

Cyborg Cockroaches Could Help Find Survivors of Natural Disasters. New Diving Suits Allow the Insects to Expand Their Search Underwater

Previously, researchers created electrical implants to control cockroaches' movements for search-and-rescue missions. Now, they've made 3D-printed suits that provide oxygen, allowing the critters to survive submerged for up to three hours



Sara Hashemi | Daily Correspondent

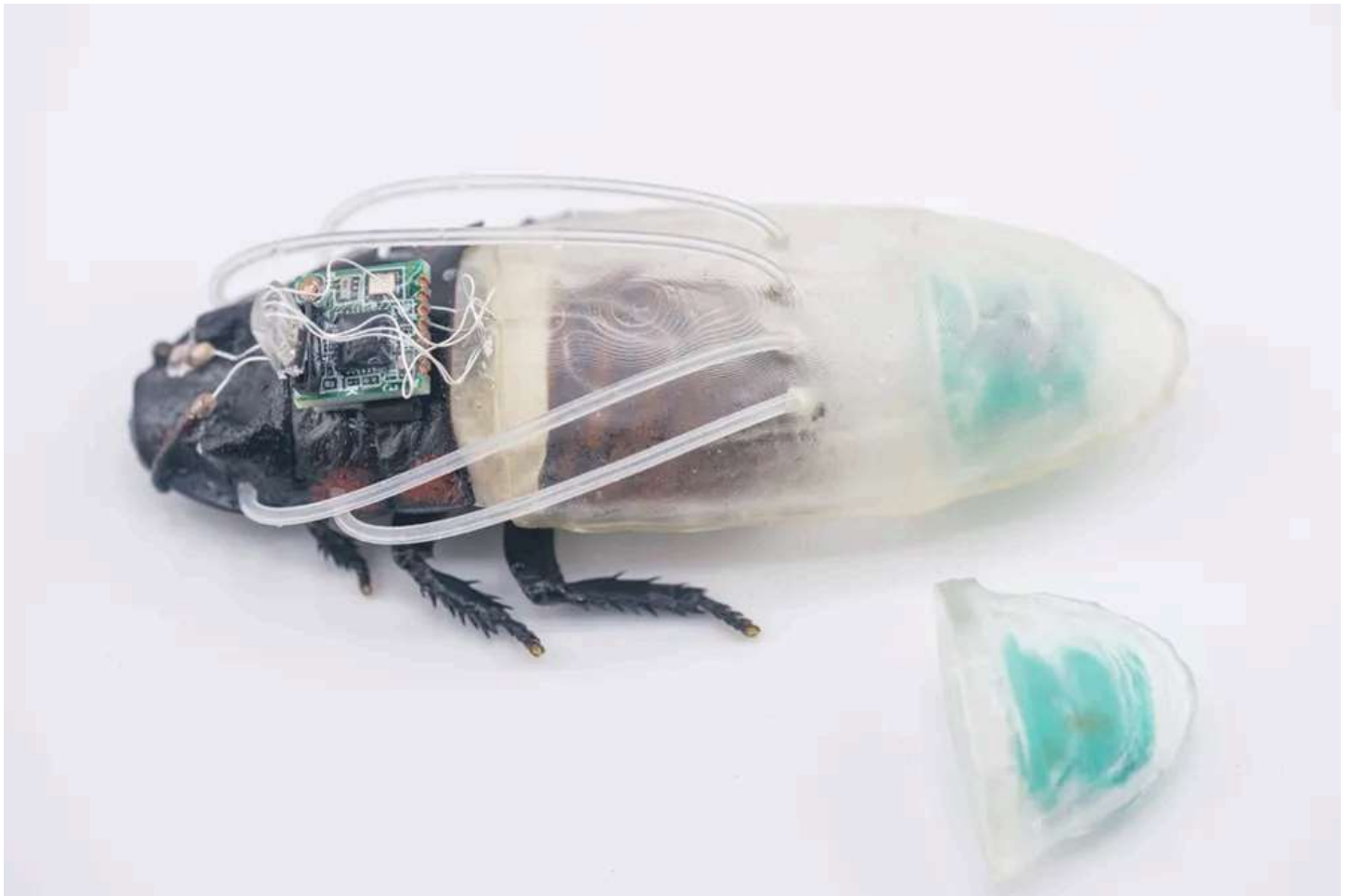
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A cyborg cockroach wearing a diving suit, which provides oxygen. Nanyang Technological University

Imagine a horde of cyborg cockroaches diving underwater during a search-and-rescue mission following a flood. While this scenario might sound surreal, it's actually not that far-fetched.

