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Synaptic Transmission [1]

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Most neurons do not communicate directly with one another due to the space that separate them, the synaptic cleft. A process called synaptic transmission is necessary for these neurons to communicate. Chemical synapses enable the transmission of information (action potentials) from one neuron to another. These synapses require chemicals known as neurotransmitters.

The process of synaptic transmission involves four steps:

I. Synthesis and Storage

Neurotransmitters are divided into two categories: (1) small-molecule neurotransmitters and (2)neuropeptides. Small-molecule neurotransmitters are processed within the axon terminal. An example of this is acetylcholine (Ach), which is particularly known as an excitatory neurotransmitter. On the other hand, neuropeptides are larger than small-molecule neurotransmitters and act as messengers. Because o their large size, they are made inside the neuronal cell body.

Unlike the small-molecule neurotransmitters, the synthesis of neuropeptides requires more effort and is likened to that of the synthesis of an ordinary secretory protein. The first step in neuropeptide synthesis is DNA transcription, followed by messenger RNA or mRNA construction and travel, and then translation.

After the synthesis of neurotransmitters [3], they are stored in vesicles located at the axon terminal. While in storage, they await the arrival of an action potential, which is the triggering factor for their release.

II. Neurotransmitter Release

The terminal of a neuron serves as the storage of vesicles containing neurotransmitter when at rest. These vesicles are strategically located in active zones, places found at the pre-synaptic membrane. Once an action potential arrives at the presynaptic neuron terminal, there would be a considerable influx of calcium ions, causing the neurotransmitter to be released from the vesicles.

III. Neurotransmitter Postsynaptic Receptors

Neurotransmitters released into the synaptic cleft go into an interaction at the postsynaptic cell together with receptor proteins. In order to interact, these neurotransmitters must be recognized by postsynaptic receptors first. As a result, membrane ionic channels open, and another action potential is initiated. In turn, this leads to depolorization.

IV. Inactivation of Neurotransmitters

Some neurotransmitters are sent back to the synaptic cleft once they have been identified by the appropriate post-synaptic receptors. Special transporter proteins transfer these neurotransmitters back to the pre-synaptic cells. Then, they undergo re-packaging and re-storage in a vesicle until it is needed once again for chemical signalling. Other neurotransmitters simply diffuse away.

Types of Neurotransmitters

Studying the different types of neurotransmitters is necessary due to the fact that many drugs affect their levels to deal with various psychological and behavioural disorders. These neurotransmitters are divided into two major types: acetylcholine and biogenic amines.

Acetylcholine is the only neurotransmitter that helps the proper transmission of information between motor neurons and voluntary muscle cells, via synapses. Alzheimer's disease is linked to the degeneration of the acetylcholine-producing cells.

Biogenic amines are a group of neurotransmitters which are comprised of dopamine, norepinephrine and serotonin. Low levels of dopamine are associated with Parkinson's disease, whereas decreased levels of serotonin and norepinephrine are associated with clinical depression.

Other neurotransmitters include gamma aminobutyric acid (GABA), glycine, endorphins and substance P. The increase in the action of **GABA** gives a tranquilizing effect. **Glycine** serves as the major inhibitory neurotransmitter both in the brain stem and in the spinal cord. **Endorphins** modulate other neurotransmitters' activities, and are called "neuromodulators". Lastly, **Substance P** is related to the experience of pain and is found in neural circuits.

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