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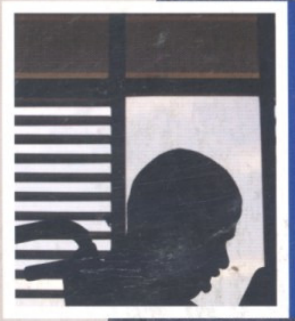
Between East and West

Péter Leonov aims to strengthen Malév's role as a network carrier



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A touch of the future

Hungarian-invented robot hand developed with Asian aid

It seems like science fiction: a prosthetic limb, directed by the human brain, that can actually feel and touch, just like a human hand. But it is almost reality, thanks to 33-year-old Dr. Jenő Páli, Hungarian neurobiologist, brain specialist, and inventor of 'the touch-sensing robot hand', a technological breakthrough with important medical, scientific and commercial possibilities.

There are many fields of application for the technology behind the touch-sensing robot hand (sensory prosthetic limb), says Páli. "Besides clinical use for limb replacement, the know-how can be employed in robot technology – for example doing repair works in dangerous places like nuclear power plants or searching surfaces on other planets – or it can be used to develop intelligent training- +shoe soles to improve sport performances."

During a recent visit to India with a business delegation, Páli's invention captured the attention of local companies there. One of those immediately offered $1.5 million so Páli can finish the development phase of the prototype. "The concept, the technology and the software are already elaborated. We only have to make the sensors smaller, so we can place them on the skin of the robot fingers," he says, showing the sensory surface that is now about the size of a sheet of writing paper. The Indian company plans to start production of sensory prosthetic limbs by 2009-2010.

Eureka moment

"My research has always been focused on the brain, the nervous system and related impairments," Páli explains. His Ph.D. topic was the operation of the touch sensing system (palpation) in normal and brain-damaged animals. Later on, neuroprosthetics – the science of using the activity in the brain for commanding artificial devices – became his field of specialization. "I have studied whiskers of rats, the most precise touch sensing organs of the animal world, then started to think of an application beneficial for human purposes."

The decisive leap in his invention came in a eureka moment. "I was walking home one night in 2000 and suddenly the idea of how the working sensory surface should be created and connected to the nervous system so that you can feel and control the device with the brain came to mind," he says. The essence of his idea is to create an artificial touch-sensing surface with electronic sensors that are able to remember the sensory nerve endings in the human skin, and to use stem cells to create an artificial nerve connection point for the communication between the artificial limb (the robot hand with sensors) and the nerves of the body (arm, leg, whatever) and the brain (see "Sensors and synapses").

Many friends and colleagues thought his idea couldn't be realized for another 50-100 years and often called it a dream or science fiction. But in December 2001, Páli started putting the different concepts together: an artificial touching, sensing and gripping device, a three-finger robotic hand with humanlike fine motor control, and the artificial nerve connection point.

He also wrote and submitted the patent descriptions, first in Hungary and then in the EU. "The neuroprosthetics received patent protection very quickly, in 2004, because it was a brand-new scientific sensation so there was no similar innovation to protect it from," he says. The concept of neuroprosthesis is meanwhile widespread around the globe, from the US to China and Japan. In the US, the field even receives the largest financial resources spent on research and development in the country, because so many American soldiers are coming home from the wars in Iraq and Afghanistan with limbs missing. "Today, there are some similar procedures in the

> Doing business

In 2008, Páli became the executive director and one of the owners of Beike Hungary Biotechnology Co. Ltd., a Hungarian subsidiary (the first one amongst EU countries) of the Chinese company Shenzhen Beike Biotechnology, which treats patients from all around the world with stem cell therapy. In addition, Páli and his team will set up what he says is the most professional rehabilitation center in the EU using stem cell therapy. Top Hungarian universities, hospitals and doctors are going to contribute to the clinical trials of the stem cell treatment and the operation of the rehabilitation center.

