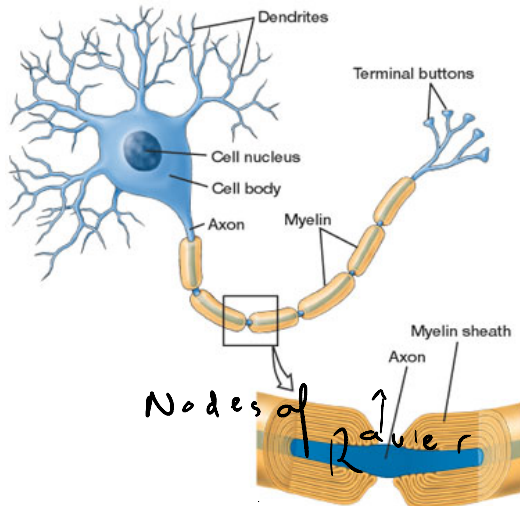


UNIT 7 ANSWER KEY

1. Draw and label a myelinated neuron showing the cell body, dendrite, axon, axon terminal, Schwann cells and Nodes of Ranvier. Provide a brief description of the function of each labeled structure beside its label. Please be neat!



**cell body** = performs housekeeping functions of the cell

**dendrite** = receives chemical signals from other neurons and conduct electrical messages to cell body

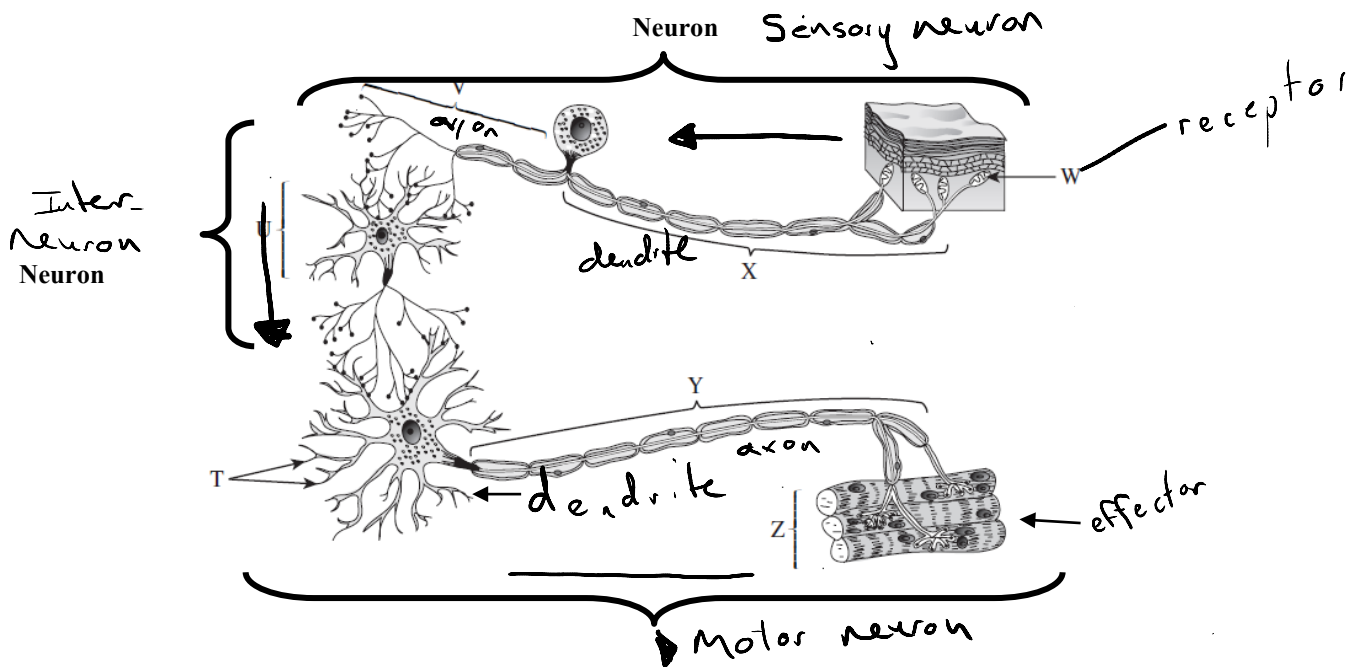
**axon** = transmits electrical signals from cell body to axon terminal

**axon terminal** = converts electrical signal back to chemical signal by releasing transmitter substances into a gap called the synaptic cleft between the terminal and dendrite of the next neuron

**Schwann cells** = myelinates the axon to help speed up the electrical signal

**Nodes of Ranvier** = gaps along the axon between myelinating cells where saltatory conduction ("signal jumping") occurs

2. Below is a diagram of a reflex arc:
  - a. Label each cell as an interneuron, motor neuron or sensory neuron.
  - b. Using arrows, indicate the direction of nerve impulse through each neuron.
  - c. Label the receptor end of the sensory neuron, the dendrite and axon.
  - d. Label the effector (muscle/organ) of the motor neuron, the dendrite and the axon.



