

The excitation and inhibition in the central nervous system

The functional states of neuron

1. The state of rest

excitatory = inhibition
influence influences

2. The state of excitation

excitatory > inhibition
influence influences

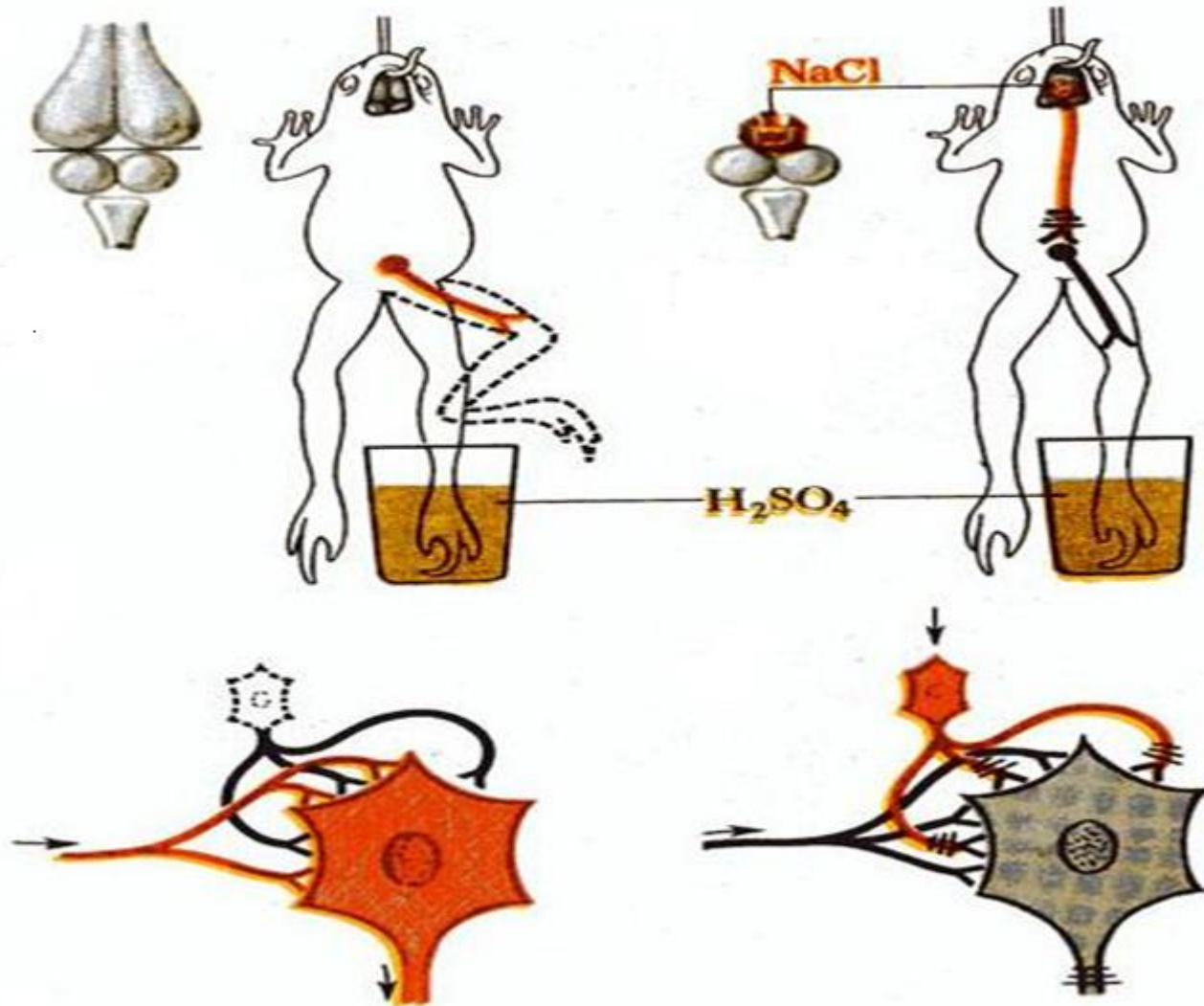
3. The state of inhibition

excitatory < inhibition
influence influences

The inhibition in the central nervous system

The inhibition – independent neural process that is initiated by excitation and leads to inhibition other of excitation

