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Bacteria Use Photosynthesis to Make Sugar for Biofuels

Proterro has received $3.5 million in funding to scale up its low-cost approach.

By Kevin Bullis on December 17, 2012

Biofuels production is limited by the cost of sugar – which is fermented to make ethanol – and by how much sugar can be produced on available land. Proterro, a startup that aims to produce ultra-cheap sugar at high yields using photosynthetic microörganisms, says it has just raised $3.5 million in a financing round led by Braemar Energy Ventures to continue developing its technology. It had previously raised $5 million.

Proterro hopes to reduce costs and improve yields using photosynthetic cyanobacteria that have been engineered to continuously secrete sucrose. It hopes to produce sugar for five cents a pound, less than a third of the price of sugar now. The company says it has shown in the lab that, if its process is scaled up, the current performance of its cyanobacteria – which are grown inside closed, transparent containers – would be enough to produce 10 times more sugar per acre than sugarcane. It expects it can further engineer the bacteria to increase this yield, to as high as 30 times more sugar per acre than sugarcane.

A number of other companies are developing photosynthetic organisms for producing biofuels, but these typically make use of algae's ability to produce oil, not sugar. One of the challenges with those approaches is that harvesting and processing that oil can be expensive. What's more, while yields per acre can be impressive, the containers, pumps, and other equipment needed to grow the microörganisms can be expensive, making the overall process uneconomical.

Proterro is trying to make its process economical in part by reducing the amount of water needed. To do this, it has developed a design for photobioreactors – the transparent containers used to grow the bacteria and harvest their sugars – that grow cyanobacteria on a fabric that is kept wet with a trickle of just enough water and nutrients to sustain them.

One challenge with Proterro's approach is that the organisms, by excreting sugar, create an ideal

environment for other, competing microörganisms to grow (see “Engineered Organisms for Making Cheap Sugar”). But Proterro says that its microörganisms have been able to produce high levels of sugar even when competing microörganisms have been purposefully introduced into the photobioreactor in a test.

Kevin Bullis Senior Editor, Energy

My reporting as *MIT Technology Review*’s senior editor for energy has taken me, among other places, to the oil-rich deserts of the Middle East and to China, where mountains are being carved away to build the looming cities.

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