

THE *Current*

May 17, 2013

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UCSB Assistant Professor Michelle O'Malley Receives 2013 DOE Early Career Award.

Michelle O'Malley, an assistant professor in UC Santa Barbara's Department of Chemical Engineering, has received a 2013 Early Career Award by the U.S. Department of Energy's (DOE) Office of Science. O'Malley is among 61 recipients of the annual research award, chosen from a pool of approximately 770 proposals.

"I am honored that I have been selected to receive a DOE Early Career Award," said O'Malley. "The DOE is a champion for genome-enabled biology; and its application toward sustainable energy. My lab works at the interface of biology and engineering to address these issues, and we do this by developing new genomic tools to control anaerobic gut fungi.

"This is an incredibly competitive award, especially for a new laboratory," she added. "My proposal's success is a testament to the dedication of the students and postdocs in my lab who helped me gather the preliminary data in support of the project."

The award, funded at \$750,000 over five years, will go toward O'Malley's ongoing research on biofuels. Her proposal, "Engineering Anaerobic Gut Fungi for Lignocellulose Breakdown," presents a new way of harnessing fuel from non-food plants and agricultural waste, while addressing concerns over the financial costs incurred in biofuel production. Her project was selected for funding by the Biological

and Environmental Research (BER) Division of the Office of Science.

"We are very proud of this recognition that has been bestowed on Michelle O'Malley," said Frank Doyle, professor of chemical engineering and associate dean for the College of Engineering. "It is a fitting tribute to her creative research endeavors to find novel means of biomass-derived fuels. Such problems in biotechnology and bioengineering represent an area of growing interest to our campus, and a number of our campus research centers, such as the Institute for Collaborative Biotechnologies, will benefit directly from Michelle's investigations on this important topic."

O'Malley's research, which she recently presented at the spring meeting of the American Chemical Society, involves the use of anaerobic gut fungi from horses, sheep, and other large herbivores to convert the cellulose in plants into sugars. Nature has evolved these fungi to break through lignin, a tough biopolymer that surrounds cellulose, and convert that cellulose into sugars. Through a process of fermentation, these sugars are later converted into bioalcohols such as ethanol. Typically, food crops like corn and sugarcane have been used for bioalcohol production because extraction of sugars from these materials is relatively easy. However, a drawback to fuel production from these energy crops is that they compete for space with crops grown for food. Meanwhile, using non-food crops, or the parts of food plants with denser lignin networks to extract sugar, is costly and energy-consuming.

An added benefit of these gut fungi is that they secrete unique enzymes that convert the cellulose into the sugars, and they also directly ferment them into biofuels. O'Malley's research will leverage collaborations with the DOE-Joint Genome Institute (JGI) to identify new enzymes from gut fungi, and to develop new tools to genetically modify their metabolic processes. While bacteria have been extensively studied for their roles in biofuel production, enzymes from fungi have not, because of their relatively low numbers, and the difficulty in isolating and growing them.

"The DOE Early Career Award recognizes researchers for innovation, for real contributions to energy solutions," said Rod Alferness, dean of the College of Engineering. "Professor O'Malley's research in cellulose conversion opens doors for more efficient biofuel technology."

Initial funding for this research came from the United States Department of Agriculture; The Institute for Collaborative Biotechnologies, through contract No. W911NF-09-D-0001, from the U.S. Army Research Office; and the University of California, Santa Barbara.

Established in 2009, the Energy Department's Early Career Award is a funding opportunity, under the Early Career Research Program, for researchers in universities and DOE national laboratories. It supports the development of individual research programs of outstanding scientists early in their careers and stimulates research careers in the disciplines supported by the DOE Office of Science, including advanced scientific computing research; biological and environmental research; basic energy sciences; fusion energy sciences; high energy physics; and nuclear physics.

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