Micro-motors would fit to swim human arteries

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Courtesy Monash Univeristy and World Science staff

Many complex surgies for stroke, hardened arteries or blood vessel blockages are about to become safer as researchers finalize the design of micro-motors small enough for injection into the bloodstream, scientists say.

A paper published Jan. 20 in the Journal of Micromechanics and Microengineering details how researchers are harnessing piezoelectricity—the energy force most commonly used to trigger-start a gas stove—to produce “microbot motors” a fourth of a millimetre wide.

The remote-controlled robots are small enough to swim up arteries could save lives by reaching remote parts of the bloodstream without violating delicate tissues. With sensor equipment attached to the microbot motor, a surgeon’s view of, say, an artery could be enhanced; it’s also hoped that the ability to work remotely would increase the surgeon’s dexterity.

Motors have lagged behind in the age of technological miniaturisation and provide the key to making robots small enough for the bloodstream, said James Friend, leader of the research team at Australia’s Monash University.

“If you pick up an electronics catalogue, you’ll find all sorts of sensors, LEDs, memory chips, etc. that represent the latest in technology and miniaturisation. Take a look however at the motors and there are few changes from the motors available in the 1950s,” he remarked.

Friend and colleagues began their research over two years ago in the belief that piezoelectricity was the best energy force for micro-motors because the engines can be scaled down while remaining forceful enough, even at the sizes necessary to enter the bloodstream, for motors to swim against the blood’s current and reach spots difficult to operate upon.

Piezoelectricity is most commonly found in quartz watches and gas stoves. It’s based on the ability of some materials to generate electric potential, enabling a flow of current, in response to mechanical stress.

In the case of a gas stove, the ignition switch on a stove triggers a spring to release a ball that smashes against a piece of piezoelectric material, often kinds of crystal, which translates the force of the ball into more than 10,000 volts of electricity which then travels down wires, reaches the gas, and starts the stove fire. “Opportunities for micro-motors abound in fields as diverse as biomedicine, electronics, aeronautics and the automotive industry. Responses to this need have been just as diverse, with designs developed using electromagnetic, electrostatic, thermal and osmotic driving forces,” Friend said.

“Piezoelectric designs however have favourable scaling characteristics and, in general, are simple designs, which have provided an excellent platform for the development of micro-motors.” The team has produced prototypes of the motors and is now working on ways to improve the assembly method and the mechanical device which moves and controls the micro-motors, he added.