McGowan Institute for Regenerative Medicine
A program of the University of Pittsburgh and UPMC

Pitt Team Developing Technology to Allow Amputees to Feel with Prosthetic Limb, Improving Its Function

McGowan Institute for Regenerative Medicine affiliated faculty member Michael Boninger, MD, will co-direct with Robert Gaunt, PhD, a Defense Advanced Research Projects Agency (DARPA) program which hopes to one day give people with an arm amputation a prosthetic limb that not only moves like a natural one, but "feels" like it, too. They, along with rehabilitation experts at the University of Pittsburgh School of Medicine, expect such sensation will improve dexterous control of the device and give users greater intuition about what they are doing with their prosthetic.

With funding from DARPA's Hand Proprioception and Touch Interfaces (HAPTIX) program, Dr. Gaunt, assistant professor, Department of Physical Medicine and Rehabilitation (PM&R), Pitt School of Medicine, and a multidisciplinary research team from Pitt, West Virginia University, and Ripple LLC will begin developing the technology with the aim of being able to test it in patients' homes within 4 years.

"Advanced prosthetic limbs that behave like the hand and arm they are replacing have been an unrealized promise for many years largely because until recently, the technologies to really accomplish this goal simply haven't been available," Dr. Gaunt said. "To make the most of these new capabilities, we have to integrate the prosthetic into the remaining neural circuitry so the patient can use it like a regular hand that, for example, can pick up a pen, gently hold an egg, or turn a stuck doorknob."

In the 18-month, first phase of the project, the team will recruit five volunteers to try to demonstrate that stimulation of the sensory portion of the spinal cord nerves, which would normally innervate the hand and forearm, can cause the amputee to feel distinct sensations of touch and joint movement in the "phantom" hand and wrist.

They also plan to insert fine-wire electrodes into the forearm muscles of able-bodied volunteers to collect and interpret muscle signals to guide movement of a virtual prosthetic hand to control hand opening and closing, as well as thumb movement. Eventually, the team aims to devise a fully implantable system for home use.

Dr. Boninger, PM&R professor and chair, called it a very exciting study.

“In my treatment of rehabilitation patients, the goal is always clear,” Dr. Boninger said. “They want the medical team to make them like they were. The technology developed through HAPTIX will enable that dream.”

The project will be conducted by a multidisciplinary team of engineers, scientists, and clinicians from PM&R, plastic surgery, and neurological surgery in the School of Medicine, and occupational therapy, and rehabilitation science & technology in the School of Health and Rehabilitation Sciences at the University of Pittsburgh. Key aspects of the system will be designed by researchers at West Virginia University, and Ripple LLC, in Salt Lake City, Utah, will develop all the implantable system components.

Funding for the research was made possible by an award from the BRAIN Initiative, a White House program launched to revolutionize understanding of the brain and accelerate the development of new technologies. The National Institutes of Health, the National Science Foundation, the Food and Drug Administration, and DARPA committed more than $110 million to the Initiative for fiscal year 2014.

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