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THE BRAIN AND ITS IMMENSE POWER

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ABSTRACT

The brain is a structurally determined device that defines the individuality and uniqueness of every person. For this reason, all people are different, and these abilities are not inherited. This article is devoted to the study of the human brain and the uncovering of its mysteries.

Keywords: Human, development, brain, functions, mind, capabilities, activity, information.

INTRODUCTION

"People should know that from the brain, and only from the brain, arise our joys, pleasures, laughter, and jokes, just as our sorrows, pain, grief, and tears. Thanks to the brain, we acquire wisdom and knowledge, see and hear, distinguish the ugly from the beautiful, the bad from the good, and the tasty from the bland. Due to the brain, we go mad and rave, are overcome by fear and horror. We have to endure all this when the brain is unhealthy. For this reason, I hold the opinion that this human organ possesses enormous power," wrote Hippocrates in the 4th century BCE in his book titled *On the Sacred Disease.*

Even back then, Hippocrates guessed that the human brain is one of the most complex, mysterious, and at the same time perfect creations of nature. In his time, neither he nor his contemporaries could have imagined how far we would progress in studying this organ. Thanks to technological advances in neuroimaging, medicine, biology, psychology, and neuroscience as a whole, we have been able to uncover the most important secrets of its anatomy and functions. However, there are still many mysteries and questions for which answers have not yet been found.

The brain is one of the least studied organs in the human body. Brain capacity is the brain's ability to learn what is necessary for the organism to survive in a constantly changing environment. It is not surprising that the concept of brain activity emerged with the advent of the 21st century. No other civilization before us has seen greater division between generations or undergone such rapid changes as ours.

Today, a significant portion of the knowledge gained by one generation may become completely useless for the next, creating the need for faster assimilation of acquired knowledge and the modeling of new ways of processing information so that the brain can be updated during generational changes. As humanity expands the boundaries of its civilization, moving from the specific to the global, from partial knowledge to more open knowledge, and constantly evolving, there arises the need to create an environment conducive to the emergence of more active minds capable of retaining their ability to learn throughout life. It should be noted that brain capacity implies a certain level of brain plasticity. This is important so that brain functions can be improved or restored under the influence of environmental factors, which, in

turn, have a greater impact on brain plasticity and its learning ability, forming a continuous and effective cycle.

In the brain, unlike in computers and phones, space never runs out. It is impossible to learn so much information that there is no room to store it. It is only important to remember that the brain needs sufficient sleep to better retain new information.

The brain is a complex organ that is part of the central nervous system. It is located in the front and upper part of the cranial cavity and is also present in all vertebrae. In the cranial cavity, the brain floats in a clear fluid called cerebrospinal fluid, which provides it with both physical protection and immunity. We often hear that, like muscles, the brain must be trained to avoid atrophy. Despite this, it is important to remember that it is not a muscle. This organ does not consist of myocytes but of millions of neurons connected by axons and dendrites. Each neuron individually and all together regulate the functions of our brain and body. Our breathing, eating, sleeping, ability to reason, fall in love, and argue—all of this is controlled by the brain.

The human cerebral cortex is one of the most complex and developed. It is not only larger than that of animals but also forms a complex structure with grooves and ridges, giving it a characteristic wrinkled appearance. The human brain weighs about 1.4–1.5 kg, and its volume is approximately 1130 cubic centimeters in women and 1260 cubic centimeters in men. The brain and spinal cord are covered by membranes called meninges, which protect the brain from impacts against the skull. For added protection, the brain “floats” in cerebrospinal fluid. It is believed that the brain consists of more than 100 billion brain cells, mainly glial cells and neurons. The brain works by transmitting information between neurons and other receptor or effector cells through electrochemical impulses. This transmission of information occurs during a synapse. During a synapse, neurons and cells contact each other through chemical discharges and electrical impulses, exchanging neurotransmitters that activate or inhibit the actions of another cell. Axon terminals are the presynaptic elements of neural communication through which a neuron establishes connections with dendrites, the soma, and even other axons. Information transfer between neurons takes milliseconds. Simultaneously and in coordination, hundreds of connections occur, enabling us to perceive, understand, and respond to the world around us.

The development of our brain begins in the embryonic stage and concludes in adolescence. As early as four weeks after conception, the neural tube starts to form, which will later develop into the entire nervous system, including the brain and spinal cord. At this stage, processes of cellular proliferation, migration, and differentiation commence, ultimately shaping this vital organ in our body. Neurons are produced in the neural tube and then migrate out to become part of the brain's key regions, where they differentiate and specialize depending on the functions they will perform.