Scientists have developed tiny diving suits for cockroaches with electrical implants to control their movements. The technology, described in the journal *Nature Communications* on June 29, builds on previous research that created remote-controlled insects. The goal is to deploy them to survey damage and search for survivors after natural disasters, but they were limited to dry land.

Now, a team led by engineer Hiroataka Sato has fashioned Madagascar hissing cockroaches that can survive underwater for up to three hours,

allowing them to be used in a wider range of scenarios.

“Our new insect diving suit works like the oxygen tank used by human divers. It generates oxygen and delivers it directly to the insect’s breathing holes, allowing the cyborg cockroach to survive and move in underwater or low-oxygen environments,” says Sato, of Nanyang Technological University in Singapore, in a statement.

Cockroaches could be a helpful rescue tool. They’ve evolved over millions of years to wiggle into tight spaces and survive harsh environmental conditions. The research team specifically worked with Madagascar hissing cockroaches because of their durability, lack of wings and large size of up to four inches long.



Did you know? A remote-controlled insect record

Sato holds a Guinness World Record for the first untethered controlled flight by a cyborg beetle. At the time, the team worked with giant flower beetles.

Previously, Sato and his colleagues developed backpacks that send electrical signals to the resilient insects’ nervous systems, allowing researchers to control which direction the cockroaches travel, reported Owen Walker for the Financial Times earlier this year. The cyborgs have already been deployed in a search-and-rescue mission after last year’s 7.7-magnitude earthquake in Myanmar that killed more than 3,600 people, although the ten insects failed to find any survivors via their infrared cameras, per the outlet.

A bigger swarm, however, might be successful, and helping the remote-controlled cockroaches explore aquatic environments could boost their

utility, too.

“Real disaster sites can be challenging after heavy rain or flooding, blocking access routes in the rubble, drains and narrow gaps,” Sato says in the statement. “By expanding the operating parameters of our cyborg insects to include underwater travel, we believe that they can enhance search-and-rescue efforts.”

So, Sato and his team 3D-printed a resin diving suit made of three parts: an oxygen-generation tank, a flexible shell to cover the insects’ rear end and four oxygen-supply tubes. To provide oxygen, hydrogen peroxide is injected into the tank, which reacts with manganese dioxide already inside. That releases oxygen, which gets channeled through the tubes that are plugged into the cockroaches’ breathing holes, called thoracic spiracles.

The invention was tested in a series of immersion and bending tests, which confirmed the suit’s waterproof integrity and flexibility. The researchers also dropped some cockroaches wearing diving suits from various heights up to about 3.2 feet to test real-world fall and collision scenarios. The suits remained intact—and the cockroaches alive—throughout all the tests. What’s more, the insects could move around at a water depth of roughly 20 inches and survive submerged for hours.

Cyborg cockroaches wearing diving suits might be able to explore environments beyond Earth, too. “The ultimate goal is to [take this technology to] space,” Sato tells Matthew Sparkes at *New Scientist*. “It’s kind of one step—one big step—towards space suits for cyborg insects. Exploration over the Mars surface, for example.”

In the future, the team plans to test the cockroach suits in harsh conditions similar to those on Mars, such as extreme temperatures and radiation exposure, per the outlet. They also say the outfits could be expanded to more species, such as locusts, beetles and other kinds of cockroaches.

The insect-based technology has advantages over traditional robots, says Alan Winfield, an engineer at the University of the West of England.

“There have been attempts to build very small robots, but the problem is batteries. With a very small robot, you typically don’t get very much battery life,” he tells *New Scientist*.

Madagascar hissing cockroaches, meanwhile, need batteries only for the implants that allow them to be controlled remotely—not to power their movements. The insects also have lengthy lifespans of up to five years, and they’re incredibly resilient and can search for their own food during missions. Although some people might find huge cockroaches unsettling, cyborg insects could be much more efficient than regular robots.

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