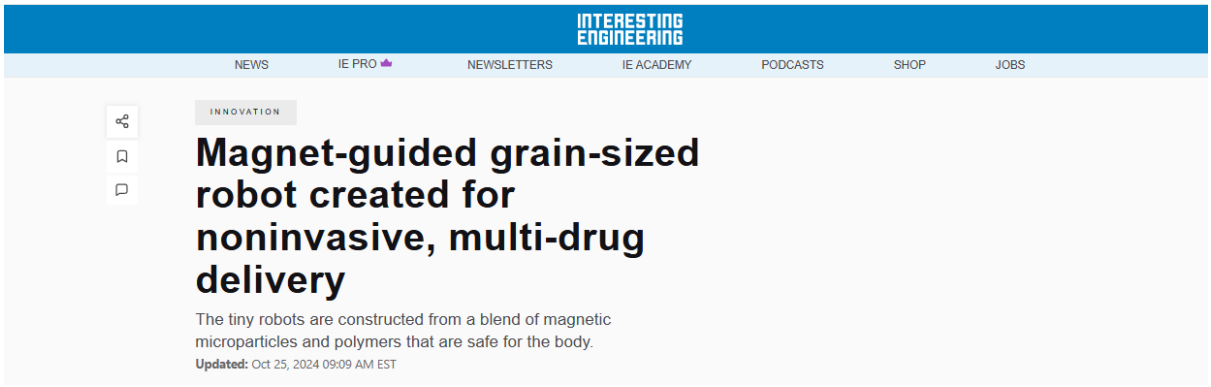
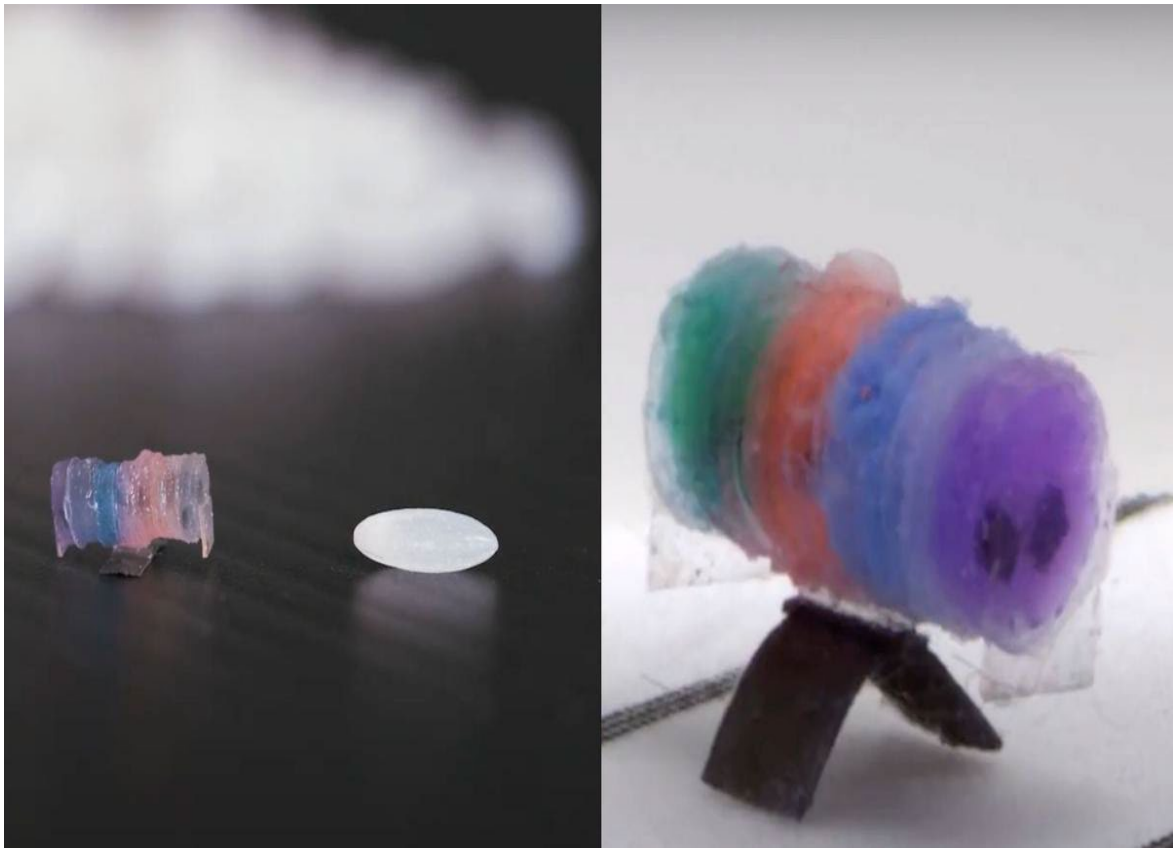
https://interestingengineering.com/innovation/grain-sized-robot-noninvasive-drug-delivery



Magnet-guided grain-sized robot created for noninvasive, multi-drug delivery

The tiny robots are constructed from a blend of magnetic microparticles and polymers that are safe for the body.

Updated: Oct 25, 2024 09:09 AM EST



Left: The robot next to a grain of rice; Right: Close-up of the robot.

NTU Singapore

Aresearch team at Nanyang Technological University (NTU) in Singapore has developed miniature, grain-sized robots capable of carrying multiple drugs and delivering them directly to targeted areas within the human body, controlled entirely by magnetic fields.

These tiny, soft robots, designed by NTU's School of Mechanical and Aerospace Engineering, are the first of their kind to be able to transport and release up to four different drugs in precise, reprogrammable sequences.

Inspired by the 1966 sci-fi movie *Fantastic Voyage*, lead researcher Assistant Professor Lum Guo Zhan remarked, "What was once sci-fi is now much closer to reality. Traditional drug delivery methods like pills or injections could one day seem less efficient next to a tiny robot that delivers drugs precisely where they're needed."

Smart materials for precise navigation

The development is a major step forward in drug delivery technology, potentially paving the way for safer, more effective treatments with fewer side effects.

Compared to earlier models, which could carry only up to three types of drugs and could not program drug release order, the NTU robots allow for a customizable, on-demand release of medications in complex environments like the human body.

The tiny robots are constructed from a blend of magnetic microparticles and polymers that are safe for the body. This unique material blend allows the robots to dexterously roll, crawl, and navigate through small, intricate spaces.

In laboratory experiments, the robots moved across sections at speeds ranging from 0.30 mm to 16.5 mm per second, successfully delivering different drugs in each section. Even in challenging environments, such as thick liquid solutions, the robots navigated efficiently, releasing drugs over an eight-hour period with minimal leakage.

"These findings show that our soft robot could potentially play a key role in the future of targeted drug delivery, especially in those treatments such as cancer therapies that need precise control over multiple drugs," said Yang Zilin, a co-author of the study.

The future of robotic drug delivery

This controlled, leak-resistant drug delivery could enable doctors to administer treatments more precisely and reduce the need for invasive procedures.

Dr. Yeo Leong Litt Leonard, a neurosurgeon at National University Hospital, sees promising applications: "As a doctor who performs minimally invasive procedures, we currently use a catheter and a wire to move through blood vessels to treat problems."