

NEUROTRANSMITTER HALL OF FAME (handout) (Learn 3rd)

Neurotransmitter	Effect	Clinical Examples
Acetylcholine ACh	<p>Excitatory or Inhibitory depending on receptors.</p> <p>Always excitatory at skeletal muscle.</p>	<ul style="list-style-type: none"> • Reduced levels of ACh in some brain areas are noted in <u>Alzheimer's patients</u>. • <u>Nicotine</u> mimics ACh in the brain triggering the release of excitatory hormones such as epinephrine and norepinephrine. • Effects of ACh at skeletal muscle are prolonged by <u>organophosphate insecticides (Malathion)</u> and nerve gas which inhibit AChase resulting in tetanic muscle spasms and neural "frying." • Release of ACh at skeletal muscle is inhibited by <u>botulinus toxin</u>. • ACh receptors at skeletal muscle can be blocked by <u>curare</u>. • Reduction in # of ACh receptors at skeletal muscle in <u>myasthenia gravis</u>.
<p>Norepinephrine NE (a.k.a. noradrenaline)</p> <p>A "feel good" NT.</p>	<p>Excitatory or Inhibitory depending on receptors.</p>	<ul style="list-style-type: none"> • NE and Dopamine are released in greater amounts in your brain helping to create those "<u>warm fuzzy</u>" feelings associated with affection, romance, love, etc. Infants who receive lots of affection show more rapid and extensive brain development. • <u>Cocaine and amphetamines</u> increase the release and block the reuptake of NE and dopamine resulting in over stimulation of the cerebral cortex. This is the "rush" users get addicted to. • <u>Tricyclic antidepressants</u> (Elavil & others) inhibit reuptake of NE and serotonin from synaptic clefts thereby prolonging their effects. • NE is released in greater amounts in your brain when you have a <u>positive "can do" attitude</u>. This causes the release of more nerve growth factor to help with learning and/or recovery from stroke. People with positive attitudes recover faster and more completely. • NE is <u>released in greater amounts during the "fight or flight" response</u> thereby increasing the # of neurons responding to sensory input. You perceive this as "heightened awareness." • <u>MAO inhibitors</u> prolong the effects of NE and serotonin by inhibiting the action of the enzyme monoamine oxidase (MAO).
Endorphins and Enkephalins	Generally Inhibitory	<ul style="list-style-type: none"> • Your own natural opiates... "your body's own morphine." • Inhibit the sensation of pain by: <ol style="list-style-type: none"> (1) inhibiting the release of substance P or (2) inhibiting (filtering out with IPSPs) ascending pain messages at the hypothalamus or thalamus or by enhancing the release of dopamine at frontal cortex. • <u>Narcotic pain killers</u> such as morphine, Demerol, heroin, and methadone <u>mimic</u> endorphins & enkephalins. They bind to and activate the same receptor sites.

<u>Neurotransmitter</u>	<u>Effect</u>	<u>Clinical Examples</u>
Substance P	generally Excitatory	<ul style="list-style-type: none"> • The “Pain NT.” • Released in the spinal cord at the ends of afferent (sensory) neurons carrying pain impulses to the CNS. • <u>Endorphins, enkephalins, morphine, heroin</u>, etc. may reduce pain by inhibiting the release of Substance P thereby reducing the # of impulses reaching the cerebral cortex.
Serotonin	Generally Inhibitory	<ul style="list-style-type: none"> • Involved with mood, anxiety, appetite, sleep induction, memory, and learning.. • Depending upon location in brain the effect may be calming & soothing OR stimulating and “mood elevating” similar to the “feel good” NTs. • <u>Chocolate</u> elevates serotonin levels. • Helps regulate the amount of information getting through the <u>thalamus</u> to the frontal cortex. • Serotonin also helps you to be cautious and careful and use reasonable judgment. Drinking <u>alcohol</u> decreases serotonin levels causing you to have poor judgment, act irrationally, start fights, act stupid, think you can drive safely when you can’t, etc. • Deficiencies of serotonin lead to anxiety and depression. • Reuptake of serotonin is inhibited by antidepressants such as <u>Prozac</u> and <u>Paxil</u> which are Serotonin Specific Reuptake Inhibitors (SSRI). Effects of serotonin at chemical synapses are thereby prolonged. • Levels of serotonin are often elevated in <u>schizophrenia</u> causing delusions, euphoria, & hallucinations.
Dopamine A “feel good” NT	generally Excitatory in cerebral cortex Inhibitory in the substantia nigra of the midbrain	<ul style="list-style-type: none"> • Dopamine is released (along with NE) in greater amounts causing those “warm fuzzy” feelings associated with affection, romance, love, etc. • Endorphins cause levels of dopamine to increase thereby “smothering” the brain with pleasurable sensations rather than painful sensations. • Cocaine and amphetamines increase the release and/or block the reuptake of dopamine and NE resulting in over stimulation of the cerebral cortex. This is the “rush” users get addicted to. • Dopamine deficiencies are often present in cases of schizophrenia. • Dopamine deficiencies are present in Parkinson’s disease. Treatment is L-dopa to stimulate the synthesis of dopamine.
Glutamate	generally Excitatory	<ul style="list-style-type: none"> • Important in learning and memory • The “Stroke NT.” During a <u>stroke</u>, oxygen deprived neurons release large amounts of glutamate causing nearby neurons to release nitric oxide (NO) which then damages or kills other nearby cells.