

### A mathematical model of the chronic pains based on the neuromatrix theory

Subject: Computational Neuroscience, and Cognitive Modeling

Khadijeh Alimohammadzadeh<sup>1</sup>, Dr. Masoud Feridoni<sup>2</sup>, Hamid Motiee<sup>3</sup>, Dr. Davud asemani<sup>4</sup>

1. M.Sc. student of animal physiology, Department of biology, Faculty of science, Ferdowsi University of Mashad, Mashad, Iran
2. Department of biology, Faculty of science, Ferdowsi University of Mashad, Mashad, Iran
3. Department of Engineering, Faculty of Electrical Engineering, Azad University of Bojnurd , Bojnurd , Iran
4. Department of Biomedical Engineering ,K. N.Toosi University of Technology, Tehran, Iran

**Background and Aim:** Acute pain evoked by noxious inputs have been meticulously investigated by neuroscientists and also has been mathematical modeled. Chronic pains e.g. phantom limbs, which are often characterized by severe pain, remains a mystery. Neuromatrix theory could explain it readily. According to this theory widespread areas of the brain must be involved in pain . We have attempted to obtain an acceptable mathematical model to explain this phenomena.

**Methods:** We have taken account of recent information and new theories in regard to chronic pains. In the proposed model the role of neuromatrix and two variables are considered in addition to previous work

**Results:** The output of the cell ( T-cell )that projects to midbrain is labeled as P' which means the raw pain because it considered as pain sensation,while it has not flowed through the neuromatrix. When it undergoes cyclical processing we call it P which means pain as perception of pain. using a function includes two variables : p'and neurosignature ( the output of body self neuromatrix) , we now have a much better understanding of the pains that can be produced in the absence of peripheral noxious inputs,in other word we can show how the phantom limbs pains are sensed via a schematic diagram.

**Conclusion:** We propose a mathematical function includes two variables in the model by which may be we reach to a better understanding of pain perception. The variables are including the effect of body-self neuromatrix and the raw pain.

**Keywords:** Phantom limb, mathematical modeling, neuromatrix, pain

Investigation of sleep quality association with restless legs syndrome in patients with multiple sclerosis

Subject: Sleep