

## Neurotransmitters:

### **Serotonin:** (regulation of sleep, mood, appetite & impulsivity)

- Similar to norepinephrine:
  - Cells who use the neurotransmitter occur in an area along the midline of the hindbrain
  - Axons from neurons that use serotonin send branches throughout the forebrain, including the hypothalamus, hippocampus and cerebral cortex
  - Affects sleep and mood
- The brain can get of the substances from which it is made, tryptophan, from **food**
  - What you eat can affect the amount of serotonin in your brain
  - High carbohydrates = High levels of serotonin
- Implicated in aggression and **impulse** control
- Low levels of serotonin in people who have committed suicide
- **Malfunction:** Depression

### **Norepinephrine:** (arousal, sleep, learning & mood regulation) (NORADRENALINE)

- Used in both central and peripheral nervous systems (contributes to arousal in both)
- Comprises the neurotransmitters used by the sympathetic NS to activate you and prepare you for action
- Half of the norepinephrine within your brain is contained in cells of the locus coeruleus (near reticular formation in the hindbrain)
- Also involved in the appearance of wakefulness and **sleep**, in **learning** and in the regulation of **mood**
- **Malfunction:** Depression

### **Dopamine:** (movement & reward)

- Used in the substantia nigra and striatum (important for **movement**)
- Dopamine systems play a role in the **rewarding properties** of many drugs, including cocaine
- **Malfunction:** Parkinson's disease, schizophrenia
  - Parkinson's disease: dopamine cells in the substantia nigra degenerate causing severe shakiness and difficulty in beginning movements
  - Schizophrenia: dopaminergic neurons whose axons go to the cerebral cortex

### **GABA:** (sleep & movement)

- Major inhibitory neurotransmitter – reduces the likelihood that the postsynaptic neurons will fire an action potential
- Neurons in widespread regions of the brain used GABA
- Drugs that cause reduced neural activity often do so by amplifying the “braking” action of GABA
- **Malfunction:** Anxiety, Huntington's disease, epilepsy
  - Huntington's disease: results in loss of many GABA-containing neurons in the striatum causing uncontrollable jerky movement of the arms and legs, along with dementia
  - Epilepsy: associated with seizures and convulsive movements

### **Glutamate:** (memory)

- Major excitatory neurotransmitters – increases the likelihood that the postsynaptic neurons will fire an action potential
- Used by more neurons than any other neurotransmitter, particularly in the cerebral cortex and hippocampus

- Strengthening of synaptic connections is necessary for normal development and may be the root of **learning** and **memory**
- Overactivity of glutamate synapses can cause neurons to die
- Malfunction: Damage after cardiovascular accident

**Acetylcholine:** (movement & memory)

- Used in parasympathetic nervous system to slow the heartbeat and activate the digestive system, and by neurons that make muscles contract
- Cholinergic neurons – neurons that use acetylcholine
- Midbrain and striatum (important for **movement**)
- Limbic system, including hippocampus and other areas of the forebrain that are involved in **memory**
- Drugs that interfere with acetylcholine prevent the formation of new memories
- **Malfunction:** Alzheimer's disease – loss of cholinergic neurons in a nucleus in the forebrain that sends fibres to the cerebral cortex and hippocampus