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Nonlinear technologies in medicine for the reactivation of brain plasticity in neurodegenerative disorders

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Recently, we proposed and theoretically substantiated the hypothesis, which offers new approaches to treating neurodegenerative diseases of the retina and brain (Zueva, 2015). For the first time, we suggested that the impact of visual environmental cues of complex spatiotemporal structure on a person throughout his life is necessary for normal development and aging of the brain and visual system. The theory sets the link between the complexity of neural connections, nonlinear dynamics of physiological processes in the brain and the nonlinear characteristics of sensory cues. The loss in the complexity of neural networks in the retina and the brain develops in such socially relevant neurodegenerative diseases as glaucoma, diabetic retinopathy, Alzheimer's disease, Parkinson's disease, etc. The necessity of maintaining and strengthening of mental abilities in extreme situations and normal aging is a separate social and medical problem. The idea is to improve the scheme of neural circuits and brain's function in normal and neurodegenerative diseases by nonlinear visual and other sensory stimuli with complex temporal structure through the reactivation of the brain plasticity. We can expect that the development of innovative non-drug technologies of impact on brain plasticity and definition of ways to manage this process will contribute to a more efficient recovery of neuronal contacts, cognitive functions, and overall functionality in patients with neurodegenerative disorders and amblyopia. The creation of devices for nonlinear sensory stimulation and the detection of mechanisms of its impact on the brain are crucial for therapeutic strategies, which can underlay of future breakthrough technologies.

Biography

Marina V. Zueva, Professor of Pathophysiology, PhD, Dr. Biol. Sci., graduated from the Lomonosov Moscow State University (Department of Physiology of Higher Nervous Activity), received her Ph.D. and Dr. Biol. Sci. degrees 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. Zueva is a member of International Society of Clinical Electrophysiology of Vision (ISCEV), European Association on Vision and Eye Research (EVER), European Society of Retina Specialists (EURETINA), the Society for Research on Biological Rhythms (SRBR). She has published over ten peer-reviewed papers in English (over 80 in Russian) and presented over 60 topics at international conferences.

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