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Battery Charged by Tears for Smart Contact Lenses

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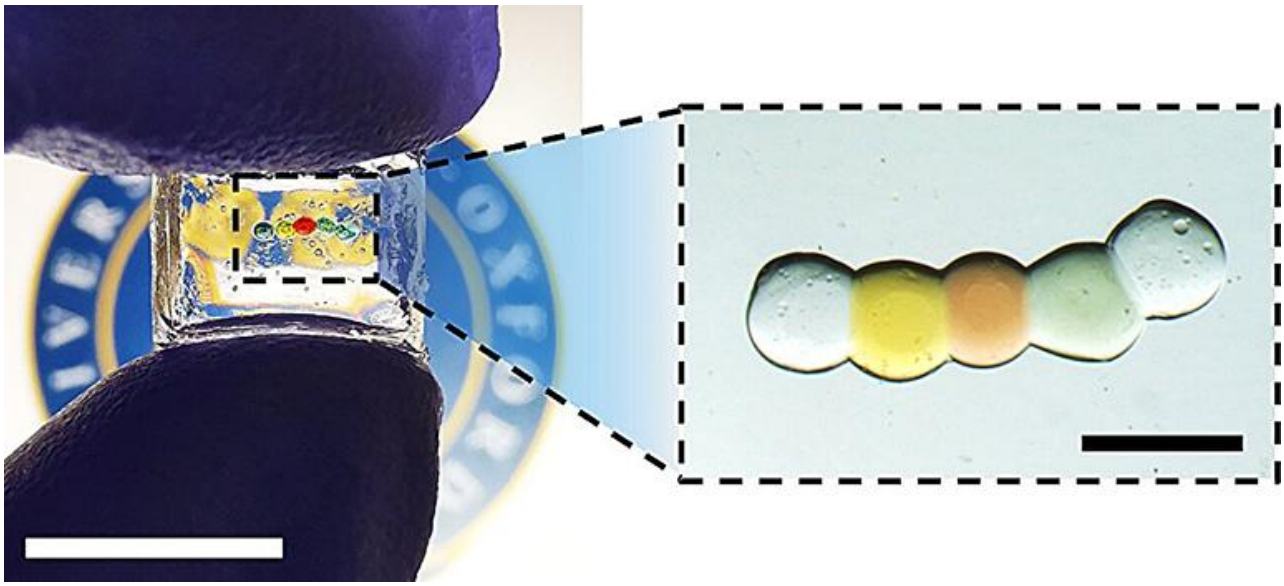
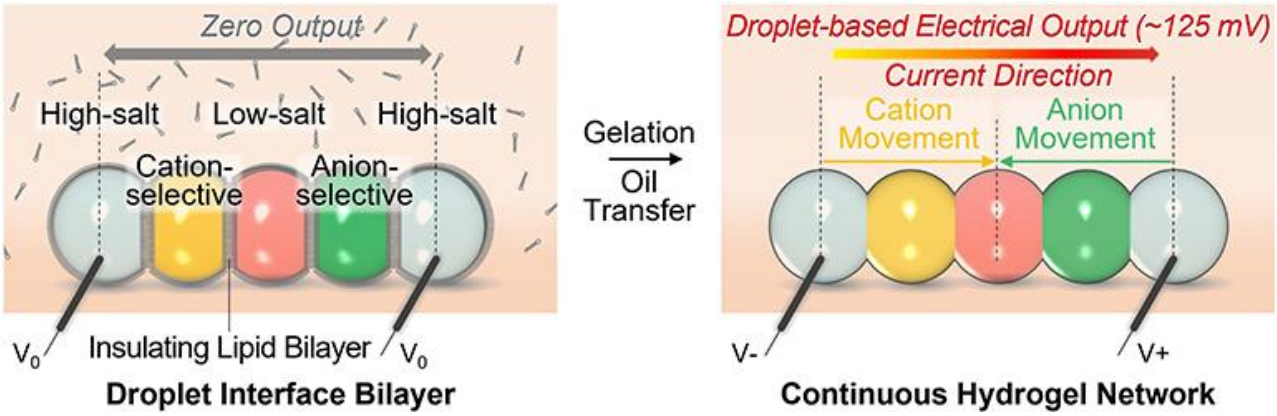