In 2005, Páli also founded the Laboratory for Neurocybernetics at the Department of Anatomy of the Semmelweis Medical University in Budapest, while in 2006, he and fellow researcher Dr. András Csillag, along with the Semmelweis Medical University, founded Biocybernetics Research and Development Kft.. with the aim of conducting scientific projects financed by the EU.

world, but at the time my idea was kind of unique," Páli says.

Over the years, Páli's team won two Hungarian tenders for international patenting and European financial support, but all this only covered the material costs of the development (Ft 25 million), nothing more. The software is, however, worth millions of forints in itself, he says, but due to the lack of funds, his colleagues provided their labor and knowledge for free. Besides the lack of financial support, Páli also had to face some "typically Hungarian difficulties," such as a lot of skepticism of colleagues, especially in connection with the stem cell therapy part. A number of Hungarian doctors still do not accept stem cell therapy, which is somewhat controversial the world over, mainly because it uses human cell material 'harvested' from human embryos and the blood in umbilical cords. "In Hungary, stem cell tests are done only on animals – mainly mice – but it has not been applied to humans yet," Páli says.

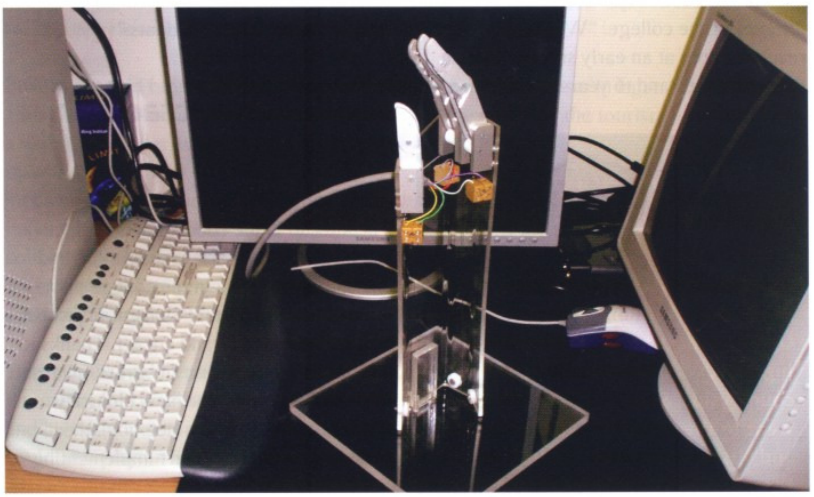
Asian investors

As of late, he is continuing his research and other work more in cooperation with Indian and Chinese experts and investors. In a country like China, stem cell therapy is widespread and thousands of patients have been treated routinely in the last couple of years, Páli notes. And although there are some concerns about the growing number of abuse cases reported recently, he says the Chinese state and the institutional background there are quite supportive. "My goal is to start treating patients with stem cells in Hungary in 2010," he adds.

Páli sees great potential for his innovation and the various purposes it can serve once the technique is perfected. And even though the Hungarian state has not really contributed to his research, he still hopes that Hungary can benefit from the results. Besides developing artificial limbs and intelligent shoe soles to improve sports performances, he has also set his eyes on space. "We plan an independent Hungarian Mars project in 2015."

> Gábi Gőbl

Páli sees great potential for his invention once the technique is perfected



The robot arm with three fingers, here connected to computers

> Photos: Márton Magócsi

> Sensors and synapses

At the moment, Páli's prosthetic limb consists of a robot arm with three fingers, connected to a touching surface the size of an A4 sheet. On the surface are 32 "sensing units", each with three sensors. These sensors can "feel" the force and the duration of the pressure and the direction where it comes from, but of course other types of sensors can be built into the units as well, Páli says, depending on what one wants it to measure (pH values, UV radiation, heat and cold, etc.). "Only imagination sets the limits."

Just like the receptors of the human skin, the sensors react to the impulses they receive and will send radio signals to the artificial nerve connection points or artificial synapses. A natural synapse is a special connection between two cells, a kind of connection point where a nervous impulse passes from one neuron to the next one. An artificial synapse would basically work the same; receiving the radio signal, send it on to the nervous system of the body and to the brain, which in turn can send signals back and thus control the prosthetic.