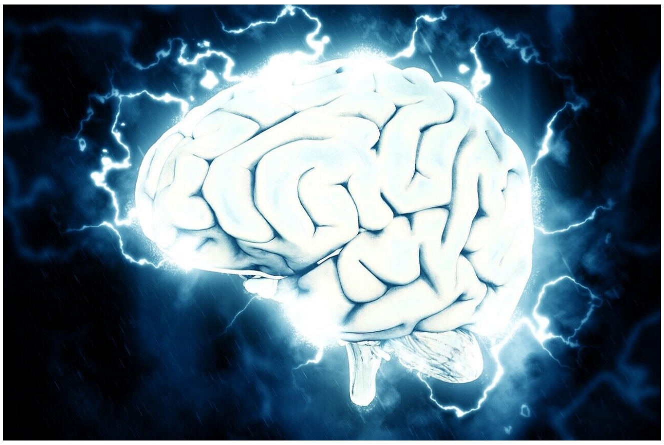
Researchers discover how the brain 're-wires' after disease

17 November 2020, by Ciara O'shea



Credit: CC0 Public Domain

Trinity researchers are studying how the brain re-wires itself in neurological disease. The team is building treatments for today's more common global conditions like motor neurone disease (MND/ALS) and spinal muscular atrophy and their findings could impact rehabilitation for patients, the discovery of effective drugs and quantifying the potential efficacy of new therapies. The paper is published in the journal *Clinical Neurophysiology*.

Up to now, scientific knowledge has told us that the polio virus affects the spinal cord, but not the brain. The Trinity team have shown this not to be the case; finding previously unknown changes also occurring in the brain networks. These findings suggest that brain networks engage in an abnormal but active communication with muscles in patient groups studied.

Today, polio is a rare condition in the world, as it has been reasonably controlled by vaccination over several decades. Incidentally, there are people in Ireland who have had the disease in the past and live with its consequences. Polio is a viral infection that damages the neural cells (neurons) in the spinal cord. Neurons take up, process and transmit information through electrical and chemical signals to other parts of the body, including muscles, for movement.

The study considerably increases the team's understanding of how the neurological and neurodegenerative diseases in parts of the nervous systems can affect brain networks , and how these networks can compensate following damage. This work helps them understand how the networks that control the movement work and how they influence and are influenced by different disease mechanisms.

Because the polio virus affects the same neurons in the spinal cord such as motor neuron disease (MND/ALS) and childhood onset spinal muscular atrophy, this work is extremely important in driving our global effort to find treatments for these diseases.

The team, led by Professor Orla Hardiman, Professor of Neurology at the School of Medicine, Trinity College assessed the abnormal changes in the neural networks underlying human movements that take place due to neurological and neurodegenerative diseases. The assessment was made using neuro-electric measurement of the brain activity (brain waves or EEG) and the muscle activity (EMG) and some complex signal analysis.

The study will be supporting the emerging approaches to diagnosis and therapy (precision medicine) where the patients can be diagnosed and treated (with rehabilitation and new drug treatments) based on how exactly their neural networks are affected (on an individual basis). This will be applicable both to the patient group in this study, but also, in cognate conditions such as different forms of MND/ALS.

Dr. Amina Coffey, Ph.D. researcher, Clinical Medicine, Trinity College and first author, said:

"This study shows that neurophysiological markers can pick up changes in brain connectivity patterns that have implications in our understanding of other similar neurological conditions like spinal muscular atrophy."

Dr. Bahman Nasseroleslami, assistant professor, Clinical Medicine, Trinity College and senior author, said: "This study is especially interesting, because it shows that advanced methods in neurophysiology and neural signal analysis can help to unravel new aspects of how different diseases disrupt our movements. These types of inexpensive non-invasive methods can be further developed for probing the different neural networks in humans that are responsible for different day-to-day movements and different diseases that affect them."

Professor Orla Hardiman, professor of neurology, Clinical Medicine, Trinity College and co-author, said:

"Our research findings show for the first time that the brain "rewires" in those who suffered from polio in childhood."

This has implications for our understanding of brain plasticity, and in the longer term for rehabilitation and new biomarker development.

More information: Amina Coffey et al. Altered Supraspinal Motor Networks in Survivors of Poliomyelitis: A Cortico-Muscular Coherence Study, *Clinical Neurophysiology* (2020). DOI: 10.1016/j.clinph.2020.10.011

Provided by Trinity College Dublin