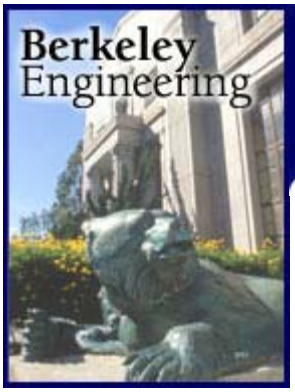

Lab Notes

Research from the College of Engineering, University of California

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Search Berkeley Engineering

Outline List

In This Issue

Body Battery

Eye in the Sky

Smart Dust Sniffers

Considering Corrosion

Berkeley Engineering History: Tung-Yen Lin

Archives

2002

July

May/June

April

Feb/March

January

2001

Nov/Dec

Sept/Oct

July/Aug

Body Battery

by David Pescovitz

Multime

Movie: The diaphrag drug delivery system e out precise amounts of the reservoir. *(AVI mov Movie courtesy Liwei Li*

While fuel cells make front page news with the promise of non-polluting automobiles and energy efficient homes, Berkeley Mechanical Engineering professor Liwei Lin is thinking smaller. Much smaller. Lin's microbial fuel cell is just .07 centimeter square in area. Even more amazing though is that this fuel cell is built to operate inside your body.

The idea is that the microbial fuel cell would power implantable medical devices such as spinal cord stimulation devices or internal drug delivery systems. For example, an implantable drug delivery system integrated with a microbial fuel cell could be employed in Spinal Drug Infusion Therapy for pain relief applications.

"Of course, people also dream about miniature surgery systems that travel through your body," Lin says.

Liwei Lin holds the microbial fuel cell and water-powered drug delivery system. (Click for larger image.)

David Pescovitz photo

Fuel cells vary in design and materials, but the ba chemistry behind them remains the same. Hydrog enter at the anode, a negatively charged electrod catalyst strips them of their electrons. These elec the current that powers the device that the fuel c connected to. In Lin's device, the fuel is nothing r glucose, a sugar abundant in the human body. It' that gives Lin's microbial fuel cell its name: Sacch cerevisiae, a microorganism commonly known as Yeast.

"The fuel cell's only waste product is carbon dioxi water," Lin says. "It's very similar in some ways t human body works."

The prototype microbial fuel cell contains a tiny cl where the microbe resides. Glucose flows into the causing hydrogen protons and electrons to be ger during the fermentation process. In a June paper, graduate students Mu Chiao, Kien B. Lam, and Yu reported that their tiny powerhouse cranked out 3 microvolts for two hours until the solution dried out in the open air. That kind plenty for microelectromechanical systems (MEMS), tiny machines fabricated the way integrated circuits are manufactured.

MEMS, microscopic devices with biological applications, are one of Lin's specialties. In another recent effort with one of Berkeley

MEMS pioneers Al Pisano and graduate student Yu-Chuan Su, Lin fabricated a drug delivery system not much larger than a single letter on a penny. The device requires no electrical energy, instead drawing its pumping power from water flowing into an osmotic chamber filled with salt. Due to the incompressibility of the water, the diaphragm expands into a drug reservoir, pushing precise amounts of the drug through an intricate path of microfluidic channels and valves.

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Photo courtes

Your Turn

Will these tiny delivery systems write a new kind of prescription?

We want to hear from you...

Lin hopes that through collaboration with industry partner Alza Corporation, acquired last year by Johnson & Johnson, research into tiny implantable drug delivery systems could improve the quality of life for individuals who require a steady flow drugs, steroids, or hormones.

"The surgeon could implant the delivery system patient wouldn't have to bother with it for a yea needed to be refilled," he says.

Related Sites

Liwei Lin's Home Page

Lab Notes is published online by the Public Affairs Office of the UC Berkeley College of Engineering. The mission is to illuminate groundbreaking research underway today at the College of Engineering that wil change our lives tomorrow.

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