

Neurotransmitter

A neurotransmitter is a molecule capable of transmitting information between cells. Most often it is a nerve impulse between neurons, between nerve and muscle cells.

Synthesized neurotransmitter	The designation of the neuron synthesizing the neurotransmitter	Designation of individual clusters of neurons
Serotonin	B	B ₁ –B ₉
Dopamine	And	A ₈ –A ₁₇
Norepinephrine	And	A ₁ –A ₇
Adrenaline	C	C ₁ –C ₃
Acetylcholine	CH	CH ₁ –CH ₆
Histamine	E	E ₁ –E ₅

Acetylcholine

It is a mediator that transmits information from preganglionic neurons to postganglionic neurons in the system autonomic nerves. In parasympathetic, acetylcholine is released again at the postganglionic endings. In the sympathetic nervous system, it is released from the postganglionic terminal noradrenaline.

Nicotine receptors

They are part of ion channel. Individual channels differ from each other in structure. The **Muscle type** has two subunits α_1 and one subunit β, γ, δ (found in embryonic muscle), but in adulthood the γ is replaced by a subunit ϵ . **The neuronal type** has a α subunit and a β subunit, there may also be a situation where both subunits have α .

- Neuronal type;
- muscle type;
- ganglion type.

Muscarinic receptors

They are in the effector organs. M₁, M₂, M₃, M₄, M₅

Function

- Cognitive processes – memory and learning (decreased amount of ACh = Alzheimer's).
- Importance in regulating wakefulness and sleep.
- Motor skills.
- Motivation, in the reward process.
- In PNS – skeletal muscle activity, modulation of transmission nociception.
- In the ANS – ganglia and parasympathetic.

Catecholamines

Tyrosine → DOPA → Dopamine → NA (norepinephrine) → A (epinephrine)

Dopamine

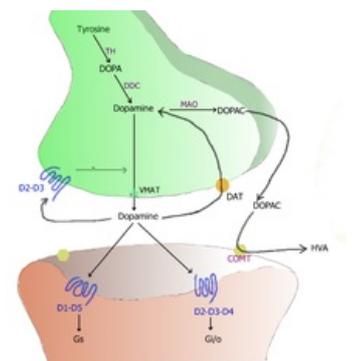
Dopamine is synthesized in nuclei A₈–A₁₇. The site of action is sympathetic ganglia.

Major dopaminergic neurons

A₈, A₉, A₁₀= midbrain
 A₉= *Substantia nigra*
 A₁₁–A₁₅= Midbrain
 A₁₂= *Nucleus arcuatus*
 A₁₇= retina

Receptors

D 1-like family – D₁, D₅



Scheme of action of dopamine

increase effects of adenylate cyclase (\uparrow cAMP)

D 2-like family – D₂, D₃, D₄

reduce the effects of adenylate cyclase (\downarrow cAMP)

Functions

They are of great importance in motivational behavior and addiction. In the case of an unexpected reward, the *stimulation* of DA is pronounced, which disappears during repetition and learning if the presentation of the reward does not evoke the stimulation of DA. In the absence of the expected reward, the DA signal is reduced. Two phases of the stimulus:

stimulus phase – *expectation of the pleasant*

phase of consumption – *experiencing a pleasurable stimulus*

It is also applied in the consolidation of memory traces. It is important in the regulation of **hypothalamic-pituitary system** and in the regulation of motor functions, but also in the **transmission and processing of nociceptive signals**.

Faults

Typically, Parkinson's disease and schizophrenia. There are also depression, substance addiction and eating disorders.

Adrenaline, Noradrenaline

Receptors

The receptors are *adrenergic*, with affinity for A and NA being almost the same.

- α_1
 - α_{1A}
 - α_{1B}
 - α_{1D}
- α_2
 - α_{2A}
 - α_{2B}
 - α_{2C}
 - α_{2D}
- β_1
- β_2
- β_3

Functions

They are used in the **stress response**. **This is the so-called eustress**, when an individual gives a double performance and the level is within the **homeostatic limits**. They are also important for attention, wakefulness and sleep.

