

Nervous System

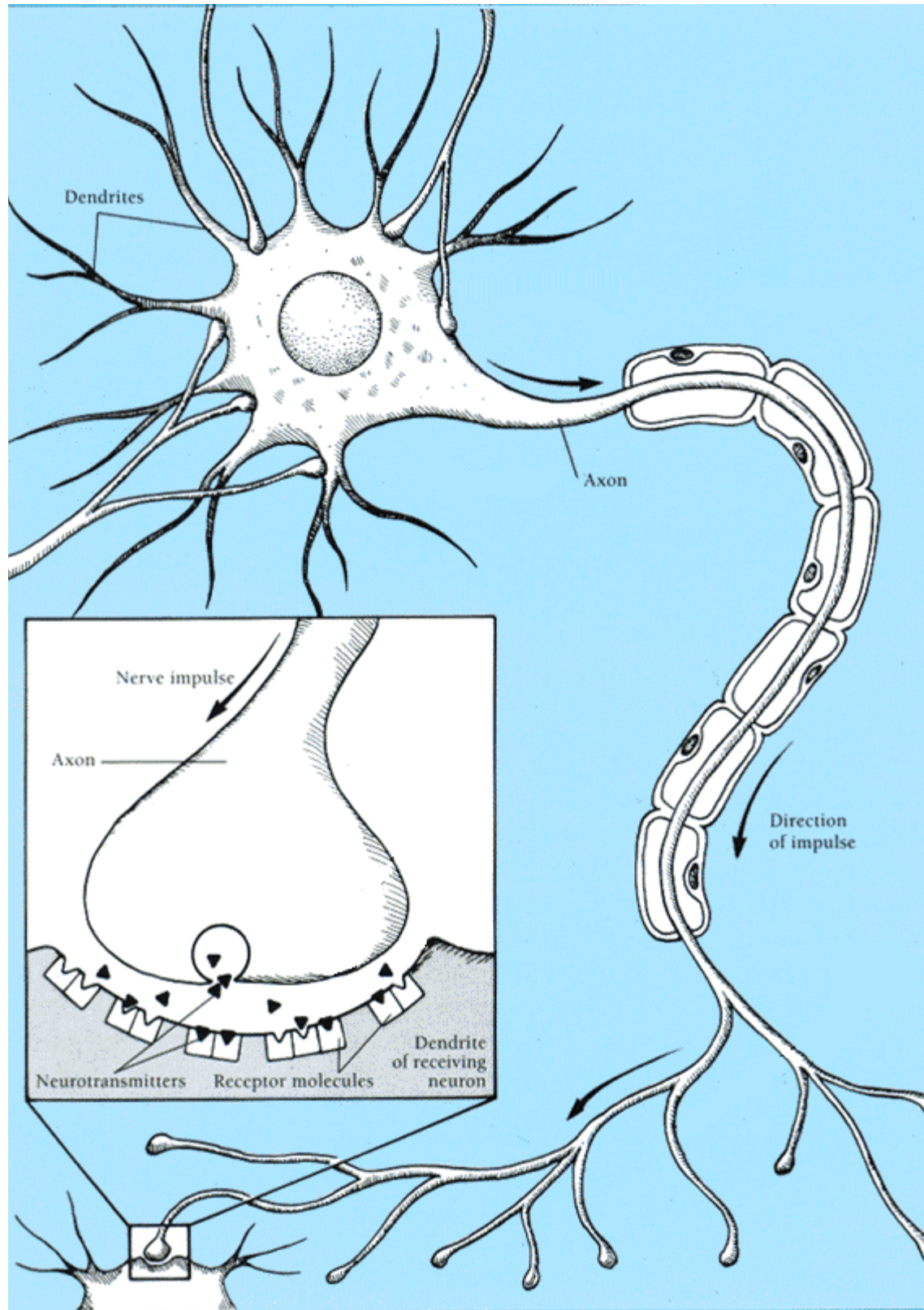
The nervous system controls and coordinates functions throughout the body and responds to internal and external changes.

I. Neurons

Specialized cells that help gather information about environment & interpret info, react to it

