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THE HUMAN BRAIN 2025: NEUROEVOLUTION, PLASTICITY, AND ADAPTATION IN THE DIGITAL AGE

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Abstract:

This article analyzes the modern technological and biological evolution of the human brain. It discusses fundamental topics such as mechanisms of neuroplasticity, cognitive reserve, and the "gut-brain" axis. It also provides information on the unique anatomical condition of dextrocardia and its influence on brain function, as well as on neurointerface technologies in 2025.

Keywords:

Neuroplasticity, Connectome, Neurogenesis, BCI (Brain-Computer Interface), Dextrocardia, Dopamine, Cognitive Hygiene, Glymphatic System.

Introduction:

The Boundless Potential of the Brain

For a long time, it was believed that the adult human brain was unchangeable. However, research in 2025 shows that our "biological computer" is capable of forming new neural connections throughout our lives. This process is called neuroplasticity. The brain is not merely composed of separate regions (such as speech or vision centers), but rather it is a vast connectome — a complex network of all neurons.

Neurobiological Processes and Chemical Balance

• Dopamine: The motivation and reward system. "Likes" in the digital world can overstimulate this system, potentially weakening willpower.

• BDNF Protein: A "fertilizer" responsible for growing new neurons. Physical activity and intermittent fasting increase its levels.

• GABA and Glutamate: The brain's brake and accelerator system. Their balance is the foundation of mental health.

Dextrocardia and Brain Lateralization

Unique physiological traits, such as dextrocardia (the heart located on the right side), are of special importance in neurobiology.

Important fact: In cases of dextrocardia associated with Situs Inversus (mirror-image organ arrangement), the functional distribution of the brain (lateralization) may also change. In such individuals, the speech center may be located in the right hemisphere, or logical and creative functions may be more symmetrically distributed. This demonstrates the genetic connection between body symmetry and brain architecture.

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Functional State of the Brain and the Impact of the Digital Age

In the modern world, the brain's main structures are undergoing the following changes:

• Prefrontal Cortex (Logic and Planning): This area is becoming more prone to fatigue due to "information overload," increasing distraction and "clip thinking."

• Hippocampus (Memory and Navigation): Reliance on devices and GPS reduces hippocampal activity, increasing the risk of atrophy.

• Cortisol (Stress Hormone): Constant notifications keep the brain in chronic stress, which inhibits neurogenesis (formation of new neurons).

• BCI (Brain-Computer Interface): Technologies like Neuralink are moving beyond treating cognitive impairments toward artificially enhancing human intelligence.

• Glymphatic System (Brain Detox): This system operates only during deep sleep and clears toxins from the brain. Blue light from screens disrupts sleep, leading to toxin accumulation.

The "Second Brain" and Cognitive Hygiene

Through the gut-brain axis, the state of the microbiota directly affects mood and memory. 90% of serotonin is produced in the gut.

Recommendations for brain health in 2025:

• Dopamine detox: Spend one day a week without gadgets to restore receptors.

• Neurobics: Perform routine tasks (e.g., brushing teeth) with the non-dominant hand to create new neural pathways.

• Quality sleep: Get 7–8 hours of sleep per night for optimal glymphatic function.

Conclusion

In 2025, the human brain is under both biological and technological pressure. Neuroplasticity allows us to adapt to these changes, but maintaining cognitive health requires conscious cognitive hygiene.

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