3. What is the purpose of a reflex arc?

= reflex arcs signal independent of the brain to ensure the fastest possible reaction time and are generally associated with involuntary reflexes that prevent us from harm such as blinking, pulling limbs away from sharp or hot objects

4. Compare and contrast the functions of sensory neurons, motor neurons and interneurons.

= sensory neuron transmits nerve impulse from sensory receptors to interneurons

= motor neurons transmit nerve impulse from interneuron to a variety of effectors to ensure an appropriate response to external or internal stimuli

= interneuron transmits nerve impulse from sensory neurons to motor neurons

5. Identify the similarities and differences between the sensory neuron and motor neuron.

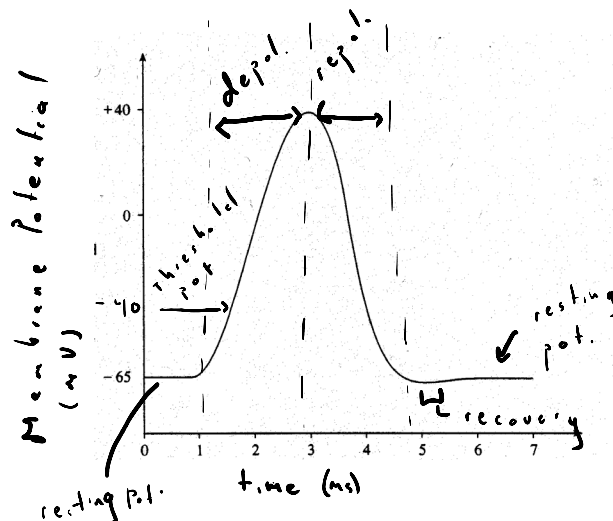
= sensory neurons have long dendrites and short axons and motor neurons have short dendrites and long axons, both have cell bodies and can be myelinated, sensory neurons carry signals from peripheral nervous system to central nervous system whereas motor neurons carry signals from central nervous system to peripheral nervous system

6. What is meant when it is said that the electrical impulse of a neuron is an "all-or-nothing" event? Please include the term "threshold" in your explanation.

= an electrical signal will not be initiated along an axon unless the threshold potential is met at the dendrite, if threshold is met it will initiate a domino effect of sodium channel openings such that the electrical signal progresses along the axon in an unstoppable or "all-or-nothing" fashion

7. Label the following diagram of an Action Potential:

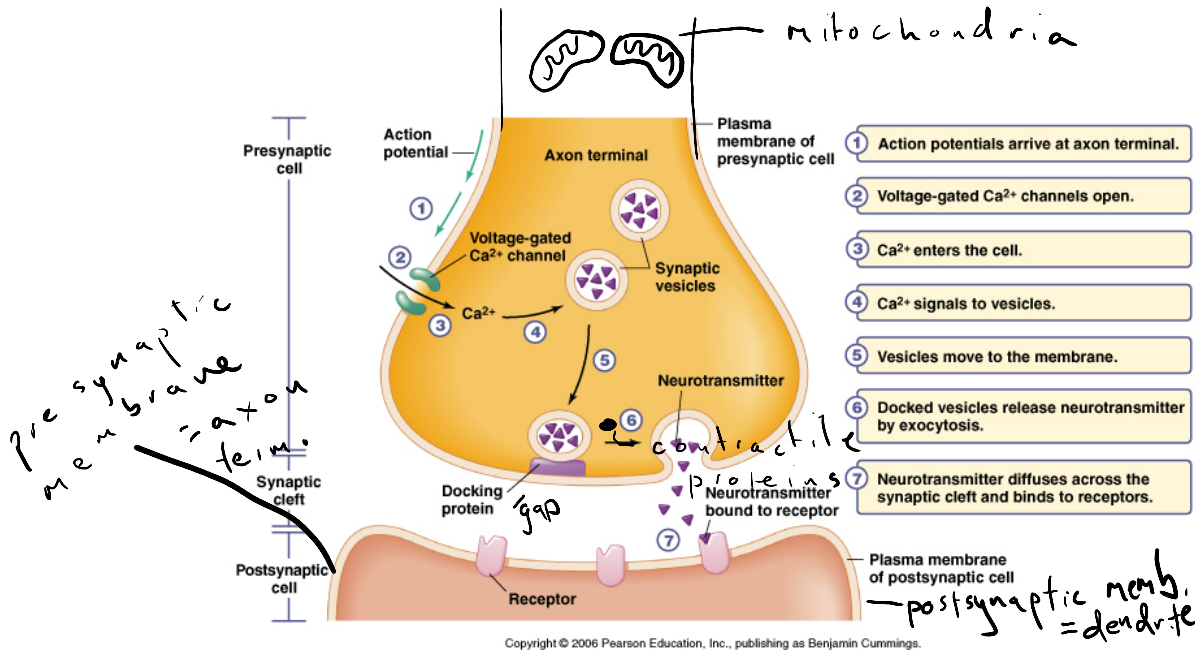
- |   |   |
|---|---|
| <input type="radio"/> repolarization                  | <input type="radio"/> recovery                |
| <input type="radio"/> depolarization                  | <input type="radio"/> membrane Potential (mV) |
| <input type="radio"/> resting potential (label twice) | <input type="radio"/> time (mS)               |
| <input type="radio"/> threshold potential             |   |