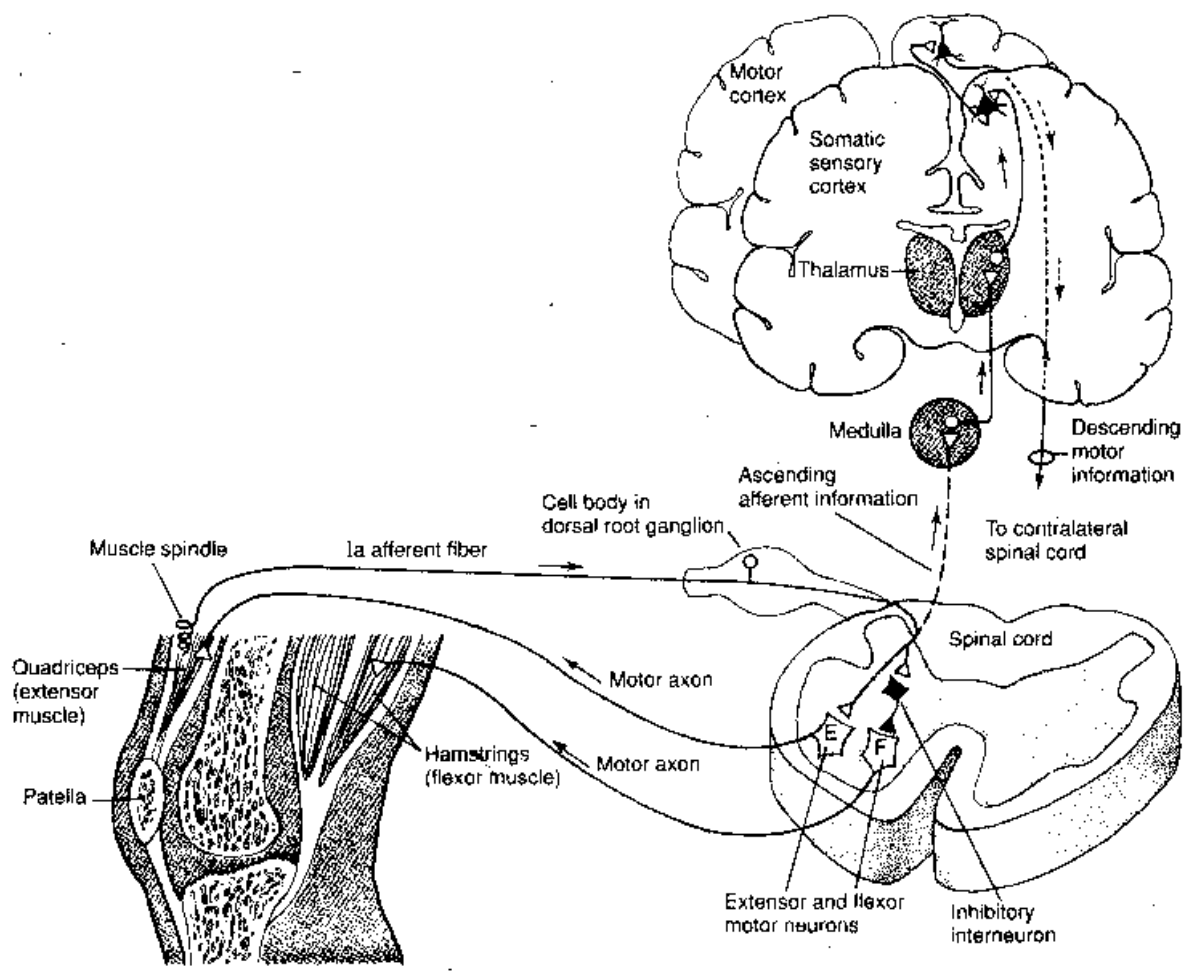
a. Made Up Of:

- i. Dendrites- receive signals (impulses) from other neurons and conduct the impulses to the cell body
- ii. Cell Body- nucleus and cell organelles , energy created here
- iii. Axon- Carries impulse from cell body to other neuron and muscles.



b. 3 Kinds of Neurons

- i. Sensory Neurons- sends impulse **from** receptors in the skin and sense organs **to the** brain and spinal cord
- ii. Interneurons - found in brain and spinal cord and carry impulse from sensory **to** motor
- iii. Motorneurons- carry impulses **away from** brain **to** gland or muscle



Brain Bytes

- Your brain contains as many neurons as there are stars in the Milky Way galaxy.
- Electrical messages in neurons travel about 220 miles per hour--that's 323 feet per second!
- It's commonly thought that you use only 10 percent of your brain. Not so! You may not use every neuron in your brain at the same time, but every one is important.
- A piece of your brain the size of a grain of sand may contain thousands of neurons and millions of synapses, all "talking" to one another.
- Nine of every ten cells in your brain--almost a trillion of them--are neuroglia support cells.

