**Cell Function Unit Curriculum Summary**

* **Cell membranes are selectively permeable due to their structure.**
  + Cell membranes separate the internal environment of the cell from the external environment.
  + Selective permeability is a direct consequence of membrane structure, as described by the fluid mosaic model.
  + Cell membranes consist of a structural framework of phospholipid molecules, embedded proteins, cholesterol, glycoproteins and glycolipids.
  + Phospholipids give the membrane both hydrophilic and hydrophobic properties. The hydrophilic phosphate portions of the phospholipids are oriented toward the aqueous external or internal environments, while the hydrophobic fatty acid portions face each other within the interior of the membrane itself.
  + Embedded proteins can be hydrophilic, with charged and polar side groups, or hydrophobic, with nonpolar side groups.
  + Small, uncharged polar molecules and small nonpolar molecules, such as N2, freely pass across the membrane. Hydrophilic substances such as large polar molecules and ions move across the membrane through embedded channel and transport proteins. Water moves across membranes and through channel proteins called aquaporins.
* **Cell walls provide a structural boundary, as well as a permeability barrier for some substances to the internal environments.**
  + Plant cell walls are made of cellulose and are external to the cell membrane.
  + Other examples are cells walls of prokaryotes and fungi.
* **Growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes.**
  + Passive transport does not require the input of metabolic energy; the net movement of molecules is from high concentration to low concentration.
  + Passive transport plays a primary role in the import of resources and the export of wastes.
  + Membrane proteins play a role in facilitated diffusion of charged and polar molecules through a membrane.
    - Glucose transport
    - Na+/K+ transport
  + External environments can be hypotonic, hypertonic or isotonic to internal environments of cells.
  + Active transport requires free energy to move molecules from regions of low concentration to regions of high concentration.
    - Active transport is a process where free energy (often provided by ATP) is used by proteins embedded in the membrane to “move” molecules and/or ions across the membrane and to establish and maintain concentration gradients.
    - Membrane proteins are necessary for active transport.
  + The processes of endocytosis and exocytosis move large molecules from the external environment to the internal environment and vice versa, respectively.
    - In exocytosis, internal vesicles fuse with the plasma membrane to secrete large macromolecules out of the cell.
    - In endocytosis, the cell takes in macromolecules and particulate matter by forming new vesicles derived from the plasma membrane.
* **Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.**
  + The neuron is the basic structure of the nervous system that reflects function.
  + A typical neuron has a cell body, axon and dendrites. Many axons have a myelin sheath that acts as an electrical insulator.
  + The structure of the neuron allows for the detection, generation, transmission and integration of signal information.
  + Schwann cells, which form the myelin sheath, are separated by gaps of unsheathed axon over which the impulse travels as the signal propagates along the neuron.
  + Action potentials propagate impulses along neurons.
    - Membranes of neurons are polarized by the establishment of electrical potentials across the membranes.
    - In response to a stimulus, Na+ and K+ gated channels sequentially open and cause the membrane to become locally depolarized.
    - Na+/K+ pumps, powered by ATP, work to maintain membrane potential.
  + Transmission of information between neurons occurs across synapses.
    - In most animals, transmission across synapses involves chemical messengers called neurotransmitters.
  + Transmission of information along neurons and synapses results in a response. The response can be stimulatory or inhibitory.