

- Electrochemical gradient = Concentration gradients – dif in concentration of a chemical between 2 regions; Electrical gradients – dif in electrical charges between 2 regions
 - Help move substances across plasma membrane
 - Down concentration gradient = **passive process**
 - **Facilitated diffusion** = passive; carrier moves solute down its concentration gradient across plasma membrane, no energy required
 - **Active process** = cellular energy is used to drive substance against its concentration gradient
- **Active Transport**
 - Primary active transport: energy derived from hydrolysis of ATP changes shape of a carrier protein, which pumps a substance across plasma membrane
 - Ex. Sodium-potassium pump → expels 3 Na⁺, brings in 2 K⁺
 - Secondary active transport: the energy stored in a Na⁺ or H⁺ concentration gradient is used to drive other substances across the membrane against their own concentration gradients
 - Symporters = transporters moving two substances in the same direction; ex. Sodium-glucose symporter
 - Antiporters = moving two substances in opposite directions across membrane; ex. Sodium-Calcium antiporter
- Organelles
 - Mitochondria – powerhouse of the cell, generate ATP through aerobic respiration, large number in muscles and liver
 - Nucleus – controls cellular structure, directs cellular activities, produces ribosomes, contains cells genes which are located on chromosomes
 - Ribosomes – sites of protein synthesis, some are attached to ER
 - Endoplasmic Reticulum – network of membranes in the form of flattened sacs
 - Smooth – does not have ribosomes on its outside surface, contains enzymes that synthesize fatty acids and steroids, help detoxify liver
 - Rough – covered with ribosomes, processes and sorts ribosomes
 - Lysosomes – membrane enclosed vesicles that form **Golgi complex**; can engulf other organelles, digest it, and return the digested components to cytosol; clean out the cell

Chapter 4: Tissue Organization

- Intracellular junctions:
 1. Tight junctions – weblike strands of transmembrane proteins that fuse together the outer surfaces of adjacent plasma membranes to seal off passageways between adjacent cells → stomach or bladder
 2. Adherens junctions – contain plaque, cadherins join cells, contain adhesion belts → intestines
 3. Desmosomes – contain plaque and cadherins, weld-like junctions that prevent cells from separating under tension and contraction → epidermis and cardiac muscle cells
 4. Hemidesmosomes – anchors cells to each other but not to basement membrane →
 5. Gap junctions – membrane proteins called connexins form fluid filled tunnels that connect neighboring cells; plasma membranes of gap junctions are not fused together; ions and small molecules can diffuse from one cell to another; allow cells to communicate with one another → nervous system, cardiac muscles, cornea of eye
- **Epithelial Cells**
 - Apical surface = free surface, may contain scilia / microvilli
 - Lateral surface = face adjacent cells on either side, may contain junctions
 - Basal surface = adhere to extracellular materials (basement membrane)
 - Basement membrane = thin extracellular layer formed by:
 - Basal lamina = closer to and secreted by epithelial cells

- **Sympathetic:** fight or flight
 - Preganglionic neurons leave from thorocolumbar area of spinal cord
 - Preganglionic fibers synapse far from end organ; may synapse with 20 or more postganglionic neurons
 - Postganglionic axons terminate in multiple end organs = widespread effects
 - Enzymes that degrade NE are slow so effects last longer
- **Parasympathetic:** rest and digest
 - Preganglionic neurons leave from craniosacral areas of spinal cord
 - Preganglionic neuron usually synapses with 4-5 postsynaptic neurons
 - Postganglionic neurons supply single visceral effector = specific effects
 - Enzyme degrades ACh quickly for short effects
- Structural Classification of Neurons
 - Multipolar – several dendrites and one axon; most brain and spinal cord neurons
 - Bipolar – one main dendrite and one main axon; special sensory receptors found in retina of eye, inner ear, olfactory area of brain
 - Unipolar – dendrites and one axon that are fused together; cell body is to the side; sensory neurons touch and pain ex. Corpuscle of touch in epidermis
- Functional Classifications of Neurons
 - Sensory (afferent) – stimulus activates, sends AP to CNS
 - Motor (efferent) – convey AP from CNS to effectors
 - Interneurons – CNS between sensory and motor neurons; process incoming info from sensory neurons and illicit motor response (multipolar)
- Neuroglia in CNS
 - Astrocytes – protect capillaries, form blood brain barrier, maintain chemical environment
 - Oligodendrocytes – processes make myelin sheath of CNS
 - Microglial cells – remove cellular debris; phagocytes
 - Ependymal cell – line ventricles, produce and monitor cerebrospinal fluid
- Neuroglia in PNS
 - Schwann Cells – make myelin
 - Satellite cells – structural support and regulation of materials between neuronal cell bodies and interstitial fluid
- Gray matter – neuronal cell bodies, dendrites, unmyelinated axons, neuroglia
- White matter – myelinated axons
- Ganglion – groups of cell bodies
- Tract = in CNS
- Nerve = in PNS
- Resting membrane potential of nerve = -70mV
 - 3 factors that maintain:
 - Unequal distribution of ions in ICF and ECF
 - Most anions cannot leave the cell
 - Na⁺/K⁺ pump → 3 sodium out, 2 potassium in
- Graded potential – used to depolarize cell to threshold before AP can be generated
- **Inhibitory postsynaptic potential:** Hyperpolarizing postsynaptic potential opens ligand-gated Cl⁻ or K⁺ channels; postsynaptic cell is less likely to reach threshold
- **Excitatory postsynaptic potential:** depolarizing postsynaptic potential opens ligand-gated Na⁺ or Ca²⁺ channels; postsynaptic cell is more likely to reach threshold
- Summation: several presynaptic end bulbs release their NT near the same time, combined effect may generate nerve impulse
 - Spatial: summation of effects of NT released from several end bulbs onto one neuron
 - Temporal: summation of effect of NT released from 2 or more firings of the same end bulb in rapid succession onto neuron