Serotonin

As a neurotransmitter, it acts **vasoconstrictive**. It affects sleep and thermoregulation. Also called the **hormone of happiness**.

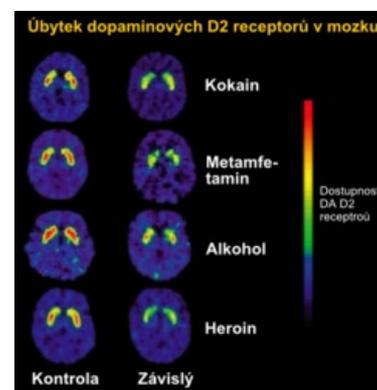
Receptors

The receptors for serotonin are predominantly metabotropic, coupled to G protein. It can bind to a large number of receptor types. The information is also led to all areas of the CNS.

Functions

They are used in waking and sleeping, circadian rhythms. It is also related to pain, food intake and sexual behavior. **Serotonin deficiency is associated with depression, anxiety and migraine.**

Histamine



Dopaminergic D2 receptor decline

The nuclei are designated E₁–E₅. They project into the spinal nuclei and into the cerebellum. Efferent pathways are to the entire cerebral cortex.

Functions

Application in the regulation of sleep cycles, energy and endocrine homeostasis. In the regulation of body temperature and food intake. It is related to the regulation of secretion hypothalamic-pituitary system. Also synaptic plasticity, learning and nociceptive signals.

Excitatory amino acids

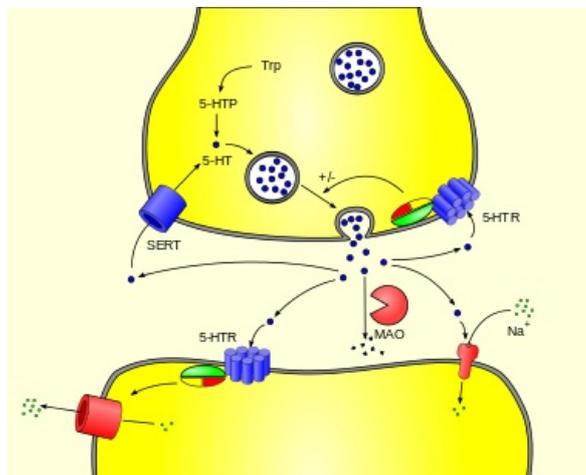
Glutamate

It interferes with and is found **everywhere in the CNS. Its receptors are metabotropic, where the first, second and third groups of glutamate receptors and ionotropic receptors are located, which include AMPA, kainate, NMDA.** The function is applied in motor coordination, memory processes (long-term potentiation), emotional processes and sensory information transfers. Decreased levels are associated with epilepsy, Huntington's chorea, ischaemic brain injury.

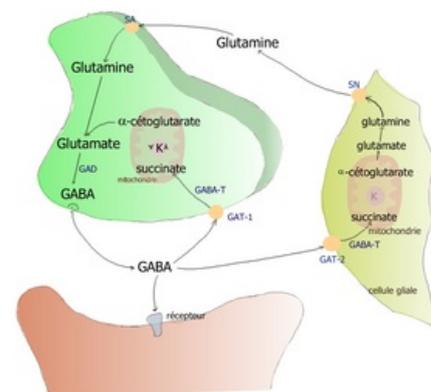
Inhibitory amino acids

GABA

The receptors for GABA are ionotropic GABA A and metabotropic GABA B. Its important pathways lead to the cerebellum. The function is associated with monosynaptic and polysynaptic signal transmissions. Transmission of nociceptive information, presynaptic selection of afferent flow of information into the CNS. They cause the chloride channel to open, resulting in hyperpolarization. Decreased GABA levels are associated with Huntington's chorea, is related to epilepsy and anxiety, i.e. anxiety.



Synapse



GABA receptor

Links

Related Articles

- Synapse
- Metabotropic receptors
- G-protein
- Acetylcholine
- Adrenaline
- Noradrenaline

References

- AMBLER, Zdeněk. Basics of neurology. 6th edition. Prague: Galén, 2006. pp. 171-181. ISBN 80-7262-433-4 .

Source

- Lecture in physiology, second year.
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