8. When a neuron is not sending an electrical signal it is said to be at rest.

Draw a synapse. Label and briefly describe the function, in relation to a synapse, of the following:  
(Be sure to use the terms exocytosis and diffusion where applicable)

- synaptic vesicle
- neurotransmitter
- mitochondria
- presynaptic membrane
- synaptic gap
- postsynaptic membrane
- $Ca^{2+}$
- axon terminal
- dendrite
- contractile proteins



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- Synaptic vesicle = contains neurotransmitter
- Neurotransmitter = chemical messenger that diffuses across synaptic cleft
- Mitochondria = provides energy from ATP to power sodium/potassium pumps and vesicle movement
- Presynaptic membrane = before synapse = axon terminal
- Post synaptic membrane = after synapse = dendrite
- Synaptic cleft = space between two adjacent neurons
- $Ca^{2+}$  = ion that binds to contractile proteins causing synaptic vesicles to move to and fuse with presynaptic membrane
- Axon terminal = converts electrical signal to chemical signal
- Dendrite = receives chemical signals with potential to convert to electrical signal
- Contractile proteins = enable synaptic vesicles to move

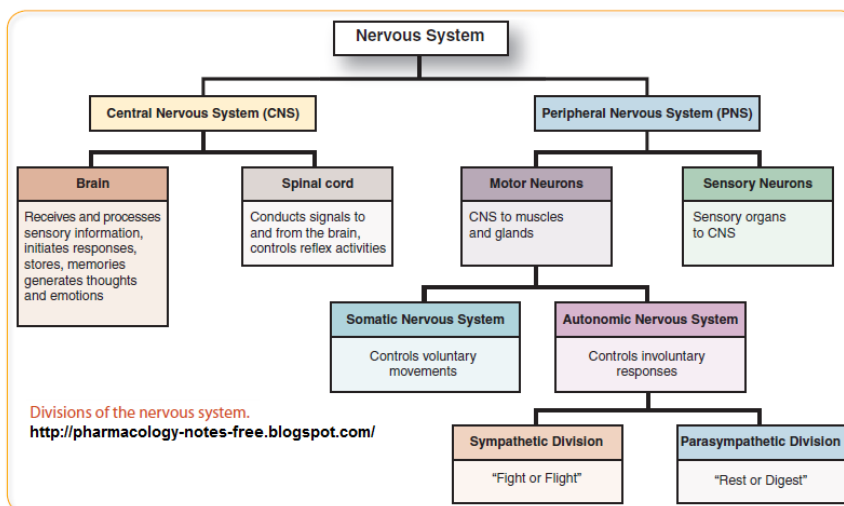
THE BRAIN

1. Identify and briefly describe the two major divisions of the nervous system.
  - = central nervous system including brain and spinal cord for receiving and integrating information from peripheral nervous system and directing responses to internal and external stimuli
  - = peripheral nervous system is essentially all the nerves excepting those of the brain and spinal cord and it is responsible for detecting external and internal stimuli and transmitting the information to the central nervous system where it is then integrated to direct a response that is then transmitted via the peripheral nervous system to effectors

2. Identify and briefly describe the two major divisions of the peripheral nervous system.
  - = autonomic nervous system – control system that acts largely unconsciously and regulates bodily functions such as heart rate, digestion, respiratory rate, papillary response, urination, and sexual arousal. This system is the primary mechanism in control of the fight-or-flight response.
  - = somatic nervous – responsible for movement of voluntary muscles and the process known as a reflex arc. This system carries nerve impulses back and forth between the central nervous system and skeletal muscles, skin, and sensory organs.
  
