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Assignment

1) Glutamate

Glutamate is a nonessential amino acid that does not cross the blood-brain barrier and must be synthesized in neurons from local precursors. The most prevalent glutamate precursor in synaptic terminals is glutamine. Glutamine is released by glial cells and, once within presynaptic terminals, is metabolized to glutamate by the mitochondrial enzyme glutaminase. Glutamate can also be synthesized by transamination of 2-oxoglutarate, an intermediate of the tricarboxylic acid (TCA) cycle. Hence, some of the glucose metabolized by neurons can also be used for glutamate synthesis.

Glutamate synthesis and cycling between neurons and glia. The action of glutamate released into the synaptic cleft is terminated by uptake into neurons and surrounding glial cells via specific transporters. Following its packaging into synaptic vesicles by a magnesium ion (Mg^{2+})/ATP-dependent transport process, glutamate-filled vesicles are ready to dock and be released from presynaptic sites. Glutamate is removed from the synaptic cleft by several high-affinity glutamate transporters present in both glial cells and presynaptic terminals. Glial cells contain the enzyme glutamine synthetase, which converts glutamate into glutamine; glutamine is then transported out of the glial cells and into nerve terminals. In this way, synaptic terminals cooperate with glial cells to maintain an adequate supply of the neurotransmitter. This overall sequence of events is referred to as the glutamate-glutamine cycle

2) Oxytocin

The oxytocin peptide is synthesized as an inactive precursor protein from the OXT gene. This precursor protein also includes the oxytocin carrier protein neurophysin I. The inactive precursor protein is progressively hydrolyzed into smaller fragments (one of which is neurophysin I) through a series of enzymes. The last hydrolysis that releases the active oxytocin nonapeptide is catalyzed by peptidylglycine alpha-amidating monooxygenase (PAM). The activity of the (PAM) peptidylglycine alpha-amidating monooxygenase enzyme system is dependent upon vitamin C , which is a necessary vitamin cofactor.