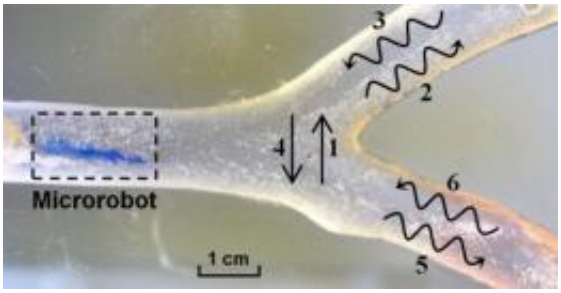
Take two robots and call me in the morning

January 6 2012, By Joel N. Shurkin



Researchers in South Korea demonstrated a microrobot moving through a structure intended to simulate the environment of a blood vessel. The microbot can move up and down (1 and 2), and wiggle through the simulated vessel in a helical motion (2, 3, 5, 6). Credit: S.M. Jeon, Hanyang University, et al

In the 1966 film "Fantastic Voyage," medical personnel board a submarine that shrinks to microscopic size and enters the bloodstream of a wounded diplomat to save his life.

The going is rough, with waves of blood that rock the sub with every heartbeat, and antibodies that attack it as an infection. They succeed in the end.

Physicians would love to produce microrobots capable of navigating through the body like that sub, delivering drugs, taking samples, moving things around. Shrinking doctors? Not so much.

Scientists are constructing devices fractions of an inch in size that would

be navigated and powered from outside the body by magnetism.

In contrast, now, when someone's arteries clog with plaque, a process that could lead to a heart attack, physicians insert a catheter into a vein in the arm or leg, shove the device to a target in the coronary arteries, and watch where it goes in an x-ray machine. Called an angioplasty, the cardiac surgeons can forcibly unblock obstructions. While the process is not ordinarily painful, it is invasive and carries some risk.

What if you could insert a tiny robot into the bloodstream and let it swim to the right place and either deliver medicine that would clear the obstruction or ream it out?

That's what scientists in Korea and at the University of California, Berkeley are developing. In their vision, a patient would lay inside an MRI machine and the doctors would guide the tiny device to the target, watching where it goes all the time on a video screen.

The MRI machine would drive the device, eliminating the need to provide internal power.

Gunhee Jang, professor of engineering at Hanyang University in Korea, said that previous attempts required one process to move the robot forward and back, another to take it around turns and still a third to make it corkscrew. Jang's team was able to create all the motions with one system, and reported the results in the IEEE Transactions on Magnetics in October and in a paper accepted for publication later this year in the *Journal of Applied Physics*.

"It has been tested on rabbits and then on pigs, and it looks quite promising," Jang said.

Swallow a Robot, Not a Pill

Researchers in Tel Aviv and Boston are working on a robotic endoscope.

Now, when doctors want to see what's inside the gastrointestinal system, they have to insert a tube down a patient's throat and push the end into the stomach and beyond, again not usually painful but uncomfortable and not as efficient as they would like.

Gabor Kosa, an engineering professor at Tel Aviv University, working with physicians and engineers Peter Jakab and Noby Hata at Boston's Brigham and Women's Hospital, is developing a potential replacement.

Kosa, who said as a science fiction fan he was inspired by the "Fantastic Voyage" movie and the Isaac Asimov novel that followed, admits the science in the screenplay (shrinking molecules) is impossible. His device uses more conventional physics.
Kosa's apparatus, reported in Biomedical Microdevices, also uses an MRI machine for power.

The MRI produces a magnetic field that makes a tail of the torpedo-shaped device wiggle, so it "swims" through the body. The patient swallows the endoscope and the physicians guide it to the stomach, or perhaps all the way to the small intestine. It would take images, snip out biopsy samples, or deliver drugs.

Kosa has so far tested the propulsion and navigation of a model in a water-filled aquarium, but he said he had no reason to think it would not work just as well in a human body.

The goal is a capsule about a third of an inch wide, about three-quarters of an inch long that would explore the stomach.

"We do not have a prototype yet," he said. "We developed the propulsive mechanisms of the robot which is a big step forward."

Kosa thinks it will be three to five years before such a device could be used in humans.

Jun Ueda, professor of mechanical engineering at Georgia Institute of Technology in Atlanta, who works on similar devices, said some robot prototypes have been tested in humans, but so far none has replaced current medical techniques.

Part of the delay is getting government approval for testing technology on humans, according to Ueda.

"Besides federal approval issues one of the issues in medical robotic devices is time. A procedure with a robotic device tends to take longer than conventional ones," Ueda said.

Source: Inside Science News Service