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ASSIGNMENT

Describe in details the synthesis of two named neurotransmitters

1. Synthesis of Acetylcholine

Acetylcholine is synthesized from acetyl coenzyme A and choline by the enzyme choline acetyltransferase. In the nervous system, this enzyme is thought to exist primarily in the nerve terminal cytoplasm. Coenzyme A is synthesized in mitochondria and accesses choline acetyltransferase following transport across the mitochondrial membrane into the cytoplasm. In addition to its synthesis in the liver, choline employed in acetylcholine production is derived from dietary sources. There is a carrier system in capillary endothelial cells that is responsible for transport of choline, in its free and phospholipid forms, into the brain. Hydrolysis of choline-containing phospholipids may also liberate choline that is used in acetylcholine synthesis. As choline acetyltransferase is not saturated by concentrations of acetyl coenzyme A and choline that are estimated to be present in the nerve terminal, it appears that the rate of acetylcholine synthesis is dependent on precursor availability. Enzyme activity is also regulated by product inhibition; by binding at an allosteric site on choline acetyltransferase, acetylcholine inhibits its activity. In addition, mass action and neuronal activity influence the rate of acetylcholine formation. Short-term regulation of enzyme activity is partly achieved by phosphorylation induced by protein kinases. There are no very specific and potent inhibitors of the enzyme and it should be noted that pharmacological blockade of this step (e.g. with naphthylvinylpyridine) in the life-cycle of acetylcholine produces a less profound effect on the transmitter than does inhibition of choline transport.

2. Synthesis of Epinephrine

Epinephrine is synthesized from norepinephrine within the adrenal medulla, which are small glands associated with the kidneys. Preganglionic fibers of the sympathetic nervous system synapse within the adrenals. Activation of these preganglionic fibers releases acetylcholine, which binds to postjunctional nicotinic receptors in the tissue. This leads to stimulation of NE synthesis within adrenomedullary cells, but unlike sympathetic neurons, there is an additional enzyme (phenyl ethanolamine-N-methyltransferase) that adds a methyl group to the NE molecule to form epinephrine. The epinephrine is released into the blood perfusing the glands and carried throughout the body.