Scientists build army of 1 million microrobots that can fit inside a hypodermic needle

Honey, I shrunk the robots.

Jackson Ryan
Aug. 26, 2020 6:00 p.m. PT

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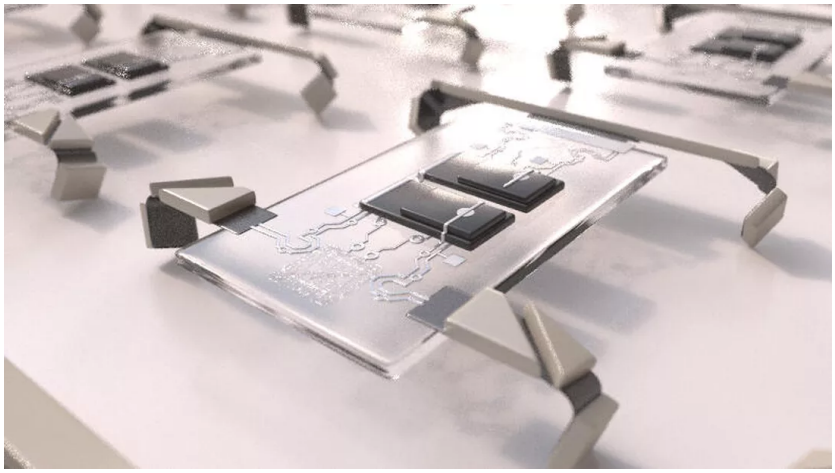


An artist's illustration of the tiny robot.
Criss Hohmann

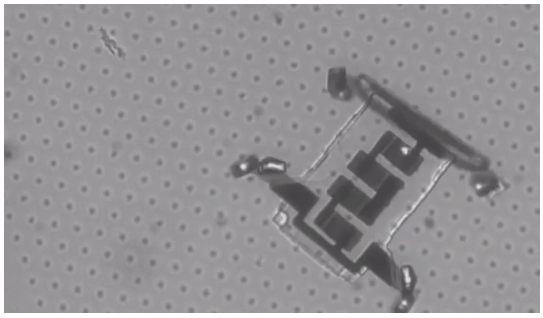
A four-inch wafer of silicon has been turned into an army of one million microscopic, walking robots, thanks to some clever engineering employed by researchers at Cornell University in New York.

In a paper, published Wednesday in the journal Nature, a team of roboticists detail the creation of their invisible army of robots, which are less than 0.1mm in size (about the width of a human hair) and cannot be seen with the naked eye. The robots are rudimentary and are reminiscent of Frogger, the famous 1980s arcade game. But they take advantage of an innovative, new class of actuators, which are the legs of the microrobots, designed by the team.

Controlling movement in these tiny machines requires the researchers to shine a laser on minuscule light-sensitive circuits on their backs, which propels their four legs forward. They've been designed to operate in all manner of environments such as extreme acidity and temperatures. One of their chief purposes, the researchers say, could be to investigate the human body *from the inside*.

"Controlling a tiny robot is maybe as close as you can come to shrinking yourself down," Marc Miskin, now an engineer at the University of Pennsylvania and the study's lead author, said in a statement.

"I think machines like these are going to take us into all kinds of amazing worlds that are too small to see."



This short video (sped up 8x) shows how the microrobot moves.

Marc Miskin

But shrinking down robots to this size and enabling them to move through the microscale world is a challenging technical task. It's much more difficult to move through the world when you're about the size of a Paramecium.

The team was able to build incredibly small legs, which are connected to two different patches on the back of the robot -- one for the front pair of legs, one for the back. Alternating light between the patches propels the microrobot forward.

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As you can see in the GIF to the right, it's not graceful, but it does the trick.

These types of devices are known as "marionettes" because their power source is not on board the device and their functions are controlled remotely, note MIT researchers Allan Brooks and Michael Strano in a related article published in Nature.

Without the external input from researchers, the devices don't have the capability to move around. But Brooks and Strano said the marionettes are important because they provide a stepping stone for future devices that can work autonomously. The microrobots are more tech demo than functional product for now, but they show what is capable in the microscopic world.

The research team were able to show the microrobots devices could fit within the narrowest hypodermic needle and thus, could be "injected" into the body. That kind of capability isn't worthwhile right now and not possible. The machines aren't intelligent enough to target a diseased cell or respond to stimuli, so there's no application for this invisible army. However, the researchers said that "their capabilities can rapidly evolve" and suggest that future production costs could be "less than a penny per robot," making them a valuable ally in the battle against disease.

The researchers are now trying to program the robots to perform certain tasks, using more complex computation and autonomy. Improvements could pave the way for swarms of robots to head inside the body and repair wounds or go on the attack against diseases like cancer, but that future is years -- or potentially decades -- away.

Even with the future years away, it should be noted that any potential treatment options using such devices would require stringent safety checks, have to overcome significant regulatory hurdles and would need to be trialled extensively before they were ever used inside human beings.

Update Aug. 26: Adds note on regulation.

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9 COMMENTS

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