Central inhibition by I.M. Sechenov



Classification of inhibition

By the localization

- presynaptic
- postsynaptic

By the mechanism

- depolarizative
- hyperpolarizative

By the types of neural circuits

- Direct
- Reverse
- lateral
- reciprocal

Mechanism of presynaptic inhibition

Distribution of AP to the terminal inhibitory neuron,
release inhibitory mediator

Blockade of Ca-channels
of presynaptic membrane
of exciting neuron

depolarization of
presynaptic membrane of
exciting neuron

Reduced input Ca into the terminal of exciting neuron

Reduced secretion of mediator

Reduced EPSP

Inhibitory

The mechanism of postsynaptic inhibition

Distribution of AP to the terminal inhibitory neuron, release inhibitory mediator, the mediator interacts with receptors on the postsynaptic membrane



Opening of K^+ channels



Opening of Cl^- channels

K^+ comes out of cells

Cl^- enters in the cell



Hyperpolarization of the postsynaptic membrane

Increase the threshold depolarization

Reduced excitability



Inhibitory

- By the structure of the center

- Monosynaptic

- Polysynaptic

- By the nature of effector responses:

- Motor

- Vegetative

- By origin:

- Unconditional

- Legend

Comparative characteristics of conditioned and unconditioned reflexes

unconditioned

acquired

generic

stable

Turned on the effect of specific adequate stimulus

Reflex arc closes at lower parts of CNS

conditioned

hereditary

individual

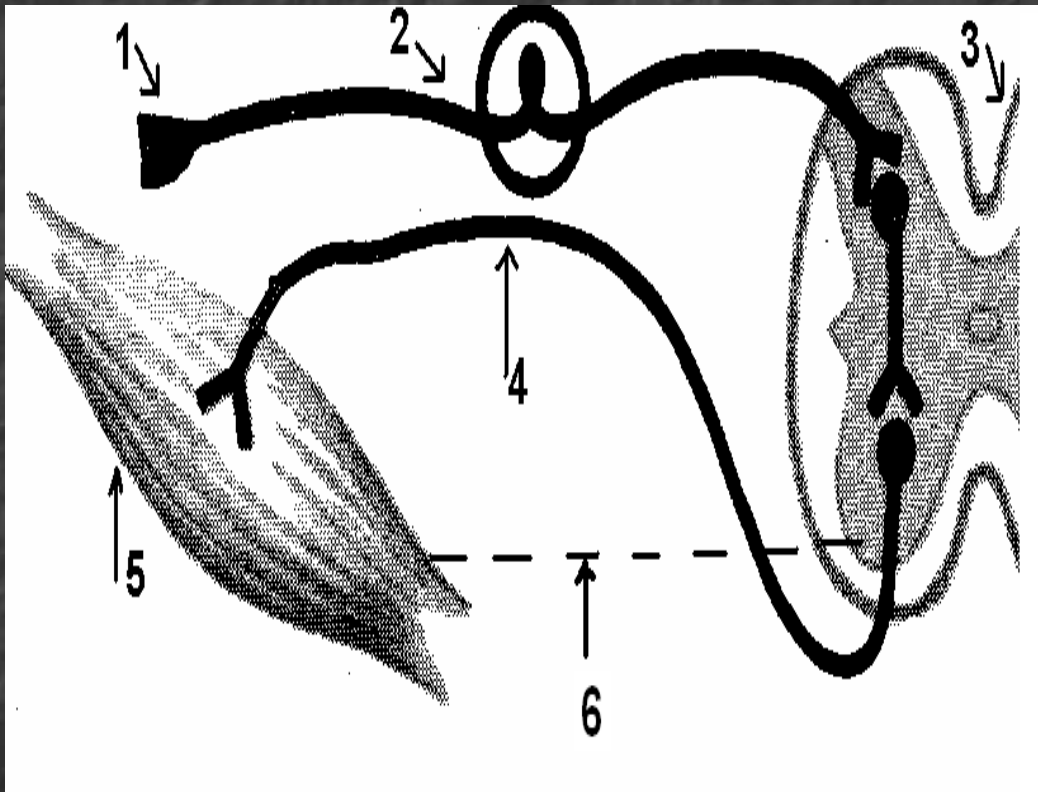
unstable

turned on the effect of any stimulus

Reflex arc closes at at the level of the cerebral cortex

formed on the basis unconditional

Reflex arc - neural circuit that provides the reflex



- 1 - the receptor*
- 2 - the afferent pathway*
- 3 - the nerve center*
- 4 - the efferent pathway*
- 5 - the effector*
- 6 - the reverse afferentiation*

Peculiarities of excitation along a reflexive arc

- The integrity of the reflex arc
- Specificity
- Isolation of conduction
- Sidedness of conduction
- Synaptic delay
- Synaptic potentiality
- A reversible afferentiation

Functions of individual components of the reflex arc

R E C E P T O R - a specialized cell or cell part, which distinguishes natural stimuli and transmit information about them to the CNS

Receptor functions:

Perception of stimulus

Initial filtering of information

Encoding of information

Information transfer

Classification of receptors

- By modality (feeling, formed in humans):

Visual

Olfactory

Thermal

Hearing

Flavor

Pain

- By factor that contributes to stimulation of the receptors:

Mechanoreceptors

Thermoreceptors

Chemoreceptor

Photoreceptors

- By the nature of the interaction between the receptor and the stimulus:

Distant

Contact

- By location:

 - Exteroreceptors**

 - Interoreceptors**

 - Proprioreceptors**

- By the ability to adapt:

 - Tonic**

 - Phase**

- By the mechanism of functioning:

 - Initially sensitive**

 - Secondary sensitive**

The mechanism of excitation of initially sensitive receptors

Effects of stimulus



Increased permeability of the membrane to sodium ions



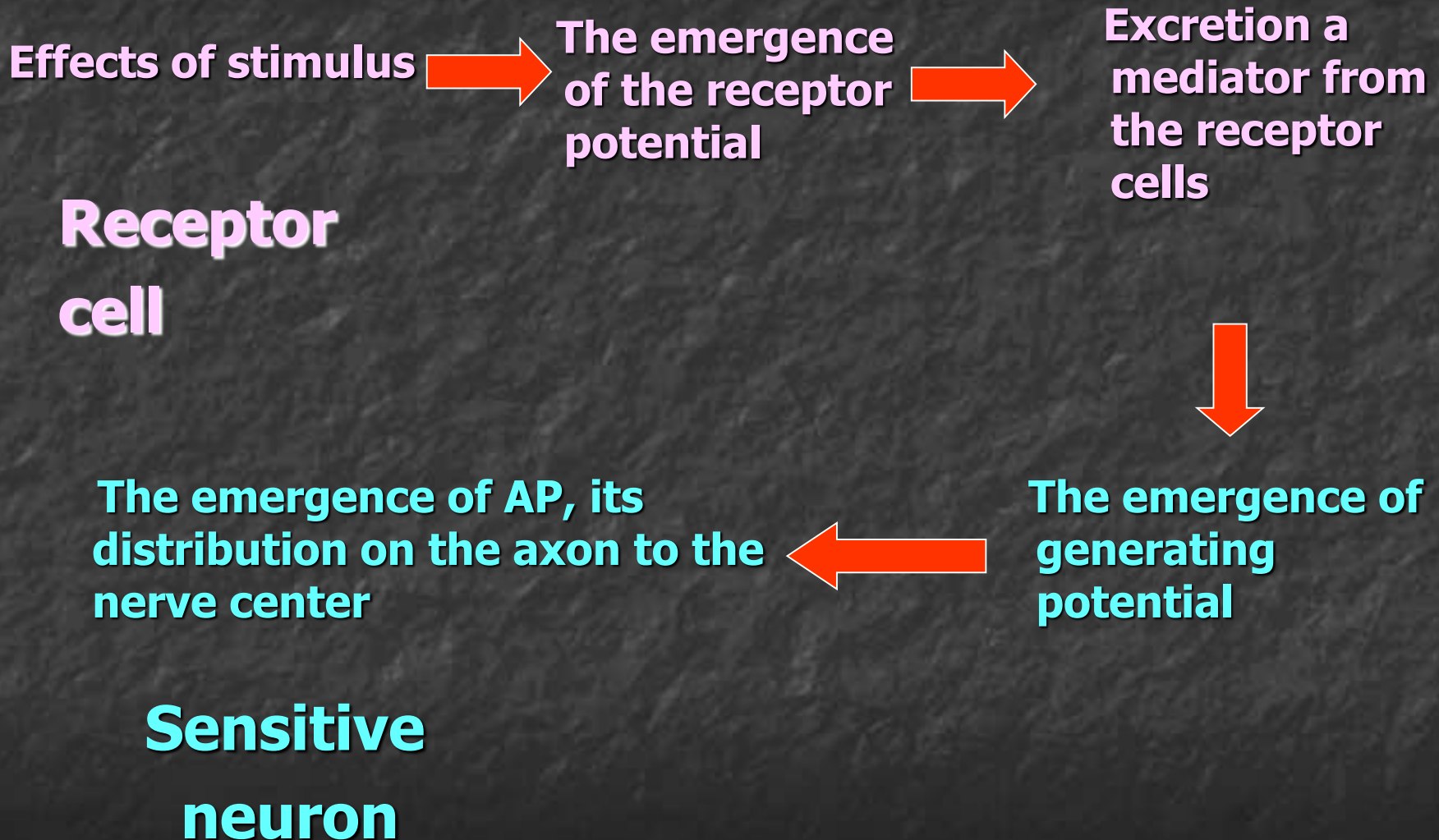
The emergence of the receptor potential



The emergence of AP, its distribution on the axon to the nerve center

Receptor cells

The mechanism of excitation of secondary sensitive receptors



