Organizing enzymes to create electricity

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An assistant professor at the University of California, Riverside's Bourns College of Engineering has recently received a $360,000 grant to better organize enzymes on electrodes to create nanoscale devices that more efficiently convert the chemical energy of sugars and complex carbohydrates in to electricity.

Ian Wheeldon, an assistant professor of chemical and environmental engineering, is one of 40 scientists and engineers to receive an award from the Young Investigator Program run by Air Force Office of Scientific Research. He will receive the funding over three years.

In nature, enzymes are often in precisely organized multi-enzyme structures. Influenced by nature, spatial organization of multi-enzyme pathways has emerged as a tool in bionanotechnology, synthetic biology and, most recently, bioenergy systems.

Initial experiments have shown spatial organization of enzymatic pathways has resulted in increased power density in biofuel cells. However, there is a lack of understanding of the fundamental principles that govern reaction pathway kinetics.

"This limits engineering pathways to trial-and-error approaches," Wheeldon said. "That's an impossible task when increasingly complex pathways are considered, such as those need for advanced biofuel cells."

The first objective of Wheeldon's project is to define relationships between multi-enzyme scaffold design and pathway reaction rate. These

relationships will define a set of rules that can enhance kinetics by spatial organization.

The second objective is to apply the newly developed understanding of multi-enzyme pathways to create novel anodes for enzymatic biofuel cells.

Beyond biofuel cells, potential applications include new synthesis routes for pharmaceuticals, including antibiotics, and commodity chemicals, such as ethers and biofuels.

Provided by University of California - Riverside