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STUDYING THE ROLE OF BRAIN NEUROPLASTICITY IN THE LAUNCH OF SANOGENESIS PROCESSES AND ACTIVATION OF ADAPTATION AND COMPENSATORY MECHANISMS OF THE HUMAN BODY

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Summary. The article discusses the phenomenon of brain plasticity or neuroplasticity. This is a recent discovery in the field of modern neurobiology, psychology, physiology and rehabilitation therapy. It is neuroplasticity that induces plastic changes and the necessary reorganization of the relevant parts of the nervous system after damage or in the course of life's needs. All recovery mechanisms in the nervous system are implemented by neuroplastic processes, through the activation of adaptation and compensatory mechanisms and the restoration of function lost by the body after an illness or injury. In addition, neuroplasticity plays an important role in the brain's adaptation to stress and other psycho-emotional factors, because in response to stressful situations, the brain can change its structure, strengthening or weakening certain connections between neurons, which allows a person to adapt to new conditions or reduce the negative impact of stress factors.

Key words: brain plasticity, neuroplasticity, adaptation and compensatory mechanisms, sanogenesis, neurogenesis, rehabilitation therapy, neuroplastic potential and brain resource.

Introduction. Neuroplasticity, or brain plasticity, is a fundamental adaptive ability of the nervous system that arises under the influence of external and internal factors and is realized through structural and functional changes. In recent decades, many scientists' research in neurobiology and neurophysiology has radically changed our understanding of the brain. Previously, scientists believed we were born with billions of neurons that gradually die with time and age and cannot be reproduced by division. In reality, we are born and die with millions of unformed stem cells in our brains that could become new neurons and form new neural connections. The discovery of the phenomenon of neuroplasticity has significantly supplemented the data on the already known mechanisms of the nervous system to neurogenesis, activation, and morphological and structural changes. The first to use the term 'neuroplasticity' was the Polish neuroscientist Jerzy Konorski in 1948.



Although in the early 1900s, the brain was usually considered an irreplaceable organ, and the famous scientist Santiago Ramon y Cajal used the term 'neural plasticity' to describe non-pathological changes that occurred in the structure of the adult brain. Neuroplasticity, the ability of the nervous system to change its structure and functions in response to various internal and external influences, is one of the most fascinating and vital topics in neurobiology and psychology. Neuroplasticity is crucial for the processes of adaptation and compensation in the human body, allowing it to adapt to environmental changes and heal after injuries or illnesses. Neuroplasticity reflects the ability of neurons (nerve cells) to change their connections and interactions with other neurons. This happens both through structural changes in the brain and functional adaptations. Thus, neuroplasticity allows the brain to 'reprogramme' or 'rebuild' its networks to perform new tasks or to compensate for losses caused by damage. Neuroplasticity is a recent discovery and a trend in modern neurobiology, psychology, physiology, and rehabilitation therapy. Neuroplasticity is the basis of post-stroke rehabilitation. Any damage induces plastic changes and the necessary reorganization of the relevant parts of the nervous system. In addition, all cyanogenetic recovery mechanisms are implemented by neuroplastic processes through the activation of adaptation and compensatory mechanisms and the restoration of the function lost by the body after illness or injury.

Objective. The purpose of our study was to review the literature to determine the features of neuroplasticity, its types, and its impact on the human body. The aim was also to analyze the extent to which brain neuroplasticity is involved in initiating angiogenesis (self-healing) processes through the activation of adaptation and compensatory mechanisms of the human body.

Materials and methods of the study. We analyzed foreign and domestic bibliographic scientific sources for the study, including articles, professional, scientific, medical, and pedagogical literature, modern research by specialists and leading scientists, etc.

Results. Brain plasticity is a universal biological property in most body cells, but this process is most pronounced in nerve cells. This feature of nervous tissue to structural and functional changes was described about 100 years ago and confirmed by many experiments and neurophysiological and neuroimaging studies.

Neuroplasticity is the primary mechanism underlying the body's adaptation to various external and internal influences. When the environment changes, the brain can modify its structures to ensure a more effective response. For example, if a person needs to learn new skills, the brain forms connections between neurons, allowing them to perform new tasks efficiently.

In addition, neuroplasticity plays an essential role in the brain's adaptation to stress and other psycho-emotional factors. In response to stressful situations, the brain can change its structure, strengthening or weakening certain connections between neurons, which allows a person to adapt to new conditions or reduce the negative impact of stressors.

Neuroplasticity is also an important component of compensation processes in the human body, particularly after brain damage. In the case of stroke, traumatic brain injury, or other pathological conditions, neuroplasticity allows the brain to

redirect functions that have been lost due to damage to other healthy parts of the brain. This restoration of functions occurs through changes in neural networks, allowing a person to partially or fully regain lost abilities.

Brain plasticity is the cornerstone of neurorehabilitation processes that enhance the adaptation and reorganization of cortical structures. Neuroplasticity is the basis for the physical rehabilitation of a number of neurological diseases, including stroke and brain and spinal cord injuries.

Neuroplastic changes in the brain are manifested primarily in the development of adaptation and compensatory mechanisms and the launch of angiogenesis processes. For example, if a person has lost their eyesight, their hearing becomes more acute. The brain creates new neural pathways and networks when a person systematically learns something new and gains new life experience (similar to how a new path is formed in the grass if you walk on it many times). Damage to the central nervous system activates neuroplasticity processes, and the use of rehabilitation methods helps to compensate for the disorders.

Thus, neuroplasticity is closely related to the nervous and humoral mechanisms of stress, the cytotoxic effects of various agents, acute and chronic cerebral ischemia and hypoglycemia, mechanisms of apoptosis, and neuroprotection. It is the most potent factor capable of modulation under the influence of external stimuli, which explains the high clinical effectiveness of reflexology in rehabilitating patients after damage to the nervous system and brain in particular [1,2].

