Neurotransmitters
The Neurochemical Basis of Human Behavior

- Neurotransmitters are chemicals that relay and modulate messages between neurons.
- Much of human behavior is mediated by the action of neurotransmitters in the brain. Researchers are also demonstrating that behavioral pathology is largely due to imbalances in one or more neurotransmitter systems. Physical diseases may also be due to specific neurotransmitter pathway disturbances (e.g., Parkinson disease).
- Neurotransmitters are chemicals that are stored in and released from the terminal boutons of neurons; they are released into the synaptic cleft.
- Once in the synaptic cleft, neurotransmitters can be destroyed by enzymatic degraders, chemical substances that break down a neurotransmitter so that the postsynaptic neuron can repolarize in order to fire again.
- Neurotransmitters can also be reabsorbed by the presynaptic terminal boutons in a process called reuptake.
- Sometimes there is a decrease in the number of receptors for a neurotransmitter on the postsynaptic neuron due to long-term exposure to the neurotransmitter. This is called downregulation.
- Neurotransmitters can be classified into 4 major groups:
  1. Amino acids (e.g., glutamate, gamma-aminobutyric acid [GABA], aspartic acid, glycine)
  2. Peptides (e.g., vasopressin, somatostatin)
  3. Monoamines (norepinephrine, dopamine, serotonin)
  4. Acetylcholine (ACh)
- There are multiple neurotransmitter systems in the brain (and in the enteric nervous system).
- In the peripheral nervous system (PNS), only 2 neurotransmitters are used: ACh and norepinephrine.
- Neurotransmitters can be excitatory or inhibitory, depending on which receptor sites they bind to. They work like the brain’s brake and accelerator systems.1-3

**Major Neurotransmitters About Which Information Is Known**

- ACh
- Gamma-aminobutyric acid (GABA)
- Glutamate (GLU)
- Dopamine (DA)
- Serotonin (5-HT)
- Norepinephrine (NE)
- Substance P
- Endorphins
- Histamine