II. A Nerve Impulse

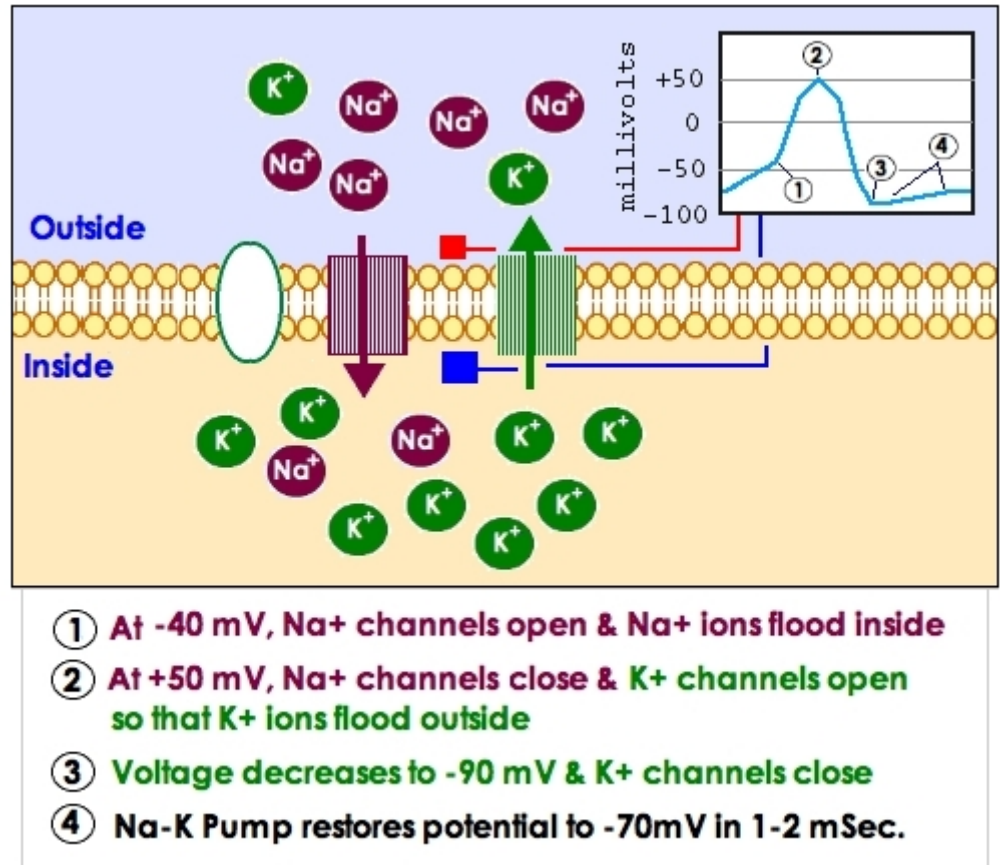
a. A nerve at rest

- i. Not conducting an impulse, more sodium (Na^+) ions outside the cell. More potassium (K^+) on inside.
- ii. Sodium - Potassium pump actively transport Na^+ ions
- iii. For every 2 K^+ pumped into neuron, 3 Na^+ are pumped out to keep a positive charge outside the neuron

b. Action Potential

- i. = nerve impulses
- ii. Threshold- minimum stimulus to cause an action
- iii. Stronger impulse \neq stronger action potential
- iv. All or nothing- meaning impulse is either strong enough to travel down the neuron or not

- v. When stimulus reaches threshold, channels in plasma membrane open up
- vi. Na^+ rapidly moves into cytoplasm causing temporary reversal of electrical charge
- vii. Inside of cell is now + charged, which causes other channels to open
- viii. K^+ leave cell through these opening restoring + to outside of cell
- ix. This creates a "wave" along the axon



c. Speed of Action Potential

- i. Many axons have covering (Myelin) which has many gaps called nodes
- ii. Na⁺ & K⁺ cannot go through myelin but goes through nodes

- iii. In the body there are neurons w/ and w/o myelin

- iv. Neuron w/ myelin carry impulses associated w/ sharp pain

- v. Neurons w/o myelin carry impulses associated with throbbing or dull pain

- d. **Synapse**

- i. Small gap between axon of one neuron and dendrites of another

- ii. When impulse reaches the end of axon, small sacs (vesicles) with neurotransmitters fuse with the membrane and release the neurotransmitter.

Example: In a motor neuron, the neurotransmitter causes the muscle to contract

e. Neurotransmitter

- i. Chemical that diffuses across a synapse and binds to the receptors on a dendrite which causes channels on neighboring neuron to open
- ii. Neurotransmitters don't last long
 - 1. It either diffuses away from synapse or
 - 2. Enzymes might break down or
 - 3. Recycled and used again

III. Peripheral Nervous System

Nerve - bundle of axons

a. Somatic Nervous System

- i. Relay information from external sensory receptors to CNS

- ii. Motor nerves relay information from CNS to skeletal muscles, usually voluntary
- iii. Not all responses are voluntary, some are reflex
- iv. Reflex - do not require conscious thought-some signals only go to the brain

b. Automatic Nervous System

- i. Carries impulses from CNS to heart and other internal organs
- ii. Body responds involuntarily w/o conscious control
- iii. When scared or active, body responds in fight or flight
- iv. When calm, body rests and digests

c. Two branches of Autonomic Nervous System

- i. Sympathetic
 - Active in times of emergency or stress
- ii. Parasympathetic
 - Active when at rest
 - Counterbalances effects of sympathetic and restores body to resting state

