Physiology of Higher Nervous Activity.

Innate Forms of Higher Nervous Activity

Physiology of Higher Nervous Activity

- It is the activity of the cerebral cortex and the nearest subcortical structures governing the behavior of humans and animals (I. P. Pavlov)

History of the Development of the Doctrine of Higher Nervous Activity

Rene Descartes (1596 – 1650)

Creating the Foundations of Reflex Theory

Rene Descartes:

- reflex principle of the body's response
- the concept of a stimulus
- idealistic ideas about the mechanism of reflex ("animal spirits»)

H. Bell and F. Magendie:

- the closing mechanism of the reflex arc in the spinal cord,
- dorsal roots of the spinal cord is composed of sensory fibers and the ventral - from motor.

The Law Of Bell-Magendie

Excitement on the afferent nerves goes through the spinal cord to the efferent ones.

Yirgi Prochazka (1749 – 1820)

- Introduced the term "reflex"
- Law of force
- Extended the reflex principle of activity to the higher parts of the brain (without evidence)

Ivan Mikhailovich Sechenov (1829 – 1905)

I. M. Sechenov's Reflex Doctrine

"Reflexes of the Brain" (1863)

- Reflex is interpreted as a universal form of interaction between the body and the environment.
- The role of interaction of excitation and inhibition processes in brain activity is shown.
- The reflex nature of mental processes is postulated (without experimental evidence).

Ivan Petrovich Pavlov (1849 – 1916)

I. P. Pavlov's Doctrine of Conditioned Reflexes

- The laboratory method of objective study of behavior is the method of conditioned reflexes.
- The role of the cerebral cortex in the formation of conditioned reflexes.
- The doctrine of types of higher nervous activity.
- The doctrine of I and II signal systems.
- Cortical theory of sleep and hypnosis has been developed.

Alexey Alekseevich Ukhtomsky (1875 – 1942)

- The dominant principle

Vladimir Mikhailovich Bekhterev (1857 – 1927)

- Physiological analysis of violations of physiological and mental functions in patients with focal lesions of the Central nervous system.

Peter Kuzmich Anokhin (1898 – 1974)

- Theory of functional systems

Classification of Forms of Higher Nervous Activity

- Congenital (Innate)
- Acquired

Innate Forms of Higher Nervous Activity

- Motivations
- Instincts
- Emotions
- Sleep

Motivation

Motivation is a state of high selective readiness of the Central Nervous System of the body to implement a complex behavioral response aimed at satisfying a vital need.

- **THE VITAL NEED (A DEFICIT OF ANYTHING)**
- **MOTIVATION**
- **BEHAVIOR**
- **RESULT (SATISFACTION OF THE NEED)**

Classification of Motivations

BIOLOGICAL

- Hunger
- Thirst
- Gender

SOCIAL

- Education
- Hobbies
- Getting spiritual values

PATHOLOGICAL

- Drug addiction
- Alcoholism
- Smoking

Structural and Functional Basis of Motivation

- **Hypothalamus and limbic system** (for biological and pathological motivations).
- **Cerebral cortex (associative), hypothalamus, limbic system** (for social motivations).

Reasons for Motivation

HUMORAL

- Changes in blood chemical constants (glucose, ions, amino acids, etc.).
- Changes in the level of hormones and neuropeptides (insulin, serotonin, dopamine, norepinephrine, oxytocin, etc.).

NERVOUS

- Pulsing from visceroreceptors (baro-, chemo -, osmo-, mechano-) and exteroreceptors.

Mechanism of Motivational Excitation

- The **DOMINANT** occurs in the structures of the Central nervous system.
- This is a persistent long-term dominant focus of excitement, which has a number of properties: irradiation, vector, the ability to lower the threshold of excitation of the structures involved, to suppress other centers of excitement, to attract excitement to itself.

Prevailing Motivation

- This is the main motivation that determines purposeful behavior at the moment.
- This motivation is based on the most important need at the moment.

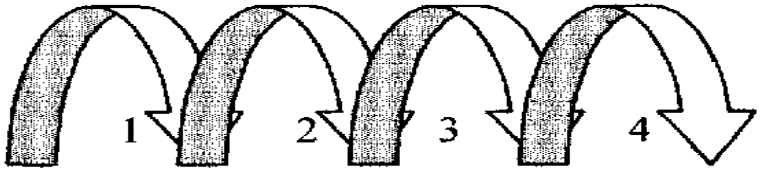
Features of Motivational Excitement

- **Personality** (there are features of the Central nervous system, hormonal and humoral status).
- **Great Energy** (activation of analyzers, memory, limbic system, reticular formation).
- **Leading Character** (motivation is ahead of excessive deviation of constants of the internal environment of the body from homeostasis).
- **Accompanied by Emotions**.

