Marina V Zueva, J Nanomed Nanotechnol 2017, 8:4(Suppl)
DOI: 10.4172/2157-7439-C1-048

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The prospects of applications of nonlinear stimulation techniques to recover and improve the dynamics of brain activity and performance in neurological disorders and after the influence of stress factors

We recently proposed that the deficiency of nonlinear (temporal and spatial) characteristics of environmental sensory cues leads to abnormal development and aging of the central nervous system. The use of fractal and other regimes of nonlinear stimulation may be effective in restoring brain function including in trauma, stroke, and neurodegenerative diseases through the reactivation of neuroplasticity. The dynamics of natural rhythms of activity of the brain are well described, including oscillations of the spontaneous brain activity and discharges of individual neurons. It is known that fractal dynamics distinguishes normal physiological processes, and pathologies destroy long-range correlations and reduce the complexity of the behavior of various systems. According to our theory, the loss for different reasons of complex nonlinear characteristics of the environmental cues contributes to simplification of the neuronal circuits and activity in the brain. New technologies of impact on the neuroplasticity should contribute to a more efficient neuronal contacts, cognitive functions, and overall functionality in people with neurological disorders or under extreme conditions. Knowledge how nonlinear stimuli influence brain functions may be useful not only in future innovative strategies to treat neurodegenerative diseases. They may be prospective for healthy persons in extreme conditions when the use of particular regimes of fractal therapeutic stimulation could help restore and enhance cognitive function and the adaptive brain reserve. Numerous studies have demonstrated that the normally functioning brain operates in a state of so-called "Self-organized criticality." It can be expected that the use of non-linear techniques to restore physical and mental performance after heavy load and effects of stress factors, including in the sport, will help to restore the complex nonlinear dynamics of functional activity, maintaining a high level of criticality and improving the adaptive brain reserve. We will consider the concrete, practical application and the future market of non-linear technologies.

Biography

Marina V Zueva, Professor of Pathophysiology, graduated from the Lomonosov Moscow State University (Physiology of Higher Nervous Activity), received her PhD and BiolSciD from Moscow Helmholtz Research Institute of Eye Diseases. Currently, she is the Head of the Division of Clinical Physiology of Vision at the Moscow Helmholtz Research Institute of Eye Diseases. She is a member of International Society on Clinical Electrophysiology of Vision (ISCEV), European Association on Vision and Eye Research (EVER), and European Society of Retina Specialists (EURETINA). She has published over ten peer-reviewed papers in English (over 86 in Russian) and presented over 65 topics at international conferences.

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