Neuroplasticity is a dynamic process that lasts throughout life. Certain activities, such as learning, exercise, social interactions, etc., can enhance it. An example of neuroplasticity is the effect of exercise on increasing the number of neurons in the brain.

Reflexology is very important among the therapeutic and rehabilitation areas that help patients after strokes. The theoretical concepts that originated in ancient Eastern philosophy and medicine, which served as the basis for modern reflexology, are consistent with existing and proven concepts, particularly the idea of neuroplasticity when analyzed in detail. It explains its use in patients, particularly after strokes, as neuroplasticity is a set of processes aimed at remodeling and adapting the nervous system to physiological and pathological changes in the external and/or internal environment [2].

At the same time, studies by other scientists [3] have shown that people who received physical therapy after a brain injury recovered damaged neural connections faster. Thus, externally controlled influences on the human body through kinesitherapy, reflexology, etc., can be an effective way to implement neuroplasticity to restore patients' physical condition after brain injury, in particular.

Scientists identify several types of brain plasticity:

1. The primary one is the processes of remodeling synaptic connections aimed at optimizing the functioning of neural boundaries in the processes of phyllo- and introgression;

2. Tissue - the compensatory functional activity of the brain in cerebral damage, which is accompanied by the deterioration of function. Baseline neuroplasticity can be divided into adaptive (positive effect) and desadaptive (negative effect) [4,5].



Also, neuroplasticity can be short-term (occurs quickly and temporarily, for a few seconds or minutes, in response to changes in presynaptic activity) and long-term (happens in response to repeated or prolonged synapse stimulation). Long-term neuroplasticity is formed over hours and persists for a long time, involving morphological, structural, and functional changes in synapses [6].

Scientists also distinguish between synaptic plasticity (changes in the strength of synaptic connections between neurons) and morphological plasticity (changes in the structure of neurons), including the formation of new dendritic branches or even new neurons (neurogenesis).

However, different parts of the central nervous system have neuroplastic potential. The cerebral cortex has the highest adaptive resource due to the diversity of its cellular elements, which allows the use and formation of additional signal transmission pathways. This is due to the growth of axons and dendrites, active neuroneogenesis, systemic reorganization, and the formation of new synaptic connections.

The brain, while exhibiting very high functional activity, is incredibly vulnerable. It has been shown that even short-term pathogenic exposure causes a decrease in cell volume, loss of intercellular contacts, and changes in membrane formations, which lead to a pronounced energy deficit, development of ischaemic damage to cellular structures, and disruption of the integrative activity of the brain. This happens because the brain has no nutrient reserves; oxygen reserves last for 2-8 seconds, and glucose reserves last for 2-3 minutes. This means that at any given time, the brain's metabolic needs determine cerebral blood flow's perfusion characteristics [7].

Aerobic exercise with physical activity is the 'gold standard' of motor rehabilitation after a stroke, activating neuroplasticity processes. Special rehabilitation programs are used to restore the motor functions of the affected limbs, among which the most effective are methods of physical activity with biofeedback control. This process is the basis for rehabilitation of patients after strokes, injuries, or neurodegenerative diseases. Special training and exercises can stimulate neuroplastic processes and restore brain function, improving the quality of life.

Neuroplasticity depends on many factors, both genetic and external. Age is among the main factors affecting neuroplasticity, as the highest brain plasticity is observed at a young age, although the ability to undergo neuroplastic changes decreases over time.

Daily physical activity and regular exercise help to improve neuroplasticity by stimulating the growth of new neurons and strengthening neural connections.

Getting enough sleep is also essential. During sleep, your brain works overtime to recover from the day's activities. The primary function of sleep is to restore physical and mental strength, which allows you to adapt to changing conditions of the external and internal environment, thereby stimulating neuroplastic processes. During sleep, new neural connections are formed in our brains. They can be compared to building roads between cities. These connections are responsible for the acquisition of new knowledge and skills. When new information is captured during the day, it is stored in short-term memory. For this knowledge to reach deeper

structures and be remembered for a long time, it must be transferred to long-term memory. This process takes place during sleep. Once the information is transferred to long-term memory, short-term memory becomes free to absorb new knowledge.

Psycho-emotional health is also essential. In particular, stressful events, negative emotions, disruptions in social interaction, loneliness, isolation, traumatic events, depression, or anxiety can reduce the level of neuroplasticity.

Meditation, auto-training, friendly communication, positive emotions, sincere communication, diet, new experiences, exercise, good sleep and a balanced diet, yoga, and other stress reduction methods can help activate neuroplasticity.

Education and cognitive training, newly acquired skills, problem-solving, and learning foreign languages or musical instruments can stimulate changes in brain structures, improving neuroplasticity.

Conclusions. Neuroplasticity is an essential brain ability that contributes to the human body's adaptive and compensatory processes. It allows people to adapt to environmental changes, restore functions after injuries and illnesses, and improve their psycho-emotional state. Modern research and rehabilitation techniques that use the principles of neuroplasticity help people better cope with the effects of brain damage and maintain cognitive and emotional health throughout their lives.

Neuroplasticity is a key mechanism underlying learning and memory. When a person learns something new, the brain forms new connections between neurons or strengthens existing connections to store and recall that information. Over time, repeated learning can lead to lasting changes in brain structure and function. Therefore, neuroplasticity can be used in a targeted manner: to trigger the processes of angiogenesis, overcome stress and the effects of brain injuries, create new neural pathways, and implement valuable and positive habits.

The systematic practice of new activities, repeated exercise, reading, and active learning causes brain changes, creates new connections between billions of cells, and develops sensory and motor maps for each new activity (cells change their morphology, grow, and connect, forming new neural connections).

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