The Nervous System

Neurons

A. Definition
1. Basic cells of the nervous system

B. Functions of Neurons
1. Responding to chemical and physical stimuli
2. Conducting impulses
3. Releasing chemical regulators

C. Neuron Structure
1. Cell body
   a. Contains the nucleus and other organelles
2. Dendrites
   a. Receive stimuli
   b. Conduct impulses toward the cell body
3. Axon
   a. Carries impulses away from the cell body

D. Axon structure
1. Myelin sheath
   a. Insulating coat of plasma membranes
   b. Sections of sheath are called “Schwann Cells”
2. Nodes of Ranvier
   a. Bare axonal membrane between Schwann cells
3. Unmyelinated axons carry impulses much slower than myelinated axons

E. Types of Neurons
1. Motor Neurons
   a. Transmit signals from the brain and spinal cord
   b. Signals go to muscles or glands
2. Sensory Neurons
   a. Transmit information from the sensory organs to the brain and spinal cord
3. Interneurons
   a. Transmit signals from one neuron to another

Response to Stimuli

A. Stimulus
1. A change in the environment that may cause an organism to respond

B. Sensory Receptors
1. Collect and transmit information about the outside world
   a. Five senses
Transmission of Impulses
A. Electrical Impulse
   1. Nerve membranes are normally **polarized**
      a. Uneven distribution of ions inside and out
   2. Stimulation causes **depolarization**
      a. Sodium ions diffuse into the neuron
   3. Membrane quickly **repolarizes**
      a. Potassium ions diffuse out of the neuron
B. Nerve Impulses
   1. Wave of depolarization that travels along a neuron
   2. Membrane must repolarize before another impulse can travel down the neuron
C. Stimulus Threshold
   1. “All or nothing” rule
      a. Threshold must be reached for neuron to “fire”
      b. Greater stimulus fires more neurons
         (1) Individual neurons don’t fire “harder” with greater stimulus

Synapses
A. Definition
   1. Junction (or gap) between a neuron and a second cell
B. Neurotransmitters
   1. Chemical messengers that carry nerve signal across the synapse
      a. Quickly broken down or reabsorbed after signal is transmitted
   2. Examples
      a. Some amino acids
      b. Endorphins and Enkephalins
         (1) Stimulate natural opioid receptors in the brain
      c. Acetylcholine

Evolution of Nervous Systems
A. Invertebrates
   1. Wide variety of nervous systems
      a. Ganglia
         (1) Specialized bundles of nerve cell bodies
      b. Nerve net
         (1) Even distribution of nerve cells in the body
B. Three Trends in Vertebrate Brain Evolution
   1. Increase in the relative size of the brain
   2. Increased specialization of function
      a. Cerebellum, cerebrum, hypothalamus etc.
   3. Increasing sophistication and complexity of the forebrain
The Central Nervous System
A. Protection of the CNS
1. Meninges
   a. Membranes that cover the brain
      (1) dura mater and pia mater
2. Cerebrospinal fluid
   a. Cushions brain from shock
3. Cranium
4. Spinal column

B. Structures of the CNS
1. Brain
2. Spinal cord

The Peripheral Nervous System
A. Sensory Division
1. Bring information to the CNS

B. Motor Division
1. Carries signals away from the CNS
   a. Somatic (voluntary) nervous system
      (1) Skeletal muscle action
   b. Autonomic nervous system
      (1) Controls organ systems

C. Divisions of the Autonomic Nervous System
1. Sympathetic
   a. Stress responses
      (1) Pupils dilate
      (2) Mouth dries up (saliva decreases)
      (3) Heart rate increases
      (4) Blood flow to skeletal muscle increases

2. Parasympathetic
   a. Relaxation response
      (1) Heart rate slows
      (2) Pupils constrict
      (3) Stimulates salivation
      (4) Digestive processes stimulated