Instinct

- This is a complex innate behavioral response of the body, which is a complex of unconditioned chain reflexes.

- Instinctive behavior is carried out in the form of a complex of unconditional chain reflexes (the result of the next reflex is a trigger for the next one), and the final result satisfies an existing need (for example, the food instinct in a newborn).



result 1

result 2

the starting stimulus

result 3

final result

Mechanism of Occurrence of Instinctive Behaviors

For the emergence of instincts, you need:

- "internal factors" are humoral changes in the body based on biological needs.
- external (trigger) stimulus (food, water, an individual of the opposite sex, etc.).

Classification of Instincts

VITAL

- nutritional
- drinking
- defensive
- save energy

ZOOSOCIAL

- sexual
- parent
- territorial
- hierarchical

SELF-DEVELOPMENT

- research
- gaming
- freedom (overcoming the resistance)

Characteristics of Instincts

- This is a Biologically appropriate form of behavior formed in the course of evolution.
- This is a Genetically determined form of behavior.
- This is a Specific form of behavior.
- Instinct in its" pure " form is only manifested in humans during the neonatal period.

The Meaning of Instincts for Humans

- This is a form of behavior in early ontogenesis.
- This is the basis for the formation of acquired behaviors.
- This protection against the occurrence of biologically inappropriate forms of behavior (self-destructive etc.)

Negative Value of Instincts for a Person

- Anti-social behavior.
- Conflict between the conscious and subconscious, neurosis.

Emotions

- This is a special psychophysiological state of the whole organism, which reflects the presence of a need and the probability of its satisfaction (subjective experiences).

Classification of Emotions

By the nature of subjective perception.

- **Positive** (joy).

The person wants to repeat these emotions.

- **Negative** (fear, rage).

The person does not want to repeat these emotions.

Classification of Emotions

By energy consumption (by performance).

- **Sthenic emotions** are associated with increased performance, activation of vital activity and energy exchange (joy, rage).
- **Asthenic emotions** decrease of vital activity, efficiency and energy exchange (fear).

Causes of Emotions

- Biologically and socially significant incentives (pain, disaster, hospital)
- Cognitive process.
- Whether there is a need.

Information Theory of Emotions (Theory of P. V. Simonov)

$$E = - N \bullet (Ir - Ie)$$

- E - Emotion
- N - need
- Ir - information required
- Ie - existing information

Structural Foundations of Emotions

- The hypothalamus.
- The limbic system (cingulate gyrus, the amygdala, the transparent partition).
- The frontal and temporal lobes of the cortex.

Neurochemistry of Emotions

- Stimulation of the adrenergic, dopaminergic and serotonergic systems of the brain causes **positive emotions.**
- **Negative emotions** are caused by an excess of acetylcholine, substance P (neuropeptide).

Clinical Significance of Emotions

- Factor of health and quality of life
- Factor determining the course of the disease
- Recovery factor
- Factor in the development of diseases (psychosomatic: hypertension, duodenal ulcer, etc.)

Emotional Stress

- This is a reaction of mobilization of the body, which increases its resistance.

- Prolonged exposure to negative emotions (emotional stress) causes depletion of the body's reserve capabilities, the development of diseases.

Sleep

- This is a special periodic psychophysiological state of the body, in which consciousness is completely or partially turned off and there is no purposeful motor activity.

- **Types of sleep**
- Daily: monophase and polyphase
- Seasonal
- Hypnotic
- Narcotic
- Pathological

Neurophysiological Theories of Sleep

- **Subcortical theory of Hess**

The subcortical center of sleep is localized in the area of the 3rd ventricle of the brain. It is irritated by falling asleep.

- **I. P. Pavlov's cortical theory**

Sleep is the process of inhibition of neurons in the cerebral cortex.

- **The Pavlov-Hess cortical-subcortical theory.**

Phase of Sleep

- Orthodox phase (slow sleep)
- Paradoxical phase (fast sleep)

Change of phases per sleep cycle is 5-7 times.

Orthodox Phase (Slow Sleep)

- The reduction of metabolism
- Heart rate reduction
- The decrease in respiratory rate
- The decrease in body temperature
- Reduced skeletal muscle tone
- On EEG - θ - and δ - rhythms

Duration is 60-90 min.

Paradoxical Phase (Fast Sleep)

- Increased metabolism
- Heart rate increase
- Increased respiratory rate
- Fervescence
- Even more reduction in skeletal muscle tone
- Rapid eye movements
- The appearance of dreams
- On EEG - β-rhythm.

Duration is 5 - 30 min.

Sleep Functions

- Rest of the body and neurons of the cerebral cortex
- Processing of information, its systematization, translation into long-term memory

After studying the lecture, you need to be tested using the Google form service. Please fill in the fields full name, faculty and group number.

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https://forms.gle/7LUok8pq2mF29CkZ8