Researchers at Nanyang Technological University in Singapore have developed a tiny, flexible battery that is intended for use in smart contact lenses. The device is as thin as the human cornea and can be charged by a saline solution, which is particularly useful in the eye, as it is full of salty tears. When the battery-equipped smart lens is not in use, such as at night, then it can be stored in a saline solution, helping to further recharge the battery. The device avoids materials that could cause damage to the eye, such as metal electrodes, and works through a glucose oxidase coating that generates current when it reacts with ions in tears, such as sodium and potassium.

Smart contact lenses that monitor our health and even treat disease could be just around the corner. However, without a reliable and safe power source, such lenses are not likely to see much use. The problem is that these lenses must be very thin, and it is also preferable to avoid materials that could cause damage to the eye if they became exposed to its naked surface. These factors put bulky, conventional batteries out of the picture.

To address this, these researchers have created a very thin battery that does not contain metal electrodes and which can actually harvest power from the eye itself, or at least the salty tears that bathe it. “The most common battery charging system for smart contact lenses requires metal electrodes in the lens, which are harmful if they are exposed to the naked human eye,” said Yun Jeonghun, one of the lead developers of the new battery. “Meanwhile, another mode of powering lenses, induction charging, requires a coil to be in

the lens to transmit power, much like wireless charging pad for a smartphone. Our tear-based battery eliminates the two potential concerns that these two methods pose, while also freeing up space for further innovation in the development of smart contact lenses."



The researchers have tested the device using a simulated human eye. So far, they have shown that the device can produce 45 microamperes in current with a maximum power of 201 microwatts, with the potential for up to 200 charge/discharge cycles.

"This research began with a simple question: could contact lens batteries be recharged with our tears?" said Lee Seok Woo, another researcher involved in the study. "There were similar examples for self-charging batteries, such as those for wearable technology that are powered by human perspiration. However, previous techniques for lens batteries were not perfect as one side of the battery electrode was charged and the other was not. Our approach can charge both electrodes of a battery through a unique combination of enzymatic reaction and self-reduction reaction. Besides the charging mechanism, it relies on just glucose and water to generate electricity, both of which are safe to humans and would be less harmful to the environment when disposed, compared to conventional batteries."

Study in journal *Nano Energy*: A tear-based battery charged by biofuel for smart contact lenses

Via: Nanyang Technological University

We recommend

Sweat Powered Battery for Wearable Medical Devices
Conn Hastings, Medgadget, 2021

Google Announces Eye-Opener: Glucose-Sensing Contact Lenses
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Conn Hastings, Medgadget, 2022

Pressure Sensing Contact Lenses May Provide Continuous Glaucoma Monitoring

Complications of Contact Lenses
Malcolm M. Kates et al., Journal of American Medical Association, 2021

Corneal Wound Associated With Orthokeratology Lenses
Chang Liu et al., JAMA Ophthalmology, 2022

Contact Lenses Adjust to Sunlight
Rebecca Voelker, Journal of American Medical Association, 2018

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Michael T. M. Wang et al., JAMA Ophthalmology, 2023

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Conn Hastings

Conn Hastings received a PhD from the Royal College of Surgeons in Ireland for his work in drug delivery, investigating the potential of injectable hydrogels to deliver cells, drugs and nanoparticles in the treatment of cancer and cardiovascular diseases. After achieving his PhD and completing a year of postdoctoral research, Conn pursued a career in academic publishing, before becoming a full-time science writer and editor, combining his experience within the biomedical sciences with his passion for written communication.