Encoding – the process of transformation of the receptor potential in a series of AP (AP generation series)

Types of information that is encoded in the receptors

- The quality of the stimulus
- Power stimulus
- The duration of the stimulus

Nerve center

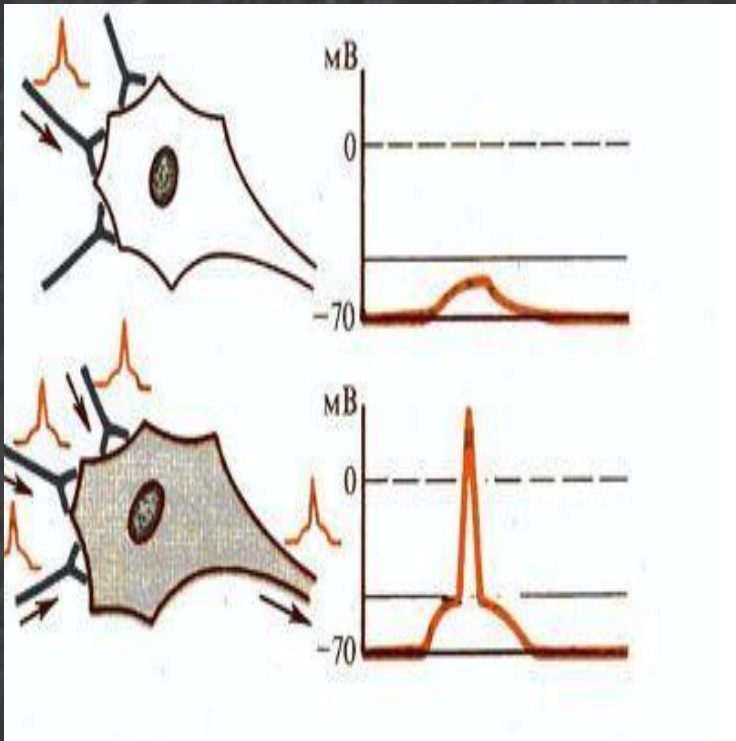
- A collection of nerve cells that organize a reflex or regulate specific physiological function

