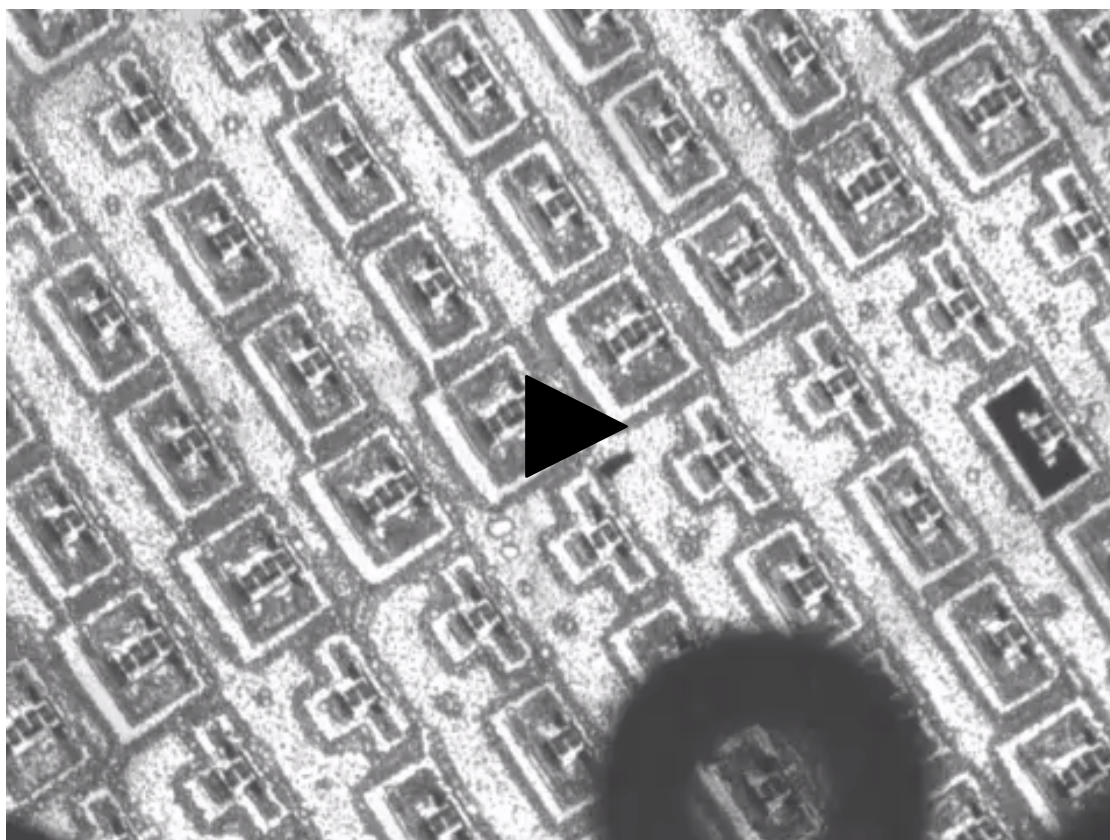


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# New cell-sized micro robots might make incredible journeys

*A million functional microscopic robots produced from a 4-inch silicon wafer in new nanofabrication process developed by engineers at the University of Pennsylvania*

AMERICAN PHYSICAL SOCIETY



## VIDEO:

RESEARCHERS HAVE CREATED TINY FUNCTIONAL, REMOTE-POWERED, WALKING ROBOTS, DEVELOPING A MULTISTEP NANOFABRICATION TECHNIQUE THAT TURNS A 4-INCH SPECIALIZED SILICON WAFER INTO A MILLION MICROSCOPIC ROBOTS IN JUST WEEKS. EACH ONE... [view more >](#)

CREDIT: MARC MISKIN

WASHINGTON, D.C., March 7, 2019 -- Researchers have harnessed the latest nanofabrication techniques to create bug-shaped robots that are wirelessly powered, able to walk, able to survive harsh environments and tiny enough to be injected through an ordinary hypodermic needle.

"When I was a kid, I remember looking in a microscope, and seeing all this crazy stuff going on. Now we're building stuff that's active at that size. We don't just have to watch this world. You can actually play in it," said Marc Miskin, who developed the nanofabrication techniques with his colleagues professors Itai Cohen and

Paul McEuen and researcher Alejandro Cortese at Cornell University while Miskin was a postdoc in the laboratory for atomic and solid state physics there. In January, he became an assistant professor of electrical and systems engineering at the University of Pennsylvania.

