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Pair look to reboot the brain

Computer chip may help people walk again

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Ranu Jung and Jimmy Abbas are at the forefront of research that could help people recover from spinal-cord injuries and diseases, enable paralyzed people to stand and walk and allow amputees to use brain waves to move artificial limbs.

The husband-and-wife team co-direct the Center for Rehabilitation Neuroscience and Rehabilitation Engineering at the Biodesign Institute at Arizona State University.

The center's researchers, including Abbas and Jung, are working on several fronts on ways to repair or replace functions for people with lost limbs, spinal-cord injuries or other neurological disorders.

That includes developing a computer chip that mimics the signals the brain sends via the spinal cord to produce movement. That could help quadriplegics stand and walk and help other people to move frozen limbs. The same technology could be used to translate brain impulses into motor signals for prosthetics. That could enable amputees to move artificial limbs the same way they move intact body parts: with their brains.

"It opens up a whole new area of research," Jung said.

Their work is funded in part by $3.9 million in grants awarded last year by the National Institutes of Health in Bethesda, Md.

"They are on a roll," ASU spokeswoman Gretchen Dobosz said.

The couple met as graduate students at Case Western Reserve University in Cleveland. Both were interested in the effects of spinal-cord injuries but pursued different lines of research. Eventually they realized their work was very compatible and teamed up.

"We're perfect colleagues," Jung said.

Jung and Abbas joined the faculty of Arizona State University in 2002, after holding research

and teaching posts at the University of Kentucky.

By studying the brains and spinal cords of lamprey eels, Jung and Abbas were able to determine how the two worked together to produce movement. That led to the development of a computer chip that can be programmed to mimic the stimulation the brain and spinal cord send to muscles.

The technology can be used to help quadriplegics stand and walk short distances and people with spinal-cord injuries to perform rehabilitative therapy on their own.

Taken to the next level, it could interpret brain signals to the spinal cord and use them to move an artificial limb or prosthesis. That could lead to the development of artificial limbs that function the same as natural ones.

"It's very exciting," Jung said.

Jung and Abbas are working to design, fabricate and test a neuroclamp that would record impulses coming from the spinal cord. Such a device could one day be used to transmit signals from the spinal cord to a prosthetic device.

The clamps will be manufactured using semiconductor microfabrication technology that can produce extremely small devices with mechanical elements, electronic components and sensors.

"The project requires expertise on several fronts, but what is most novel is the development of clamps small enough to latch onto the spinal roots," Jung said "Spinal roots can be only millimeters wide."

Another project is the development of smart limb splints for the Army that could give mobility to wounded soldiers.

To develop the product, they have formed a company called Advensys that could eventually offer a commercial version of the product.

The team also is working on a neuroprosthetic system to electrically stimulate muscles to produce repetitive stepping movements.

Recent studies indicate that individuals with spinal-cord injuries can enhance their recovery of movement by performing repetitive stepping movements. The repetition is believed to help the body re-learn how to generate signals in the brain and spinal cord that will enable them to step independently.

Individuals now do this therapy on a treadmill, supported by a harness and passive assistance provided by therapists. By using the stimulation to contract the muscles in a manner that mimics natural movement, Jung and Abbas hope to improve the therapy and reduce reliance on a harness.

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