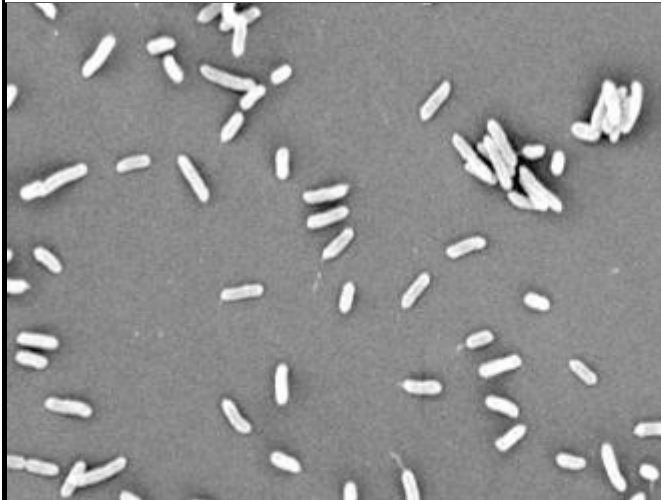




Thinking small is BioCee's big idea



Jeff Gralnik, Star Tribune

BioCee "provide good homes for good microorganisms"

U spinoff BioCee aims for a big energy impact by growing microscopic organisms.

By **THOMAS LEE**, Star Tribune

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BioCee Inc. calls itself an industrial biotech company. But co-founder and chief technology officer Marc von Keitz thinks of it as a material science company.

In truth, BioCee is a real estate company, though with very different tenants.

"We provide good homes for good microorganisms," Von Keitz said.

The Minneapolis-based start-up, spun off from the University of Minnesota, is developing thin-layer coatings that provide microorganisms like bacteria a safe place to interact and exchange materials. Such a biological dream house can help researchers produce cleaner gasoline.

BioCee was one of nearly 40 start-ups across the country to receive the first wave of funds from the Advanced Research Projects Agency-Energy (ARPA-E), a new program run by the U.S. Department of Energy to finance development of next-generation clean energy technology. The program is modeled after the Defense Advanced Research Projects Agency (DARPA), the U.S. military's top-secret research arm that gave birth to technologies like stealth bombers and fighters, body armor and global positioning systems. Perhaps the DARPA program's biggest technology contribution was the Internet, which began as a computer network connecting government and academic computers in the 1960s and 1970s. By the mid-1990s, that effort had spawned

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a digital communications revolution that continues today.

ARPA-E, which controls \$400 million in federal stimulus money, aims to kick-start a similar revolution in the energy sector. The agency awarded BioCee, the U and Pacific Northwest Laboratories \$2.2 million to develop a reactor that uses microorganisms to convert sunlight and carbon dioxide into hydrocarbons, the main ingredient in gasoline. In announcing the grants, the Energy Department singled out the team as an example of the kind of breakthrough technology it wants to fund.

Different attitude

"What's more important than the absolute [financial] amount is that it really represents a different attitude" from policymakers, Von Keitz said. "What we really see is much stronger involvement, trying to drive the development of certain technologies and giving the research teams the necessary support. ARPA-E is a driven organization and they expect results."

For years, BioCee, which has an exclusive license with the U, has been trying find a proper use for the technology.

Doug Cameron, managing director and chief science adviser to Piper Jaffray, said BioCee's technology could facilitate large-scale biological transfers of liquids, gases and even light. For instance, the company's thin films boast large surface areas that can coax the right number of microorganisms into producing fast and efficient reactions. That could make biofuel production more economical, he said.

"In some ways, it's a broad-based technology looking for the right application," said Cameron, who's familiar with the company from his days as chief science officer for Khosla Ventures, a top clean energy venture capital firm based in Silicon Valley.

Von Keitz thinks the company has finally found that application. Some bacteria can convert sunlight into hydrocarbons but need a stable source of carbon. With the ARPA-E grant, BioCee and its partners are trying to create a reactor system that uses a second microorganism to capture sunlight and carbon dioxide and convert that to sugars as food for the bacteria. The system can also capture and store whatever hydrocarbons the bacteria produce.

"What we are trying to do is to make sure we

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are combining [the microorganisms] in a real good spacial arrangement so they grow and reproduce very well," Von Keitz said. "With the coatings, we can really locate them in close proximity that makes it easier to exchange materials. You can also lock in the right ratio of organisms. Whenever you have a light-dependent organism, you have to get light to the organism. The coating can deliver sunlight to the organism."

BioCee says its ultimate goal is to dramatically increase domestic production of clean fuels and wean the country from its reliance on foreign oil. The company also hopes to use its technology to significantly lower the cost of traditional and alternative energy sources in a sustainable way.

Similar but different

The U is not the only local school to explore this area. Augsburg College in Minneapolis helped develop a way to produce cleaner biofuels from feedstock oils, a process now employed by Ever Cat Fuels at its new production plant in Anoka County. But while the university and BioCee employ living organisms to power the necessary reactions, Ever Cat and Augsburg use a metal oxide as a catalyst.

Both methods have their pros and cons. While microorganisms can operate under lower temperatures and pressure than chemical catalysts, biological systems are harder to control than chemicals.

"To my knowledge, [BioCee's work] is a breakthrough concept," said Arlin Gyberg, an Augsburg chemistry professor and adviser to Ever Cat. If the concentration of microorganisms on the film "is stable and productive, this technology has great promise. Cost and reliability at the commercial level are an additional challenge as they scale up the technology. But this project is a poster child for ARPA-E grants program to fund high-risk, high-reward energy projects."

The ARPA-E grant has opened doors for BioCee. The company recently won a \$150,000 Small Business Innovation Research grant from the National Science Foundation to research how bacteria can remove sulfur from petroleum. By "cleaning" the oil, cars can produce fewer emissions. Honeywell Corp. also recently approached the U about a potential partnership.

"I think the ARPA-E grant was very significant," said Jay Schrankler, head of the U's Office of Technology Commercialization.

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"It's a nice piece of non-dilutive cash to do development work. This is also going to lead to bigger partnerships. And bigger partnerships draw a lot of attention."

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