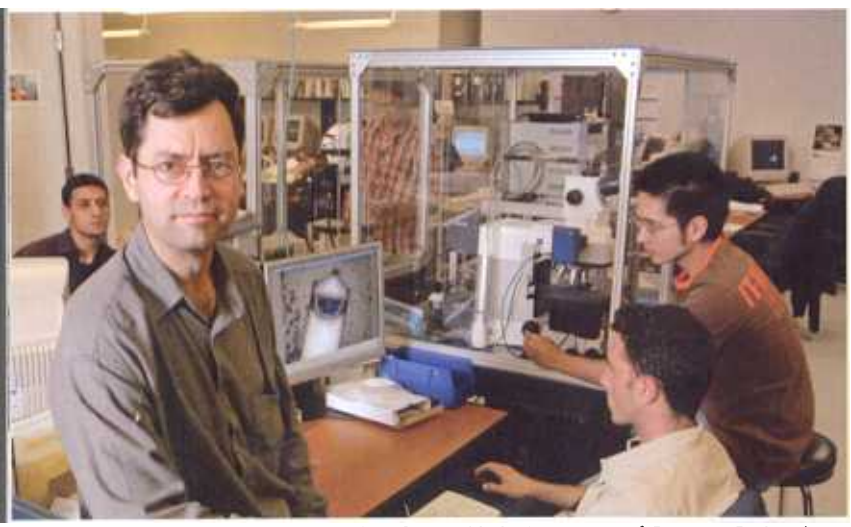
Scientific breakthrough

A world first in medical robotics

The news is being heard round the world. Some 40 years after the release of the sci-fi classic **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. For the first time, researchers have successfully steered a wireless device "in vivo" inside an artery using a clinical magnetic resonance imaging (MRI) system. In so doing, they've paved the way for novel, minimally invasive and more accurate surgeries, such as the targeted delivery of medication to tumour sites.



Sylvain Martel, Professor with the Department of Computer Engineering, holder of the Canada Research Chair in Micro/Nanosystem Development, Construction and Validation, and Director of the NanoRobotics Laboratory.

Under the direction of Professor Sylvain Martel, holder of the Canada Research Chair in Micro/Nanosystem Development, Construction and Validation, and in cooperation with researchers at the Centre hospitalier de l'Université de Montréal (CHUM), the Polytechnique team has succeeded in injecting, propelling and controlling through software an initial prototype of an untethered device (a ferromagnetic 1.5-millimetre-diameter sphere) within the carotid artery of a 25-kilogram living animal placed in a clinical MRI system. Moving at an average speed of up to 10 centimetres a second and with its course checked by computer 24 times a second, the microdevice followed the trajectory set by the software before being retrieved with a catheter.

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.

"The injection and control of nanorobots inside the human body, which contains nearly 100,000 kilometres of blood vessels, is a promising avenue," Professor Martel explained. "It could allow interventional medicine to target sites that so far have remained inaccessible using modern medical instruments such as catheters. 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 medication to tumour sites and diagnoses using navigable biosensors."

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

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