

Fantastic voyage: From science fiction to reality

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Some 40 years after the release of the classic science fiction movie *Fantastic Voyage*, researchers in the NanoRobotics Laboratory of École Polytechnique de Montréal's Department of Computer Engineering and Institute of Biomedical Engineering have achieved a major technological breakthrough in the field of medical robotics. They have succeeded for the first time in guiding, in vivo and via computer control, a microdevice inside an artery, at a speed of 10 centimetres a second.

Under the direction of Professor Sylvain Martel, holder of the Canada Research Chair in Micro/Nanosystem Development, Construction and Validation, and in collaboration with researchers at the Centre hospitalier de l'Université de Montréal (CHUM), the Polytechnique team has succeeded in injecting, propelling and controlling by means of software programs an initial prototype of an untethered device (a ferromagnetic 1.5- millimetre-diameter sphere) within the carotid artery of a living animal placed inside a clinical magnetic resonance imaging (MRI) system.

Encouraged by these results, staff at the Polytechnique NanoRobotics Laboratory are currently working to further reduce the size of the devices so that, within a few years, they can navigate inside smaller blood vessels.

"Injection and control of nanorobots inside the human body, which contains nearly 100,000 kilometres of blood vessels, is a promising avenue that could enable interventional medicine to target sites that so

far have remained inaccessible using modern medical instruments such as catheters," Professor Martel explained. "In collaboration with our scientific partners, Polytechnique researchers have begun developing several types of micro- and nanodevices for novel applications, such as targeted delivery of medications to tumour sites and diagnoses using navigable bio-sensors."

The results of this scientific breakthrough were published by Professor Martel and 10 co-authors from École Polytechnique de Montréal and the CHUM on March 14 in the scientific journal *Applied Physics Letters*.

Patent applications have been submitted for this method of real-time monitoring and guidance of devices for minimally invasive surgeries using MRI. Commercialization of the technology has been entrusted to Gestion Univalor, LP.

Source: École Polytechnique de Montréal

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