Medical Xpress

New generation of prosthetic gets closer to the real limb

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A UT Arlington bioengineer has built a neural interface that he thinks will lead to a better prosthetic arm that will allow more movement and eventually sensation for military veterans who desperately need them.

Mario Romero-Ortega and his team at The University of Texas at Arlington have obtained a new $2.2 million grant from DARPA, the research and development office for the U.S. Department of Defense, to further the development of technology that will allow amputees to naturally control and feel bionic limbs.

The grant is part of a program known as reliable neural interfacing (RENET), led by Dr. Jack Judy, program director of DARPA's Microsystems Technology Office in Arlington, Va.

Robotic prosthetics has advanced from the simple hooks used starting in the 1850s to multi-finger, electronically controlled hands with 22 degrees of freedom. The modern devices closely resemble a human hand.

But neural interfaces are required to give amputees the most natural control and sensory perception. The process involves connecting the robotic prosthetic to the nervous system of the user. Current essential technology is unreliable.

Human arms are controlled through thousands of nerve "channels" that allow the limb, hand and fingers to operate independently precisely. The channels allow for motion and sensory control.

By contrast, the most advanced neural interface for prosthetic arms uses six to eight channels and allows only for simple movement without sensation. Neural interfaces directly implanted in the brain can provide hundreds more channels, but require invasive surgery.

“What makes our research different is that we’re putting the neural interface in the limb itself,” said Romero-Ortega, speaking of the tiny interfaces that allow the arm to interpret what the brain is telling it to do, and for the brain to interpret what the arm is doing.

About 90 percent of existing research in robotics and prosthetics focuses on the head, in what is called Brain-Machine Interfaces, Romero-Ortega said. Yet there is still no long-term, neural-electronic interface, he said.

“Our research moves away from the head and into the appendage itself, looking for neural reliability and stability. It integrates the nerve into electrodes through nerve regeneration,” he added.

Romero-Ortega’s team wants to open up more of those channels to the arm through electrical and molecular engineering. The aim is to find clear signals, and results that lead to clinically viable engineered systems with sufficient reliability and stability for 50 to 70 years of usage.

Romero-Ortega said initial testing shows the potential to open up hundreds of nerve channels to a prosthetic. These open channels will enable the body to control the prosthetic as if it were real, giving new functionality to amputees, such as military veterans who have survived catastrophic injuries to their limbs.

Romero-Ortega said team members bring unique strengths to the research lab. His expertise is in neuroscience, nerve regeneration, molecular biology and regenerative neural interface. Young-tae Kim, a UT Arlington bioengineering assistant professor, works with markers of inflammation, bioengineering, neurointerfaces and histology. Yan Li, a UT Arlington assistant professor of mathematics, specializes in biostatistics and biometrics.

The project also includes Harvey Wiggins and Edward Keefer, president/founder and research scientist of Dallas-based Plexon, who bring their expertise in neurophysiology, multi-electrode electrophysiology and biochemistry to the research effort.

Provided by University of Texas at Arlington