Pitt gives thought to helping paralyzed people

Brain implants used to move prosthetics

By Mark Roth
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As executive director of the local chapter of the Paralyzed Veterans of America, Joseph Dornbrock has seen how people with paralysis struggle to do the simplest things.

So he is understandably enthused about a new research project at the University of Pittsburgh that will use computerized brain implants to enable paralyzed people to control a prosthetic arm with their thoughts.

Every day, he said, paralyzed people face a gap between what they wish they could do and what they can do, so a device "that could translate the commands of the brain into something that could jump over that gap would be really helpful."

Pitt will receive nearly $7 million in federal research funds over the next three years to test two different types of brain implants.

The implants will use different methods to detect brain signals — one will read brain waves, while the other will insert electrodes directly into brain tissue — but their goal is the same.

By decoding the various patterns of brain activity when people think about making different motions, senior scientists Michael Boninger and Andrew Schwartz hope to allow them to perform increasingly sophisticated tasks using a lifelike prosthetic arm.

The computer programs to interpret the brain signals were developed at Pitt in recent years through work with monkeys and with patients who were awaiting epilepsy surgery, but this will be the first time they will be used to enable human patients to control a prosthetic limb.

The arm was developed over the last six years at the Johns Hopkins University Applied Physics Laboratory in Laurel, Md.

SEE **ARM,** PAGE A-2

Prosthetic arms moved with mind focus of Pitt study

ARM, FROM PAGE A-1

Michael McLoughlin, program manager for the project, said the challenge was to develop a prosthetic that looked like a real arm, weighed about the same, and had similar ranges of motion.

The resulting device is now so intricate, Mr. McLoughlin said, that "if you tried to control something of that complexity with a joystick, you couldn't do it."

In the smaller of the Pitt projects, an array of 16 electrodes will be placed on the brain surfaces of three patients for a month to test the feasibility of using their brain waves to control a computer cursor and then the prosthetic arm.

In the larger trial, Dr. Schwartz's team will put two 100-electrode arrays on the motor cortex of three patients over the next three years.

One array will pick up signals from a part of the brain that controls the arm, and the other from a region that controls the wrist and hand. The signals initially will be channeled through wires from the skull to a computer, which will then control the prosthetic arm.

The first patient is scheduled to get the implants this summer and have them in for a year. A second patient would get implants in 2012 that would include a feedback loop from the prosthetic arm that would provide a sense of touch. The third patient would get implants in 2013 and possibly operate two prosthetic arms using a wireless transmission system.

"We want to make this arm perform as close to a real arm and hand as we can," Dr. Schwartz said this week. "When you ask these [paralyzed people] what they really want, they say they want to be able to use their hands to feed themselves and maintain themselves and do their buttons and zippers."

The experiment will build on work Dr. Schwartz has done with monkeys, in which they learned how to use their thoughts to control an arm that could reach for an object, grasp it and twist it.

The Johns Hopkins arm already has been tested at the Rehabilitation Institute of Chicago in a handful of human patients who have arm amputations at the shoulder, Mr. McLoughlin said.

In their cases, their natural arm nerves were routed to their chests, where surface electrodes could pick up the signals to then control the prosthetic arm.

The Pitt project is more challenging, he said, because the electrodes have to interpret raw brain signals to figure out how to move the arm.

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The $800,000 surface electrode implant project is being funded by the National Institutes of Health. The $6 million implanted electrode trial is being funded by the Defense Advanced Research Projects Agency.

The only other American research group doing similar advanced work on a brain-controlled prosthetic is a laboratory based at Brown University in Rhode Island, led by John Donoghue.

Eventually, Pitt's Dr. Boninger said, such implants might allow paralyzed people to control their own limbs through a muscle-stimulating device. "When I think of next steps," he said, "I'm thinking of something that isn't visible to the rest of the population and is able to allow a patient to use his own arm with multiple degrees of freedom."

That kind of advancement would mean more to paralyzed people than most able-bodied folks can imagine, Mr. Dornbrock said.

"The things that those of us who are relatively able take for granted and could lose in terms of daily function are absolutely astounding," he said. "These paralyzed veterans demonstrate a lot of courage just to get through each day."

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