3. The autonomic system has two major divisions:
  - a. What are the two major divisions called and what are their nicknames?
    - = sympathetic (fight-or-flight)
    - = parasympathetic (=rest-or-digest)
  - b. What effect does each branch have on the body?
    - = sympathetic prepares the body for danger or activity such as increasing heart rate, breathing rate, dilating pupils, sending blood to skeletal muscles and away from intestines, limiting digestion
    - = parasympathetic prepares the body for recovery/rest such as decreasing heart rate, breathing rate, constricting pupils, sending blood to digestive system and away from skeletal muscles, enhancing digestion
  - c. Give a specific example/scenario where each division may be activated. Identify the neurotransmitter that would be released in response to that scenario and list some of the specific effects that the neurotransmitter would have on the body.
    - = sympathetic might be activated in situations of stress such as during a test or before a big game/performance or when frightened, it will cause the nervous system to release norepinephrine (noradrenalin) which will lead to increased heart rate, breathing rate, dilating pupils, sending blood to skeletal muscles and away from intestines, limiting digestion
    - = parasympathetic might be activated after periods of stress, when relaxing in a sauna (for the yogis out there), it will cause the release of acetylcholine which will lead to decreased heart rate, breathing rate, constricting pupils, sending blood to digestive system and away from skeletal muscles, enhancing digestion
  
4. Explain how the adrenal glands are involved in the body's response to stressful situations.
 

In situations of stress sympathetic neurons release noradrenalin (aka norepinephrine) which then cause the adrenal glands to release adrenalin (epinephrine) which initiates the flight-or-flight response including increase heart and breathing rates, dilated pupils, dilated airways, increased blood flow to skeletal muscles, decreased blood flow to digestive system, and decreased saliva secretion (hence dry mouth when stressed).
  
5. Create a flow chart to illustrate the major divisions of the nervous system, including the following terms:
 

<input type="checkbox"/> PNS	<input type="checkbox"/> autonomic	<input type="checkbox"/> CNS
<input type="checkbox"/> sympathetic	<input type="checkbox"/> brain	<input type="checkbox"/> somatic
<input type="checkbox"/> spinal cord	<input type="checkbox"/> parasympathetic	<input type="checkbox"/> nervous system



6. What is the general function of the brain?  
 = to receive and process/integrate sensory information, to direct responses to such information, to store and retrieve memories of such information, to use such information to determine future responses
7. Please label the following structures on the diagram below. Please place a brief description of each structure's function beside its label. Please be neat:
- medulla oblongata
  - cerebellum
  - hypothalamus
  - thalamus
  - pituitary gland
  - corpus callosum
  - cerebrum

**Medulla oblongata** = respiratory and cardiac control centers, involuntary responses such as coughing, sneezing, hiccupping, vomiting

**Cerebellum** = balance and coordinated/graceful movement

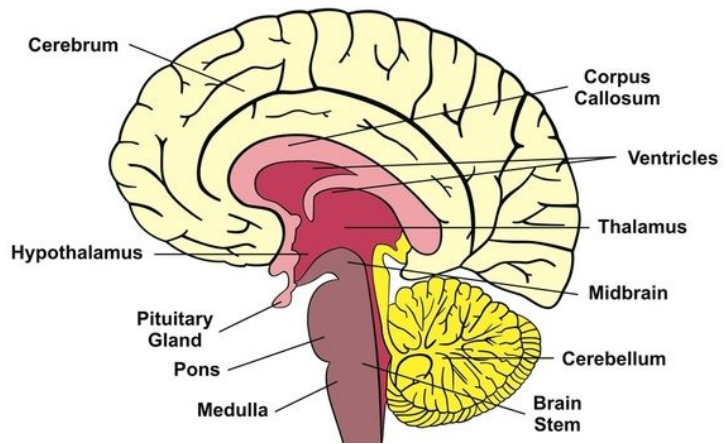
**Hypothalamus** = maintain homeostasis such as temperature, hunger, thirst, sleep, water balance, control the pituitary gland

**Thalamus** = relay station that passes on important signals to the cerebrum

**Pituitary gland** = storing and producing hormones such as human growth hormone

**Corpus callosum** = allows for communication between the right and left hemispheres of the brain

**Cerebrum** = largest portion of human brain that is involved in conscious thought, perceiving sensory information and initiating movement



8. Below is a diagram of the 4 major lobes of the cerebrum. Label each lobe and place a brief description of each lobe's function beside its label. Please be neat:

