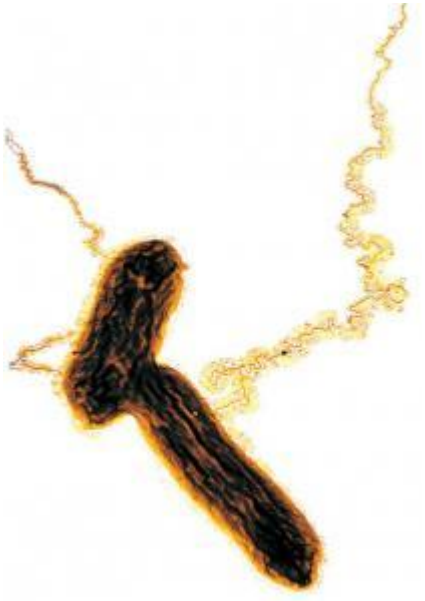
The latest dirt on technology: River germs could run computers

The Boston Globe



Geobacter bacteria with the long, hair-like pili that are capable of conducting electricity. (gemma reguera and dale callaham)

By J.M. Berger, Globe Correspondent | February 12, 2007

The next big development in computer technology may be growing in the muck of a nearby riverbed.

A research team led by Derek Lovley , a microbiologist with the University of Massachusetts at Amherst, recently patented a method to grow futuristic components using dirt-eating bacteria.

Lovley found the Geobacter germ 20 years ago at the bottom of the Potomac River, where it had naturally evolved novel methods for extracting oxygen from sediment. The microbe has become a franchise for Lovley, who has discovered that it can do everything from decontaminating radioactive ground water to powering batteries, and, now, to building incredibly tiny wires.

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With some tinkering, Geobacter can be coaxed to grow pili -- hairlike protein strands that are usually used for locomotion, but in Geobacter's case, conduct electricity. The pili are small enough to be usable in computers with subatomic components -- that will someday outrace our fastest processors.

The wires aren't ready for application yet, Lovley said. "We're just trying to understand why these are electrically conductive, because there is no precedent in biology for this."

Current techniques for manufacturing nanowires are both slow and expensive, said Peter Conley , director of equity research for MDB Capital Group in Santa Monica, Calif., whose company closely tracks the developing nanotech industry. If Geobacter lives up to its promise as a cost-effective method for manufacturing commercial-grade wires in bulk, the surge in availability would dramatically accelerate the development of new ultra-compact technologies, he said.

For instance, researchers are already trying to develop paper-thin computer screens that contain an entire computer embedded in the screen itself. A method for creating cheap, plentiful nanowires could make such technology affordable within a few short years.

"It's the Holy Grail," Conley said.

The commercialization of nanowires is already well underway for building such things as biosensors -- early warning systems that can sniff out minuscule amounts of toxins, such as anthrax, or the beginnings of cancerous tumors.

Computer giant Hewlett-Packard recently said it deployed nanowires to connect semiconductor chips, resulting in a prototype computer that is "orders of magnitude" smaller than current models, Conley said. The next stage will involve using nanowires inside the chips themselves.

Geobacter may have still more to contribute to the march of organic computing. Because it directly produces electricity as part of its biological process, the microbe could eventually be used as something more sophisticated than a microscopic wire factory. For instance, if the microbe could be bred to act as a switch, Geobacter could eventually be used to build living computers. (Lovley said such a step might be possible, but his team isn't looking in that direction just yet.)

Could breeding technological components from bacteria go disastrously awry?

"I get asked that question a lot," Lovley said with a laugh.

"As long as we're working with a naturally occurring organism, you know, it's been out in the environment for a long time. If it was going to take over the world, it's had billions of years to do it." ■

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