

March 04, 2014 | By Mario C. Aguilera

## UC San Diego Takes Top Two Positions in National Rankings for Biofuel Research

**Department of Energy report rates Scripps Institution of Oceanography lab and UC San Diego consortium as country's best in algae technology research**

A new report issued by the U.S. Department of Energy's Bioenergy Technologies Office (BETO) ranked programs at UC San Diego as the two best in the country for algal biofuels research, including Scripps Institution of Oceanography as top in the nation.

An external group of experts from industry, academia, government, and the non-profit sector evaluated 219 projects across nine technology areas representing \$1.6 billion of BETO-supported research.



*Mark Hildebrand*

For the 28 Algae Technology Area projects reviewed by the panel, Mark Hildebrand and his team at Scripps Institution of Oceanography at UC San Diego were ranked the highest for criteria that included technical progress, project relevance, and critical success factors. The report specifically cited the lab's "outstanding research" in the genetic manipulation of algae to improve the yield of key growth components for biofuel production. Coming in second was the UC San Diego Consortium for Algal Biofuels Commercialization (CAB-Comm) led by Stephen Mayfield. Members of the consortium from UC San Diego include Susan Golden, James Golden, Michael Burkart, Steven Briggs, Jonathan Shurin, and Mayfield; Scripps Institution of Oceanography members include Hildebrand, Greg Mitchell, Brian Palenik, and Bianca Brahamsha; Industry collaborators Sapphire Energy and Life Technologies and other academic institutions also participated in the consortium.

"(Hildebrand's) project is a tantalizing example of the need for and potential of genetic engineering to strongly contribute to productivity increases," the BETO report noted. "... Algal feedstocks can provide high-yield renewable oils that are well suited to displacing petroleum-based fuels and products."

CAB-Comm was cited for demonstrating how the yield potential of algae can be preserved by controlling pests through development of resistant strains, use of chemical pesticides, and cultivation of consortia of strains.

BETO strategically supports bioenergy research that will reduce dependence on foreign oil, promote sustainable energy resources, establish a domestic bioenergy industry, and reduce carbon emissions from energy production and consumption.



Mayfield

“Scripps has a unique perspective in being able to apply long-standing interests in algae productivity in the oceans to the technological application of algal productivity for biofuels,” said Hildebrand. “These high rankings indicate that Scripps and UC San Diego are among the best institutions for algal biofuels research in the world. This relates not only to the quality of the science, but to the training of students, as evidenced by recent pioneering publications led by Ph.D. student first authors. We are training scientists and policy makers who will shape the future development of renewable fuels.”

“This review validates what many in the world have known for a long time; that UC San Diego and Scripps are at the epicenter of algae biotechnology, and at the forefront of research and innovation for developing renewable fuels and bio-products from algae” said Mayfield. “The BETO review also noted that CAB-Comm ‘did an exceptional job of technology transfer to make the new genetic tools available to all researchers in the field,’ something that we at CAB-Comm view as essential in advancing algal research not only at UC San Diego, but for the entire world.”

As described in the BETO report and based on a recent paper in the *Proceedings of the National Academy of Sciences* ([more details](#)), recent Scripps Ph.D. recipient Emily Trentacoste led the development of a genetic technique to target a specific enzyme inside a group of microscopic algae known as diatoms. Trentacoste, working out of Hildebrand’s and Gerwick’s laboratories, developed a technique to metabolically increase lipids, the fat molecules that store energy and can be used for fuel, without compromising the growth of the diatom. (Trentacoste was recently selected to receive a Knauss Marine Policy Fellowship from the California Sea Grant program, during which she will work at the Aquaculture Program Office, part of NOAA’s National Marine Fisheries Service).

Separately, Scripps graduate student Cameron Coates led a new report on the biofuel properties of blue-green algae, tiny photosynthetic sea organisms also known as cyanobacteria. Working with Gerwick, a professor in the Scripps Center for Marine Biotechnology and Biomedicine and UC San Diego’s Skaggs School of Pharmacy and Pharmaceutical Sciences, Cameron and his colleagues

described for the first time the process and pathways in which cyanobacteria produce fuel compounds known as hydrocarbons. Cyanobacteria are one of only a handful of organisms that are known to directly produce hydrocarbons.

“Cameron’s work really sets the bar on describing what’s out there for cyanobacteria, one of the more notable sources of hydrocarbons in the natural environment,” said Gerwick. “Ultimately, this work will direct efforts to clone biosynthetic capacities from these marine cyanobacteria that would be expressed in other organisms, such as microalgal strains, to make a readily usable liquid fuel.”

Coauthors of the paper, which was published in *PLoS ONE*, include Sheila Podell, Anton Korobeynikov, Alla Lapidus, Pavel Pevzner, David Sherman, Eric Allen, and Lena Gerwick.

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