Miskin will present his microscopic robot research on this week at the American Physical Society March Meeting in Boston. He will also participate in a press conference describing the work. Information for logging on to watch and ask questions remotely is included at the end of this news release.

### Origins of the Micro Robots

Over the course of the past several years, Miskin and research colleagues developed a multistep nanofabrication technique that turns a 4-inch specialized silicon wafer into a million microscopic robots in just weeks. Each 70 micron long (about the width of a very thin human hair), the robots' bodies are formed from a superthin rectangular skeleton of glass topped with a thin layer of silicon into which the researchers etch its electronics control components and either two or four silicon solar cells -- the rudimentary equivalent of a brain and organs.

"The really high-level explanation of how we make them is we're taking technology developed by the semiconductor industry and using it to make tiny robots," said Miskin.

Each of a robot's four legs is formed from a bilayer of platinum and titanium (or alternately, graphene). The platinum is applied using atomic layer deposition. "It's like painting with atoms," said Miskin. The platinum-titanium layer is then cut into each robot's four 100-atom-thick legs.

"The legs are super strong," he said. "Each robot carries a body that's 1,000 times thicker and weighs roughly 8,000 times more than each leg."

The researchers shine a laser on one of a robot's solar cells to power it. This causes the platinum in the leg to expand, while the titanium remains rigid in turn, causing the limb to bend. The robot's gait is generated because each solar cell causes the alternate contraction or relaxing of the front or back legs.

The researchers first saw a robot's leg move several days before Christmas 2017. "The leg just twitched a bit," recalled Miskin. "But it was the first proof of concept -- this is going to work!"

Teams at Cornell and Pennsylvania are now at work on smart versions of the robots with on-board sensors, clocks and controllers.

The current laser power source would limit the robot's control to a fingernail-width into tissue. So Miskin is thinking about new energy sources, including ultrasound and magnetic fields, that would enable these robots to make incredible journeys in the human body for missions such as drug delivery or mapping the brain.

"We found out you can inject them using a syringe and they survive -- they're still intact and functional -- which is pretty cool," he said.

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The 2019 APS March Meeting presentation "Fabricating Autonomous Machines for the Cellular Scale," by Marc Miskin, Alejandro Cortese, Itai Cohen and Paul L McEuen, will take place Thursday, March 7, at 3:42 p.m. in room 259B of the Boston Convention and Exhibition Center. ABSTRACT: <http://meetings.aps.org/Meeting/MAR19/Session/V64.5>

## **MORE MEETING INFORMATION**

The American Physical Society (APS) March Meeting is a major international conference and the largest physics meeting of the year. In 2019, the APS March Meeting will convene March 4-8 at the Boston Convention and Exhibition Center.

## **USEFUL LINKS**

Register as Press: <https://goo.gl/forms/ur9dE24zCO1IVsLu2>

Press Site: <https://www.aps.org/meetings/march/press.cfm>

Meeting Abstracts: [http://meetings.aps.org/Meeting/MAR19/APS\\_epitome](http://meetings.aps.org/Meeting/MAR19/APS_epitome)

Main Meeting Page: <https://www.aps.org/meetings/march/>

Hotel and Travel: <https://www.aps.org/meetings/march/hotel-travel.cfm>

## **PRESS REGISTRATION**

APS will provide free registration to all staff journalists representing media organizations, professional freelance journalists on assignment, and student journalists who are attending the meeting for the express purpose of gathering and reporting news and information. Press registration grants full access to all scientific sessions, to the press room, and to the press conferences. We will also provide complimentary press registration to university press officers, PIOs and other professional media relations staff. For press related questions about the APS March Meeting, email [media@aps.org](mailto:media@aps.org).

## **PRESS CONFERENCES**

A series of press conferences on newsworthy research will be webcast live from the conference on Monday, March 4 through Thursday, March 7. A schedule will be released the week before the conference. Members of the media should register in advance at <https://webcast.apswebcasting.com/go/aps-march-19>.

## **ABOUT APS**

The American Physical Society is a nonprofit membership organization working to advance and diffuse the knowledge of physics through its outstanding research journals, scientific meetings, and education, outreach, advocacy, and international activities. APS represents over 55,000 members, including physicists in academia, national laboratories, and industry in the United States and throughout the world. Society offices are located in College Park, Maryland (Headquarters), Ridge, New York, and Washington, D.C. Read more: <https://www.aps.org/>

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