology, genetics and genomics behind how and why heat-loving bacteria called thermotogales produce large amounts of hydrogen with unusually high efficiencies. These microorganisms are found all over the globe in areas which are naturally hot – including volcanic sediments, hot springs and brines from deep oil wells.

The findings could help propel the use of hydrogen for many energy applications, including a new era of automobile travel. Hydrogen-powered cars, which exist in limited and expensive supply, are considered by many to be the holy grail of future vehicle travel.

Figuring out the mechanisms behind thermotogale hydrogen production

and exploiting these insights for applications in new hydrogen fuel cells could make hydrogen cars ubiquitous and provide one answer to the global energy crisis, says Dr. Robert Kelly, Alcoa Professor of Chemical and Biomolecular Engineering at NC State and the principal investigator for the grant.

Kelly will work with colleagues from the University of Connecticut and the University of Nebraska-Lincoln to learn more about how the thermatogales consume sugars and produce hydrogen in such efficient ways.

"These organisms produce copious amounts of hydrogen as a waste product of their metabolism, even though hydrogen ultimately inhibits their growth," Kelly says. "We'd like to learn more about the connection between sugar consumption and hydrogen yields and how to take advantage of their unique bioenergetics at high temperatures."

Kelly has worked with a number of different heat-loving organisms over the past 25 years, and has learned a lot about them, including how to effectively grow them in his lab. Besides hydrogen-producing organisms, he is also interested in organisms that efficiently break down cellulose – the primary structural component of plants – to produce sugars that can be fermented into ethanol. One of the current areas of interest is how different microorganisms from high temperature environments coexist and at the same time produce enzymes or byproducts, such as hydrogen, for biofuels applications.

"Figuring out exactly how these organisms tick – and how different types of organisms work together or are at odds with one another in nature – could yield important insights that get us to alternative energy sources in the near future," Kelly says.

Provided by North Carolina State University