Properties of the nerve centers

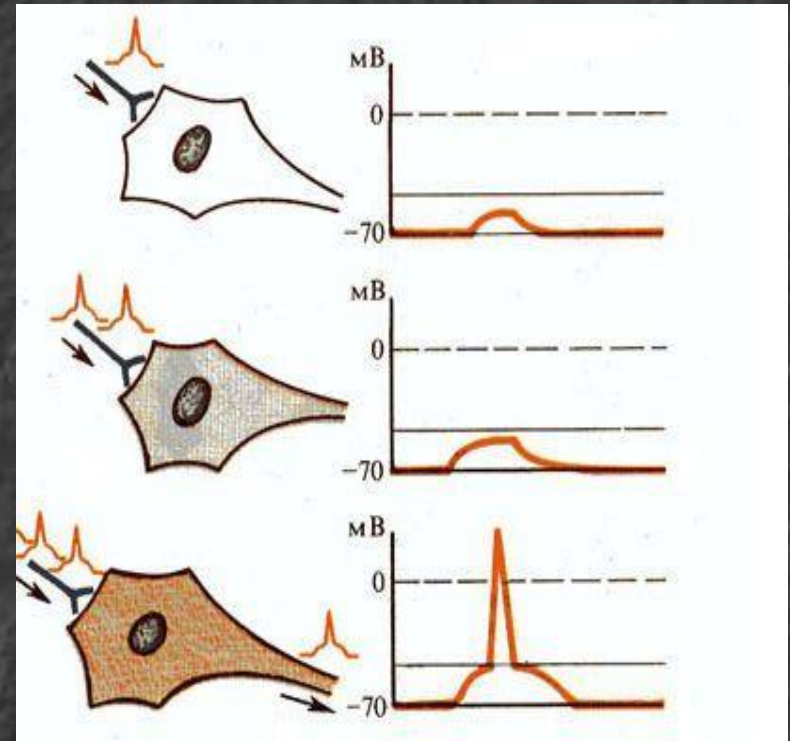
- 1. Tonus**
- 2. Summation**
- 3. Transformation of the rhythm**
- 4. Aftereffect**
- 5. Fatiguability**
- 6. High sensitivity to hypoxia**

Summation

Spatial



Temporal



The principles of interaction between nerve centers

- The principle of localization
- The principle of plasticity
- The principle of subordination
- The principle of corticalization
- The principle of dominant
- The principle of coordination

The principle of dominant

Dominant — is the dominant center of excitation in CNS, modifying and subordinates a work of other centers

Meaning of dominant:

1. Ensure the formation of behavioral reactions
2. Ensure the formation of emotions
3. Participation in the pathogenesis of diseases

Properties of dominant:

1. Increased excitability
2. Persistence of excitation
3. Ability to summation
4. Ability to brake
5. Inertia

Conditions of formation of dominant:

- Influence of environmental stimuli
- Influence of stimuli of the internal environment (level of nutrients, hormones)

Conditions of disappearance of dominant:

- Meeting the needs for which formed dominant
- The emergence of a stronger dominant
- Secondary braking in dominant

The principle of coordination

Coordination – harmonization of the activity of nervous centers

Coordination

Convergence

**summation
Alleviation
Occlusion
Common
terminal
way**

Divergence

**Irradiation
Generalization
Induction
Reciprocal
interaction**

Reverberation

Aftereffect