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Difference Between Hormones and Neurotransmitters

June 2, 2017 • by Lakna • 6 min read

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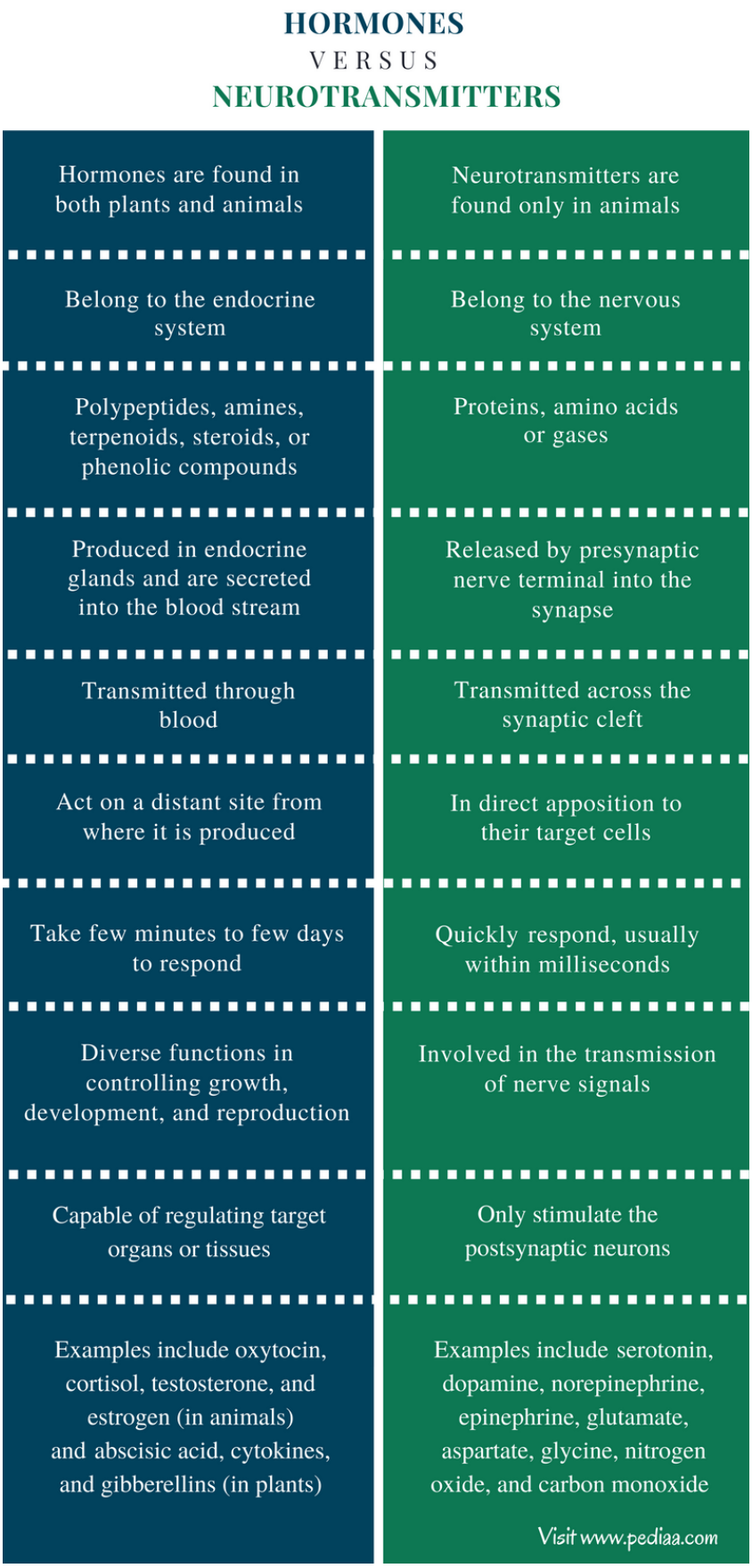
Main Difference – Hormones vs Neurotransmitters

Hormones and neurotransmitters are two types of chemical signaling molecules produced by animals. They are responsible for the behavior and attitudes of the organism. Hormones can be either proteins, lipids or cholesterol-based molecules. Neurotransmitters are proteins. The **main difference** between hormones and neurotransmitters is that **hormones are produced in endocrine glands and are released into the blood stream where they find their targets of action at some distance from its origin** whereas **neurotransmitters are released into the synaptic gap by a terminal of a stimulated presynaptic nerve cell, transmitting a nerve signal to its neighboring postsynaptic nerve cell.**

This article looks at,



What are Hormones

A hormone is a product of living cells, which circulates in fluids like blood or sap, and produces a specific, usually stimulatory effect on the activity of cells, remote from its point of origin. Therefore, hormones are chemical messengers that aid the communication between different parts of the body by sending chemical signals from one to the other. Hormones can be polypeptides, amines, terpenoids, steroids, or phenolic compounds. By the contact of a hormone, growth, and development of cells and tissues, initiation and maintenance of sexual development, food metabolism, body temperature, and mood can be affected. Since hormones are extremely powerful molecules, a few hormones may have a major effect on the body. Hormones are destroyed after their action. Therefore, they are not reusable. In animals, they are directly released into the bloodstream by endocrine glands and circulate through the body until the target tissue or organ is found. Some of the endocrine glands found in the body are pituitary gland, pineal gland, pancreas, liver, thymus, thyroid gland, adrenal gland, ovary, and testis. The hormones which are synthesized in the endocrine glands on the nervous system are shown in *figure 1*.

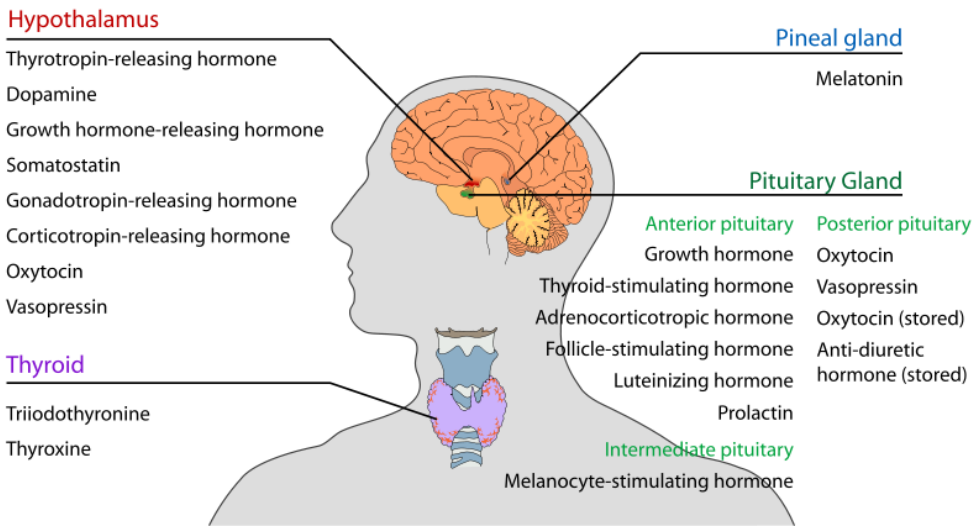


Figure 1: Hormones in the central nervous system

What are Neurotransmitters

Neurotransmitters are chemicals which transmit signals from a neuron to a target cell across a synapse. Some neurons produce only one type of a neurotransmitter. The coexistence of multiple neurotransmitters at the same time in the synapse allows neurons to exert several influences at the same time. Neurotransmitters are stored in synaptic vesicles, which are present at the terminal of the presynaptic neuron cells. Once the presynaptic neuron is stimulated by a nerve impulse, neurotransmitters are released into the synapse from the axon terminal. The released neurotransmitters diffuse across the synapse and bind to the specific receptors on the postsynaptic neuron. Generic neurotransmitter system is shown in *figure 2*.

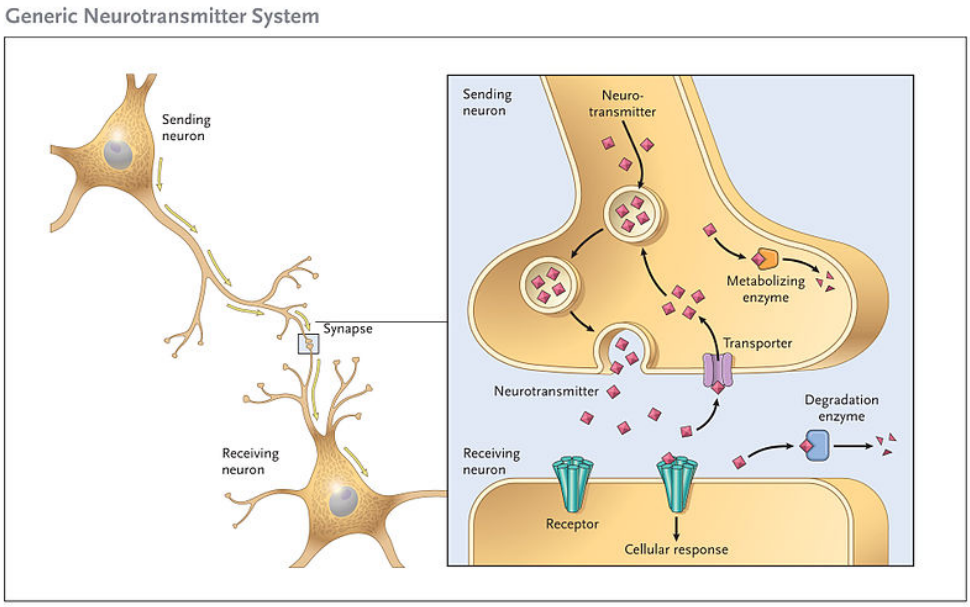


Figure 2: Generic neurotransmitter system

Classification of Neurotransmitters

Neurotransmitters are classified based on their function as excitatory and inhibitory neurotransmitters. **Excitatory neurotransmitters** increase the trans-membrane ion flow, allowing postsynaptic neurons to produce an action potential. In contrast, **inhibitory neurotransmitters** decrease the trans-membrane ion flow, prohibiting postsynaptic neurons to produce an action potential. However, the overall effect of excitatory and inhibitory functions determines whether the postsynaptic neuron "fires" or not. Several classes of neurotransmitters are found: acetylcholine, biogenic ammines, and amino acids.

