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UMass researchers say "wired" microbes could power electronics

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By ADAM GORLICK
Associated Press Writer
July 03, 2005 12:42PM

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They've been caught turning waste material into gold and churning mud into electricity.

Now the geobacter - a microscopic organism that's become the pet project of some researchers at the University of Massachusetts - is again wiggling from under the microscope into the spotlight.

Derek Lovley, a UMass microbiologist, says he's spotted hair-like wires sprouting from the geobacter that can conduct electricity. If that sounds like a discovery best kept in a laboratory, you're not thinking the way Lovley is.

He says the microbes could possibly be used to wire tiny electronic devices.

"It's always a goal in technology to get smaller and smaller," Lovley said. "But we're at a point where wires are just too big. The geobacter could help shrink things down."

And because geobacters can be grown in a lab, they'd be cheaper and easier to produce than minuscule wires made of metals, he said.

Lovley's research was published in a recent issue of the science journal Nature, and marks his latest findings about the microbes.

In previous experiments, Lovley has shown that geobacters could draw traces of pollutants, such as uranium, out of groundwater. The microbes essentially serve as a filter by "eating" the diluted toxins, then excreting the metal in a solid form that can easily be removed.

One test fed the microbes a meal of dissolved gold and muck that was easily secreted as solid gold droppings.

The process has proven geobacters successful at cleaning up uranium in groundwater at several U.S. Department of Energy sites. They've also been used to help remove contaminants from landfill pollution and petroleum spills.

And when they're chowing down on their muddy food supply, the geobacters also release electrons. The more radioactive materials or sewage they eat, the more electricity they produce, it seems. Lovley has been able to draw enough energy from the microbes to power a battery, but he never knew exactly how the geobacters were transmitting their electrons.

Then he saw the wires.

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Using an atomic force microscope, Lovley and his research team were able to detect the filaments, called pili, which are more than 10,000 times finer than a human hair and up to 20 times longer than the geobacter itself. (It would take about 10,000 geobacter stacked side-by-side to measure an inch.)

"We always had this quandary about how the geobacters got the electrons outside the cell," Lovley said. "You just accept that it happened until you get around to figuring it out. This finding is a quantum jump for our understanding."

Lovley was able to manipulate the geobacter's genetic makeup to show that if it doesn't produce pili, it can't transfer electrons. And that, Lovley says, proves that the wires are indeed conducting electricity.

"No one knew about this mechanism," said Eugene Madsen, a Cornell University microbiologist familiar with Lovley's work. "There's been a fundamental mystery about the flow of electrons from the geobacter."

Understanding how the geobacters transfer their electricity can help better use them in waste cleanup projects and lead scientists to figure out how to best harness their energy.

And while Lovley sees the day when the wires are used to help shrink the size of electronic devices, Madsen said it's too early to expect to see geobacter-powered electronic equipment sometime soon.

"By definition, scientists are skeptical," Madsen said. "To really prove the geobacter uses the pili the way that Dr. Lovley suggests, there ought to be further study. It looks promising, but people are going to say 'Wait a second. I need to see more.'"

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