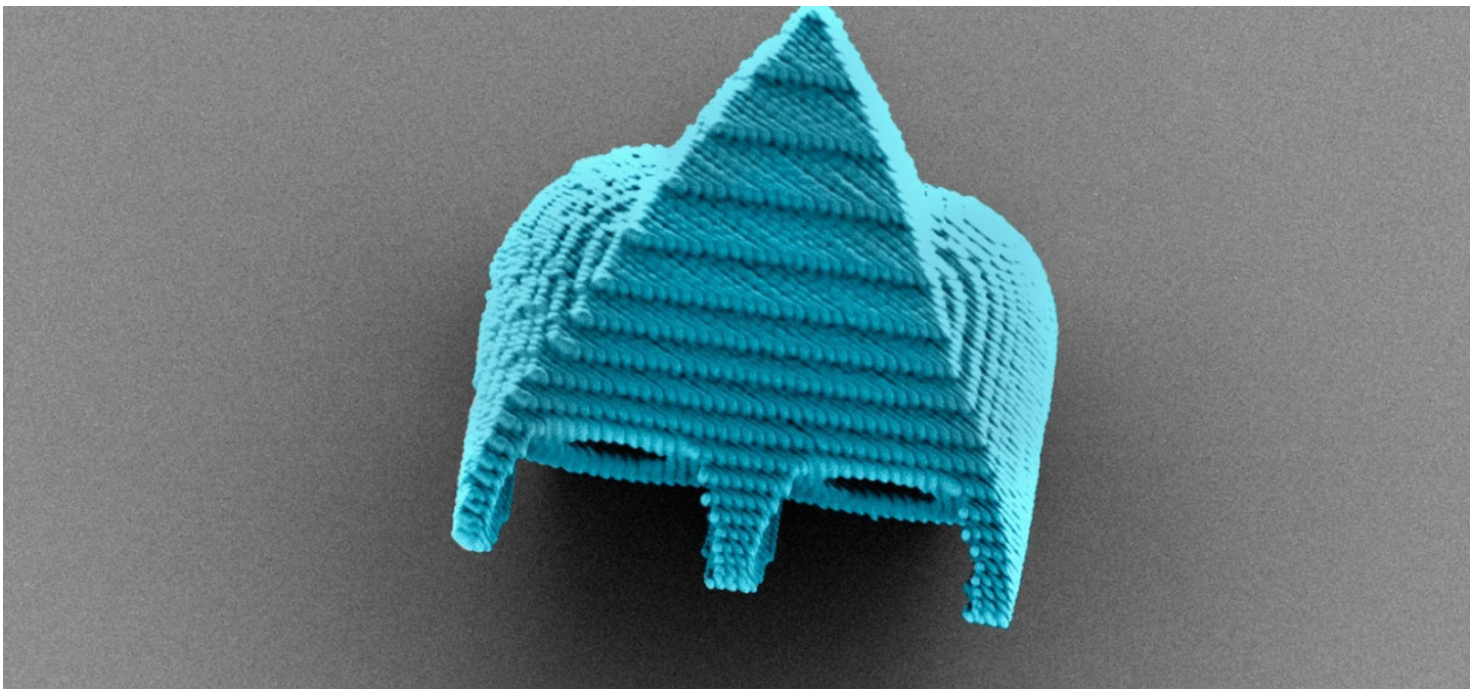

A scanning electron microscope image shows a cell-size robotic swimmer that can be powered and steered by ultrasound waves. | Photo source Cornell University

MICRO-ROBOTS STEERED BY ULTRA-SOUND COULD DELIVER TARGETED DRUG DELIVERY

SCIENCE

Tiny robots inspired by bacteria could one day be used to deliver targeted drug therapy to individual cells

Spotted: A Cornell research team led by Mingming Wu has created cell-sized robots inspired by the way that bacteria and sperm move. One limiting factor in the creation of very small robots is a power source. To solve this problem, the team found a way to use high-frequency sound waves as an energy source.

The team used a laser lithography system called a NanoScribe, which creates 3D nanostructures on a photosensitive resin. This resin also happens to be hydrophobic. After several months of experimentation, the team created a micro-robot with a pair of precisely placed cavities etched on it, each one with a different diameter.

When submerged, a tiny air bubble is trapped in each cavity. These air bubbles can be made to oscillate using an ultrasound transducer. As the air bubbles move, vortices are created in the liquid, and these propel the robot. Because the cavities have differently-sized openings, the researchers can control which direction the robot moves by exciting one bubble more than the other.

Wu explains how another challenge is to use the right number of bots, explaining that "you could have a group of micro-robotic swimmers, and if one failed during the journey, that's not a problem. That's how nature survives. In a way, it's a more robust system. Smaller does not mean weaker. A group of them is undefeatable. I feel like these nature-inspired tools typically are more sustainable, because nature has proved it works."

The Cornell micro-robot is the first we have seen to use bubbles and ultra-sound for propulsion, but it is not the first micro-robot that we have seen at Springwise. This is not surprising, given their promise for drug delivery. So far, we have seen a micro-robot that can be directed by magnets and a micro-robot that uses electro-adhesion to climb walls.

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20th October 2021
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Takeaway:

Although other researchers have developed “single bubble” micro-bots, the Cornell researchers are the first to use two bubbles, to make it easier to control and direct the robots. The ultimate goal is to create a remotely controlled micro-robot that can navigate in the human body and target the delivery of medication only to affected areas. Wu points out the benefits of this, saying that if “you can send medicine to a targeted area, like cancer cells, then you won’t have as many side effects.” The next step is to make the robots out of materials that are biodegradable and biocompatible, so that they can be used inside the human body and will dissolve once their job is done.