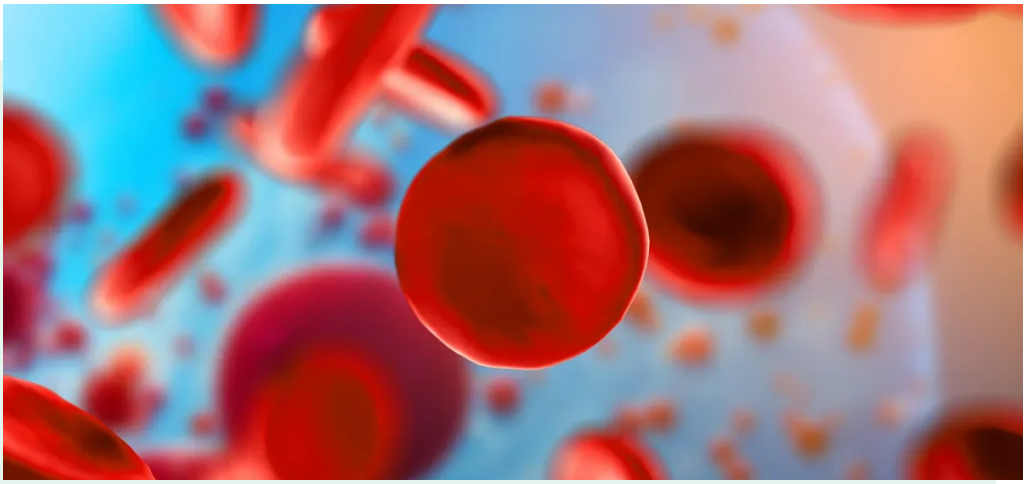
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This implant burns up excess blood sugar with electricity

這種植入物用電流燃燒掉血液中多余的糖分

難度 進階 · IELTS 6-6.5 · TOEFL 4-4.5 · KAOYAN 50-65 · CET-6 425-500



圖片: Scientific American

A new wireless implant could burn up excess sugar in the blood, letting people with type 2 diabetes live healthier lives without having to completely rely on medication.

Traditional drugs used for diabetes such as insulin, metformin and glucagonlike peptide 1 (GLP-1) agonists all treat the condition by effectively forcing the body to keep glucose levels under control-but these treatments are prone to side effects and many involve taking a fixed quantity of medication regularly despite blood sugar changing with mood, sleep and meals. Automated insulin pumps can adjust dosing to a patient's blood sugar in real time, but they still deliver drugs that can linger in the body.

"We wanted to have a completely new principle," says Martin Fussenegger, the study's senior author and a bioengineer at the Swiss Federal Institute of Technology Zurich. For a new study in mice, published in Science, he and his team abandoned drugs altogether by developing a below-the-skin implant that chemically eliminates glucose from the blood on its own rather than triggering the body's own mechanisms in order to do so.

重點詞彙

16 詞條

catalyst*
n 催化劑

obesity
n 肥胖

compatibility*
n 相容性

insulin*
n 胰島素

oxidizes*
v 氧化

secrete*
v 分泌

diabetes
n 糖尿病

wirelessly
adv 無線地

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This implant burns up excess blood sugar with electricity / 續

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The device, called ECHO, which stands for electrocatalytic closed-loop health optimization, looks like a little flat rectangular chip, roughly the size of a USB stick. It contains a graphite wafer that carries an electric current, embedded with branching structures of gold nanoflakes that are studded with even smaller spheres of platinum. These structures work as a catalyst-a substance that speeds up a chemical reaction without being consumed in the process. The implant is operated and powered wirelessly, and when voltage is applied, the surface oxidizes glucose into an easily processed metabolite called gluconate. The mouse subjects' bodies burned roughly a fifth of the resulting gluconate for energy, and the rest was flushed out through the kidneys.

Blood carries important molecules similar to glucose such as fructose, galactose and lactose, but the implant successfully targeted glucose specifically. Fussenegger admits the researchers don't yet know why it is so successful, although that likely relates to the particular combination of gold and platinum. "We have no functional or structural explanation for that. We did not design for it," Fussenegger says. "The specificity is, I would say, a lucky strike."

In diabetic mice with obesity, the implant brought blood glucose levels under control within an hour when turned on, and repeated treatment held it there for six weeks. The mice also showed reduced triglycerides-a type of fat associated with disease risk-and lower body weight.

The team also tested the implant while connected via a smartphone to a commercial continuous glucose monitor, which relayed blood sugar readings that allowed the smartphone to turn the implant on and off as needed. For two weeks, this closed-loop system ran with no human involvement.

Many glucose-focused implants under development rely on capsules containing engineered cells that secrete therapeutic proteins-these tend not to last because they get sealed off by scar tissue in the body. But for ECHO, the mice's tissue showed no signs of inflammation around the implant, no scarring and no leached metal. Implants removed after six weeks still worked, and some remained active even after three months under the skin, according to the study.

"Six weeks of operational stability is already well beyond the current technology," says Luisa Torsi, a chemist at the University of Bari

重點詞彙

16 詞條

specificity
n 特異性

inflammation
n 炎症

metabolite
n 代謝物

catalytic
adj 催化的

incision
n 切口

orbit
n./v. 軌道；繞軌道運行

voltage
n. 電壓

ice sheet
n. 冰蓋

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Aldo Moro in Italy, who was not involved in the study. “The crucial next steps are to establish long-term tissue compatibility, sustained catalytic activity and safe, effective glucose removal at the scale required for human treatment.”

A mouse has roughly two milliliters of blood, whereas humans typically hold five liters-ECHO would need to scale up to function at that level. Fussenegger is confident about that task, however. As part of the study, the team circulated sugary fluid through a five-liter flask-a stand-in for human blood volume-and the implant cleared it just as efficiently.

Because the device is small and sits just under the skin, Fussenegger expects the implantation procedure in humans would require a minor incision rather than complex surgery. “If it’s possible to do this maybe every three months or up to a year, and then ‘I can forget my diabetes,’ I think people would be happy,” he says.

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重點詞彙

16 詞條

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