It is estimated that during the prenatal period, more than 250,000 brain cells are generated every minute. At birth, an infant already possesses all the necessary nerve cells, though these cells are not yet interconnected. Over the first two years, these connections begin to form, primarily driven by genetic factors, interactions with the environment, and stimuli received. Myelination, the process in which nerve fibers are covered with an insulating fatty layer to enhance information transmission, accelerates this development. From 0 to 12 months:

Infants rely heavily on their spinal cord and brainstem, as these areas are not yet fully developed. As a result, they respond only to reflex stimuli and perform basic survival functions such as sleeping, feeding, or crying. Interaction with the environment helps establish new neural connections, enabling infants to quickly learn to focus on specific directions, mimic consonant sounds, and begin understanding speech. By age 3: The brain reaches approximately 80% of its adult volume. By this time, the limbic system and cerebral cortex are sufficiently developed, allowing children to recognize and express emotions, play, count, and talk. At this stage, the brain exhibits maximum plasticity, so much so that if one area is damaged, another may compensate for its functions. The brain continues to develop into adolescence, with the frontal lobes—the areas responsible for behavior, thinking, and problem-solving—maturing last. Even after the brain reaches maturity, neurogenesis (the creation of new neurons) and the establishment of new connections persist, aided by training and reinforcement of neural pathways. This is the foundation of brain plasticity.

As the primary organ of the central nervous system, the brain controls and regulates most functions of the human body. These include, vital functions: Such as breathing, heart rhythms, sleep, hunger, and thirst. Higher functions: Including reasoning, memory, attention, emotional control, and behavior. The brain governs all actions we perform, whether awake or asleep—breathing, swallowing, observing, listening, touching, tasting, reading, writing, singing, dancing, thinking in silence, speaking, loving, hating, walking, running, planning, acting spontaneously, imagining, or creating.

The mind can be defined as the sum of human intellectual and mental capabilities. It encompasses a range of psychological and cognitive processes such as perception, memory, reasoning, and more. Depending on how neurons are activated and connected in different areas of the brain, our intellectual and mental abilities can be more or less effective. Primary cognitive abilities are

Attention:
This is essential for communication with both the external and internal world. Attention allows us to focus on surrounding stimuli and respond appropriately.

Perception:
Perception is the mind's ability to interpret what we see, hear, feel, taste, and smell. It helps us understand our environment and perceive sensations within our own body.

Memory:
Memory enables us to store, retrieve, and recall information about what we have experienced or learned.

Reasoning:
Higher cognitive functions like reasoning allow us to compare new information with existing knowledge, hypothesize, and solve problems.

Coordination:

Coordination refers to the ability to perform precise and organized movements, allowing effective interaction with the environment.

Mental processes can be divided into two groups based on awareness:

Conscious processes:

These are psychological processes that we are aware of, know about, or can consciously control. For example, recalling studied information before an exam is a conscious mental process, as we voluntarily and purposefully retrieve stored knowledge.

Unconscious processes:

These include all psychological processes we perform without awareness. Scientific research shows that physiological changes occur in response to very brief emotional stimuli—lasting milliseconds—that we do not even notice. For instance, our body temperature may change unconsciously in reaction to subtle emotional triggers. An example of an unconscious mental process is our reaction to advertisements using subliminal suggestions. For instance, even if we do not consciously notice an image of juice in an ad, we might suddenly feel thirsty and desire to buy a drink.

Our primary cognitive processes form the basis of mental activity. These abilities develop throughout life, influenced by both genetics and experiences. Brain plasticity allows the brain to adapt to environmental demands. This means that depending on individual characteristics and how we stimulate our cognitive abilities, they may develop to varying degrees.

Mental disorders and illnesses are disruptions in mental health that negatively affect both the individual and those around them. The study of the mind is a focus of psychology, though psychiatry and philosophy also address this subject. Early proponents of **behaviorism** argued that the mind could not be studied scientifically and instead focused on behavior, sidelining research into the mind.

Cognitive psychology

This field sought to explain mental functioning using computational models, emphasizing psychological processes as the foundation for scientific inquiry into the mind.

Our brains are capable of much more than we can imagine. Thanks to the hidden capabilities of the mind, we make discoveries, achieve goals, and fulfill dreams. To accomplish more and avoid laziness, it is crucial to understand what the brain can do and to challenge ourselves continuously. The brain perceives both reality and imagination in the same way. We instinctively react to any action or phrase without distinguishing between truth and falsehood. The brain does not tire from intellectual work; feelings of fatigue and apathy primarily stem from emotions and stress. Most of the time, the brain operates in "automatic mode," especially during repetitive daily activities. Stepping out of our comfort zones is essential to "wake up" the brain.

The human brain, like a muscle, needs regular training. Activities such as solving crosswords, attending training sessions, taking educational courses, watching enriching films, eating healthily, getting fresh air, and exercising are essential for optimal brain function. Even in

sleep, the brain works twice as hard as during wakefulness. Regular breaks and physical activity help the brain relax and refresh. The brain also erases unnecessary information to make room for new memories. Forgetting unused data indicates that it has not been revisited for a long time.

The brain does not feel pain, as it lacks pain receptors. However, it reacts to signals transmitted by nerve endings. Engaging in consistent efforts can change the brain by forming new neural connections, enabling us to overcome challenges and achieve success.

To preserve brain health, it is vital to stay mentally active, move regularly, monitor blood pressure, and undergo regular check-ups.

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