

## Neurons

The **Nervous System** - the *electrochemical communication system* that enables us to think, feel, and behave, consisting of all the nerve cells of the peripheral and central nervous systems

### I. Neural Communication

A. **Neurons** - a nerve cell; the basic building block of the nervous system.

- carry information in the form of electrochemical impulses

1. **sensory neurons** – carry information from the body to the central nervous system (CNS)

2. **interneurons** – exist entirely within the CNS and carry messages from one type of neuron to another

3. **motor neurons** – carry messages from the CNS to operate muscles and glands

### B. Structure

- **cell body** (soma) - contains nucleus

- **dendrites** - the bushy, branching extensions of a neuron that *receive* messages and conduct impulses toward the cell body

- **axon** - the extension of a neuron that carries information (electrical impulses called *action potentials*) *away* from the cell body  
- can be very long, projecting several feet through the body

- **myelin sheath** - a layer of white, fatty tissue segmentally encasing the axons of neurons; enables vastly *greater transmission speed* of neural impulses as the impulse “hops” from one node to the next

- **axon terminals** - finger-like projections that *send* chemical messengers to other neurons, muscles, or glands

### C. Moving Information

1. Within the neuron – impulse travels at speed ranging from 2 mph to 250 mph

- cell at rest is **polarized** – negatively charged inside

- when sufficiently stimulated, gates open to let positively charged ions in

- this is called **depolarization**; the resulting impulse is an **action potential**

- positive ions are then pumped back out, and neuron enters a *refractory period*

- the level of stimulation required to trigger a neural impulse is the **threshold**

- *excitatory* (the party animals) vs. *inhibitory* (the party poopsters)

- increasing the stimulus above the threshold will not increase the action potential's intensity

- the neuron's reaction is an **all-or-none response**: either it fires or it does not

2. Between neurons – it's all about the **synapse**

- the junction between the axon terminal of the sending neuron and the dendrite of the receiving neuron

- the tiny gap at this junction is called the *synaptic gap* or *cleft*

- when axon terminals are stimulated, **neurotransmitters** (chemical messengers) are released into the synaptic gap where they bind with *receptor sites* on the receiving neuron

- as precisely as a key fits into a lock

- takes 1/10,000<sup>th</sup> of a second

- enzymes then come in to break the bond between the neurotransmitter and its receptor

- neurotransmitter is then broken down or taken back into the axon terminal (**reuptake**)

#### D. Neurotransmitters

1. **Acetylcholine (ACh)** – one of the best-understood neurotransmitters; it causes our muscles to contract
2. **Endorphins** – natural opiate-like neurotransmitters linked to pain control and pleasure
3. **Agonists** – excite; molecules that *mimic* the shape of natural neurotransmitters (heroin)
4. **Antagonists** – inhibit; molecules that *block* neurotransmitters from binding to receptor sites  
- example: curare, a poison, blocks ACh receptors, causing paralysis