Brain plasticity in the most dreaded biblical disease

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Brain plasticity is the ability of the brain to change both anatomically and functionally in response to changes in the body or in the environment.

For many years, researchers believed that the brain did not suffer major changes after childhood. Although brain plasticity predominates in the first years of life, research done in the last 30 years has shown that it may also occur in adulthood, continuing to change through learning. Brain plasticity may also occur following injury, amputation or nerve damage.

Leprosy, also known as Hansen's disease, can be traced back to early human history. Descriptions of an ailment resembling leprosy as we know it today were found on an Egyptian Papyrus dating back to 1550 B.C. Also, the word tzaraath, which some believe specifically refers to leprosy, can be found in the Old Testament, where it is considered the most dreaded of all diseases.

Leprosy is a chronic infection caused by the bacteria *Mycobacterium leprae* and *Mycobacterium lepromatosis*. The bacillus predominantly infects nervous tissues, leading to nervous inflammation that most often affects the eyes, hands and feet. Contamination between individuals may occur through a cough or contact involving fluids. Although currently not very contagious, in the past, patients with leprosy were condemned to live life in isolation in order to save others from the perils of the disease. Leprosy is curable with multidrug therapy but the physical disabilities

and deformities remain even after bacteriological cure.

Nerve damage caused by leprosy leads to limb disabilities and deformities such as a claw hand, neuropathic pain and a burning sensation. Patients with leprosy require long-term rehabilitation in order to control the chronic consequences of neural damage. Until now, leprosy was thought to affect the peripheral nerves connecting body parts to the brain without affecting the brain itself. However, a new study done by a multidisciplinary research team at the Federal University of Rio de Janeiro, Brazil, shows that peripheral nerve damage caused by leprosy can indeed change the brain.

The brain's motor cortex is the region responsible for generating neural impulses that reach the spinal cord and control the execution of movements. The group led by Dr. Claudia Domingues Vargas used transcranial magnetic stimulation (TMS), a noninvasive method, to measure the connection between the brain and the handgrip muscles in six adult patients with leprosy presenting the claw hand deformity. As expected, handgrip was generally weaker in the patients' more affected hands relative to the less affected hands and to those of healthy individuals. Also, two out of the four tested hand muscles had a relatively smaller representation in the brain if compared to other muscles in the same patient or in healthy individuals. Interestingly, the ulnar nerve, which makes the connection between the brain and the two muscles with smaller representation, was more affected by the disease than other nerves in the same patient. On the other hand, a muscle connected to the brain by a nerve less affected showed stronger neuroelectrical signal, indicating a more robust evoked response. This finding demonstrates that the brain representation for a given muscle may change depending on the degree of damage in the nerve connecting the muscle to the brain, which is evidence for brain plasticity.

"Our findings indicate that the cortical motor area corresponding to the

most affected hand suffers changes, revealing that that the damage caused by leprosy is not limited to peripheral nerve injury", says Dr. Vargas.

A better understanding of the relationship between limb dysfunction caused by leprosy and brain plasticity may help develop new treatment strategies for the millions of individuals currently suffering from this ancient disease.

More information: "Primary Motor Cortex Representation of Handgrip Muscles in Patients with Leprosy" *PLOS Neglected Tropical Diseases* www.plosntds.org/article/info: … journal.pntd.0003944

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