

UNIT-1 NEUROTRANSMITTERS

Neurotransmitter is a chemical substance that acts as a **mediator** for the transmission of nerve impulse from one neuron to another neuron through a synapse.

Criteria for neurotransmitter

- It must be found in a neuron
- It must be produced by a neuron
- It must be released by a neuron
- After release, it must act on a target area and produce some biological effect
- After the action, it must be inactivated.

Classification of neurotransmitters

Depending upon chemical nature

- **Amino Acids**

GABA, glycine, glutamate (glutamic acid) and aspartate (aspartic acid).

- **Amines**

Noradrenaline, adrenaline, dopamine, serotonin and histamine.

- **Others**

Acetylcholine, Nitric oxide (NO).

Group	Name	Site of secretion	Action
Aminoacids	GABA	Cerebral cortex, cerebellum, basal ganglia, retina and spinal cord	Inhibitory
	Glycine	Forebrain, brainstem, spinal cord and retina	Inhibitory
	Glutamate	Cerebral cortex, brainstem and cerebellum	Excitatory
	Aspartate	Cerebellum, spinal cord and retina	Excitatory
Amines	Noradrenaline	Postganglionic adrenergic sympathetic nerve endings, cerebral cortex, hypothalamus, basal ganglia, brainstem, locus coeruleus and spinal cord	Excitatory and inhibitory
	Adrenaline	Hypothalamus, thalamus and spinal cord	Excitatory and inhibitory
	Dopamine	Basal ganglia, hypothalamus, limbic system, neocortex, retina and sympathetic ganglia	Inhibitory
	Serotonin	Hypothalamus, limbic system, cerebellum, spinal cord, retina, gastrointestinal (GI) tract, lungs and platelets	Inhibitory
	Histamine	Hypothalamus, cerebral cortex, GI tract and mast cells	Excitatory
Others	Nitric oxide	Many parts of CNS, neuromuscular junction and GI tract	Excitatory
	Acetylcholine	Preganglionic parasympathetic nerve endings Postganglionic parasympathetic nerve endings Preganglionic sympathetic nerve endings Postganglionic sympathetic cholinergic nerve endings Neuromuscular junction, cerebral cortex, hypothalamus, basal ganglia, thalamus, hippocampus and amacrine cells of retina	Excitatory

Depending upon function

- **Excitatory neurotransmitters**

Acetylcholine and noradrenaline

- **Inhibitory neurotransmitters**

Gamma aminobutyric acid (GABA) and dopamine

Excitatory neurotransmitters	Inhibitory neurotransmitters	Neurotransmitters with excitatory and inhibitory actions
1. Acetylcholine 2. Nitric oxide 3. Histamine 4. Glutamate 5. Aspartate	1. Gamma-aminobutyric acid 2. Glycine 3. Dopamine 4. Serotonin	1. Noradrenaline 2. Adrenaline

Transport and release of neurotransmitter

Neurotransmitter is produced in the cell body of the neuron and is transported through axon. At the axon terminal, the neurotransmitter is stored in small packets called vesicles.

Under the influence of a stimulus, these vesicles open and release the neurotransmitter into synaptic cleft. It binds to specific receptors on the surface of the postsynaptic cell. Receptors are G proteins, protein kinase or ligand-gated receptors.

Inactivation of neurotransmitter

After the execution of the action, neurotransmitter is inactivated by four different mechanisms:

- It diffuses out of synaptic cleft to the area where it has no action
- It is destroyed or disintegrated by specific enzymes
- It is engulfed and removed by astrocytes (macrophages)
- It is removed by means of reuptake into the axon terminal.

Reuptake of neurotransmitter

- Reuptake is a process by which the neurotransmitter is taken back from synaptic cleft into the axon terminal after execution of its action.
- Reuptake process involves a specific carrier protein for each neurotransmitter.