Acetylcholine

Acetylcholine is produced from acetyl and choline and acts on the neuromuscular junctions. Acetylcholine-releasing neurons are also found in central nervous system (CNS). Once released, it binds to the receptor in postsynaptic neuron, and the degradation of acetylcholine from the receptor needs the enzyme, acetylcholinesterase.

Biogenic Amines

Biogenic amines include catecholamines like dopamine, epinephrine, and norepinephrine (NE) and indoleamines like serotonin and histamine. Catecholamines and indoleamines occur in the brain, involved in emotional behavior. They also help in regulating the biological clock. Dopamine, histamine, and NE can be either excitatory or inhibitory based on the type of receptor.

Amino Acids

Amino acid neurotransmitters include glutamate and gamma-aminobutyric acid (GABA). Glutamate in the brain promotes excitatory effects, and GABA has inhibitory effects. Neuropeptides like endorphins and Substance P are strings of amino acids, which mediate pain signals.

Difference Between Hormones and Neurotransmitters

Definition

Hormones: Hormones are regulatory substances which are produced in an organism and transported in tissue fluids like blood or sap, stimulating specific cells or tissues into action.

Neurotransmitters: Neurotransmitters are chemical substances which are released at the end of a nerve cell by the arrival of nerve impulse, transmitting the impulse into another neuron, muscle or some other structure.

Occurrence

Hormones: Hormones are found in both plants and animals.

Neurotransmitters: Neurotransmitters are found only in animals.

Belongs to

Hormones: Hormones belong to the endocrine system.

Neurotransmitters: Neurotransmitters belong to the nervous system.

Chemistry

Hormones: Hormones are polypeptides, amines, terpenoids, steroids, or phenolic compounds.

Neurotransmitters: Neurotransmitters are proteins, amino acids or gases.

Point of Release

Hormones: Hormones are produced in endocrine glands and are secreted into the blood stream.

Neurotransmitters: Neurotransmitters are released by presynaptic nerve terminal into the synapse.

Transmission

Hormones: Hormones are transmitted through blood.

Neurotransmitters: Neurotransmitters are transmitted across the synaptic cleft.

Point of Action

Hormones: Hormones act on a distant site from where it is produced.

Neurotransmitters: Neurotransmitters are in direct apposition to their target cells.

Response

Hormones: Hormones take few minutes to few days to make the response.

Neurotransmitters: Neurotransmitters quickly make the response, usually within milliseconds.

Function

Hormones: Hormones have diverse functions in controlling growth, development, and reproduction.

Neurotransmitters: Neurotransmitters are involved in the transmission of nerve signals.

Role

Hormones: Hormones are capable of regulating target organs or tissues.

Neurotransmitters: Neurotransmitters only stimulate the postsynaptic neurons.

Examples

Hormones: Oxytocin, cortisol, testosterone, and estrogen in animals and abscisic acid, cytokines, and gibberellins in plants are the examples of hormones.

Neurotransmitters: Serotonin, dopamine, norepinephrine, epinephrine, glutamate, aspartate, glycine, nitrogen oxide, carbon monoxide are the examples of neurotransmitters.

Conclusion

Hormones and neurotransmitters are two types of chemical signal molecules found in animals. Hormones occur in plants as well. They belong to the endocrine system. Hormones carry chemical signals to a tissue or organ which is far away from the site of origin. Therefore, hormones are produced by endocrine glands and are released to blood in animals and sap in plants in order to be transported to the site of action. Since neurotransmitters belong to the nervous system, they are only found in animals. Neurotransmitters are produced by presynaptic neurons and are released into the synapse. They affect target cells which are in direct apposition to the synapse. Therefore, the main difference between hormones and neurotransmitters is their site of release and site of action.

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Lakna, a graduate in Molecular Biology & Biochemistry, is a Molecular Biologist and has a broad and keen interest in the discovery of nature related things

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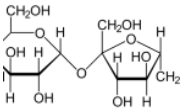

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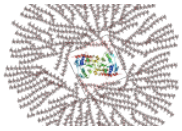

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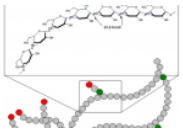

Difference Between Glycogenolysis and Gluconeogenesis

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