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| **NEUROTRANSMITTER** | **LOCATION** | **FUNCTION** | **ASSOCIATED DISEASES** | **DRUG EFFECTS** |
| Acetylcholine | Neuromuscular junction; muscle contraction, peripheral nervous system | Memory & learning | Alzheimer’s disease (deficit) | Black widow spider (agonist)  Curare poisoning (antagonist)  Botox (antagonist) |
| Dopamine | Midbrain | Movement, learning, attention, emotions, motor activity, motivation, mood | Schizophrenia (excess)  Depression (deficit)  Social anxiety (low levels)  Parkinson’s Disease (deficit) | Cocaine (dopamine transporter blocker)  Amphetamines (increase dopamine in synaptic gap)  MDMA (ecstasy) increases |
| Serotonin | Gastrointestinal | Mood, hunger, sleep, arousal, anger, body temp, aggressiveness | Depression (deficit)  Anorexia (surplus)  Sleep disorders  SIDS (abnormal serotonin neurons) | MDMA (ecstasy)  Amphetamines all inhibit  Cocaine serotonin reuptake  SSRI’s  \*\*MDMA causes delay in production of serotonin |
| Epinephrine (adrenaline) | Adrenal gland | Released to cope with stress, increase heart rate, dilates pupils | “Fight or Flight” response |  |
| Norepinephrine | Adrenal medulla CNS (peripheral) | Released in moment of danger, “fight or flight” response, eating, sleeping | Fight or flight response (mania, stress, nervous tension) (surplus)  Depressed mood (deficit)  ADHD | MDMA (ecstasy) increases activity levels of serotonin, norepinephrine and dopamine |
| Endorphins | Group of ten neurotransmitters that activate opiate receptors | Natural opiates – released in response to pain & vigorous activity | “runner’s high”  Indifference to pain (surplus) | Opiates (heroin, morphine) (agonists)  “rebound headache” – w/d from analgesics  OxyContin, Vicodin, Percodan, Codeine, Demerol, Percocet (antagonist pain centers) |
| GABA (gamma amino-butyric acid) | Hippocampus, basal ganglia | Major inhibitory neurotransmitter, calming, hunger, sleep | Overactive GABA results in panic attacks and stress | Alcohol increase GABA (agonists)  Treatment for Huntington’s and Tourette’s  \*barbiturates/benzodiazephines act as agonists of GABA receptors  \*Xanax slows down GABA  \*Rohypnol (flunitrazepam) |
| Glutamate | Neuron membranes; most dense in cerebral cortex | Major excitatory neurotransmitter, memory & learning | Overstimulates the brain, migraines, seizures (surplus) \*avoid MSG (shown to destroy nerve cells in young animals) | Ketamine (date-rape drug) receptor antagonist |

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| HORMONES, NEUROTRANSMITTERS AND THE ASSOCIATED DISEASES |