Brain-Computer Interfaces

Therapeutic Potential in Nervous System Disease

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Tantalizing new solutions on the horizon could treat a wide range of nervous system disorders

To overcome damage to spinal cord or body caused by injury, stroke, or disease, technology is under development senses brain signals to create neural interface systems, sometimes called a brain-computer interface (BCI), to sense motor intentions and reconnect them with the outside world. Electrical stimulation devices that restore hearing to the deaf (cochlear implants), as well as interventions to stop the tremor and rigidity of Parkinson's disease (deep brain stimulation) are already in use by more than 200,000 people. Furthermore, devices to restore sight to the blind are in early clinical trials.

These interfaces represent the beginning of an age of neurotechnology in which promising advances are being realized to provide a range of devices to diagnose and treat nervous system disease and restore lost function.

Using the Mind Alone to Signal Movement

In recent years, several tetraplegic people, who cannot move their body, have had tiny sensors, smaller than a baby aspirin tablet, implanted beneath their skull in the motor cortex, the brain area that generates movement commands. Each of the people in this ongoing, early stage clinical trial are unable to move their arms, body or legs. Even so, with the addition of the BCI linking the firing of a small group of motor cortex neurons to a computer interface, the subjects were able to make a computer cursor move as if they were controlling a mouse with their hand. The trial using this BrainGate neural interface has demonstrated how they gained the ability to type messages using only their thoughts to manipulate a cursor.

BrainGate is still a very early stage technology with more testing and development required. Next steps include fully implantable, "always-on" systems that can provide independence and control by connecting the brain signal to robot arms that can perform helpful functions, such as drinking, eating or grooming.

Is Paralysis Treatment Next?

In addition, work is advancing to connect brain signals with stimulators implanted inside the body and connected to muscles. Such a system could allow people with paralysis to move their arms again. Damaged natural connections between the brain and muscle would be bridged by the system's hardware and electrical impulses.

While just beginning to be realized, this type of neurotechnology has great promise to enable activity for persons with severely disabling motion limitations. Even more people might benefit, such as people who experience limited paralysis after a stroke, or amputees wishing to optimize control of a prosthetic arm. Initial testing of those uses is also underway.

Epilepsy Monitoring Also Considered

Beyond that application, brain sensors that are able to measure minute changes in brain activity may also be used to monitor potential warning signs, such as possible onset of an epileptic seizure. These advances suggest an entirely new set of solutions is on the horizon that could treat a wide range of nervous system disorders and restore function – and life quality – for people with disabilities, their caregivers and their loved ones.

For more information about BrainGate, see a 60 Minutes segment on the brain-computer interface at cnettv.cnet.com/60-minutes-braingate-movement-controlled-mind/9742-1_53-50004319.html, and visit www.braingate2.org.

Please note: *This information should not be used as a substitute for medical treatment and advice. Always consult a medical professional about any health-related questions or concerns.*

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