Serotonin

Serotonin or 5-hydroxytryptamine (5-HT) is a monoamine neurotransmitter. Biochemically derived from tryptophan, serotonin is primarily found in the gastrointestinal tract (GI tract), blood platelets, and the central nervous system (CNS) of animals, including humans. It is popularly thought to be a contributor to feelings of well-being and happiness.

Classification

It is classified based on its function, location, and the receptors it interacts with. Here are the main classifications of serotonin:

Neurotransmitter: Serotonin functions as a neurotransmitter in the central nervous system (CNS), where it acts as a chemical messenger between nerve cells (neurons). It is released from the axon terminals of serotonergic neurons into the synapses, where it binds to specific receptors on the target neurons, transmitting signals and modulating neural activity.

Peripheral Serotonin: Apart from its role as a neurotransmitter in the CNS, serotonin is also found in various peripheral tissues and organs, such as the gastrointestinal (GI) tract, blood platelets, and other cells. In the GI tract, serotonin helps regulate gut motility, secretion, and sensation.

Serotonin Receptors: Serotonin exerts its effects by binding to specific receptors known as serotonin receptors or 5-HT receptors. These receptors are classified into several subtypes (e.g., 5-HT1, 5-HT2, 5-HT3, etc.) based on their molecular structure and signaling pathways.

Common subtypes of serotonin receptors include:

5-HT1A, 5-HT1B, 5-HT1D, 5-HT1E, 5-HT1F 5-HT2A, 5-HT2B, 5-HT2C 5-HT3 5-HT4 5-HT5A, 5-HT5B 5-HT6 5-HT7 Each subtype of receptor is located in different brain regions and peripheral tissues, and they mediate different physiological responses when activated or inhibited by serotonin or other ligands.

Functions and Effects: Serotonin's effects are diverse and depend on the receptor subtype and the brain region or tissue where the receptors are located. It plays a role in regulating mood, sleep, appetite, pain perception, body temperature, blood pressure, gastrointestinal function, and various other processes.

Classification in Drug Targets: Serotonin and its receptors are important drug targets in pharmacology. Many medications, including antidepressants, antipsychotics, antiemetics, and anti-migraine drugs, act on serotonin receptors to modulate its signaling and alleviate various medical conditions.

It's worth noting that while serotonin has numerous beneficial roles, imbalances or dysregulation of serotonin levels or receptor activity can be associated with various mental health disorders and other medical conditions. As a result, understanding serotonin's classification and its interactions with receptors is crucial for developing effective treatments and medications targeting the serotonin system.

Function

Recent animal research indicates that dopamine and serotonin, neuromodulators traditionally linked to appetitive and aversive processes, are also involved in sensory inference and decisions based on such inference. Bang et al. tested this hypothesis in humans by monitoring sub-second striatal dopamine and serotonin signaling during a visual motion discrimination task that separates sensory uncertainty from decision difficulty in a factorial design. Caudate nucleus recordings (n = 4) revealed multi-scale encoding: in three participants, serotonin tracked sensory uncertainty, and, in one participant, both dopamine and serotonin tracked deviations from expected trial transitions within our factorial design. Putamen recordings (n = 1) supported a cognition-action separation between the caudate nucleus and putamen-a striatal sub-division unique to primates-with both dopamine and serotonin tracking decision times. These first-of-their-kind observations in the human brain reveal a role for sub-second dopamine and serotonin signaling in non-reward-based aspects of cognition and action [1].

1)
Bang D, Kishida KT, Lohrenz T, White JP, Laxton AW, Tatter SB, Fleming SM, Montague PR. Sub-second Dopamine and Serotonin Signaling in Human Striatum during Perceptual Decision-Making. Neuron. 2020 Oct 5:S0896-6273(20)30715-7. doi: 10.1016/j.neuron.2020.09.015. Epub ahead of print. PMID: 33049201.

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