Adelaide University

Rewiring the Damaged Brain
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A study by Adelaide University scientists suggesting that the brain can be 'rewired' could lead to a new therapy for stroke victims. The study shows that healthy brain areas may be recruited to take over the functions of areas damaged by stroke or trauma.

Observations of patients who suffer stroke or brain injury and regain only limited function had led to a view of the brain as 'hard wired,' with neural circuits laid down by puberty and remaining unchanged thereafter.

Among other things, the brain's cortex controls voluntary movement, speech and reasoning. Research now suggests that neural connections of the cortex are not fixed, but continuously modified by experience and learning.

Earlier studies have revealed that practicing a simple finger movement can change the size of the area of motor cortex that controls specific finger muscles, and even alter its neural connections.

In blind Braille readers, the cortical area for the reading finger is much larger than for a non-reading finger. Amputees show the reverse effect; cortical areas of missing muscles being taken over by those that are unaffected.

In a study published in Experimental Brain Research, researchers from the Department of Physiology at Adelaide University have discovered that stimulating the nerve from a muscle to the brain can alter the size of responses from the area of cortex that supplies the muscle. Furthermore, these changes last for some time after the stimulation has stopped.

"Our findings are quite exciting as they have implications for understanding phenomena such as skill learning and motor memory" said Dr. Mike Ridding, a Florey Postdoctoral Fellow and lead investigator on the study, "It also suggests new directions for developing potential therapeutic approaches to disordered brain function in such debilitating conditions as stroke."

Many stroke victims have difficulty with even simple tasks because of muscle weakness or unwanted muscle contractions that make co-ordinated movement almost impossible. In most instances the muscles and nerves themselves are fine, but their connections to the cortex have been damaged. The study's findings suggest that it may be possible in the future to by-pass the damaged brain area.

Differently shaped coils have been designed to produce different patterns of stimulation. Held close to a subject's head, they are non-invasive and painless.

"By developing a method of stimulating the pathways leading back to the brain from the affected muscles, we may be able to encourage the development and use of an alternative cortical area to that damaged by the stroke." said Dr. Ridding, "If we could achieve this, it would be a big step

towards enabling patients to regain at least some of the movement control they lost as a result of their stroke."

The other authors of the study are Associate Professor Tim Miles and PhD student, Julia Pitcher, both of the Sensorimotor Control Group, Dr. Brenda Brouwer, Visiting Research Fellow from Queen's University, Canada, and Professor of Neurology, Department of Medicine, Phillip Thompson.

Along with Dr Tim Miles and Professor Thompson, Dr. Ridding is now pursuing the nature of these motor cortex changes, while Julia Pitcher is examining the changes in motor cortex excitability that occur when a muscle is fatigued. Muscle fatigue and weakness are symptoms common to a number of motor control disorders, including stroke.

Dr Ridding believes that the effect may involve a protein that modifies synaptic efficiency in the brain. "Together with the results of Julia's fatigue studies, we should gain some insight into how we might manipulate the mechanisms to assist people with movement disorders regain more motor control," he said.

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