

*Waynesville High School*  
Biology  
Unit 1: Cells  
Estimated Time: 9 weeks

**Essential Understanding:**

**Students will understand...**

- Organic molecules and their function in the cell
- cells are the basic unit of structure and function for all living things.
- how science is done including observing, questioning, hypothesizing, designing, analyzing data, and communicating and supporting conclusions.

**Essential Questions:**

- What determines if something is alive?
- How do cells stay alive?
- Where do new living things come from?

**Learning Goal:**

**Estimated time: 2 weeks**

1. Students will understand the importance of the chemistry of carbon, and organic compounds.

**Targets:**

Students will be able to...

- list the elements required by living things (CHNOPS).
- explain that enzymes are a special group of proteins that enable chemical reactions to occur within living systems.
- describe the properties of carbon that allow it to form many shapes (chains, rings, and large complex molecules)
- describe the effects of high and low temperature and pH on proteins.
- describe the four macromolecules, their monomers, polymers, and functions.
- relate the structure of proteins to their function.
- design and conduct an investigation to determine the effects and/or presence of certain compounds.
- construct organic compound models based on the principles of carbon bonding.
- given a scenario, defend your claim using evidence of structure and/or properties of compounds.

**Learning Goal:****Estimated time: 2 weeks**

2. Students will understand the structures of the cell membrane and how those structures regulate what enters and leaves the cell.

**Targets:**

Students will be able to...

- define the following: diffusion, facilitated diffusion, osmosis, concentration, concentration gradient, solution, solute, solvent, passive transport, active transport, hypotonic, hypertonic, isotonic, equilibrium, homeostasis.
- describe the structure of the cell membrane (fluid mosaic model).
- explain the mechanisms of how the cell membrane regulates what enters and exits the cell.
- describe the processes of active and passive transport and the role of each in maintaining homeostasis (endocytosis, exocytosis, diffusion, osmosis).
- explain the role of the endoplasmic reticulum, Golgi apparatus and contractile vacuoles in maintaining homeostasis through transport within the cell.
- analyze explanations and models of cell transportation.
- design and carry out an investigation to determine the effects of different solutions on a cell.
- predict the effects of different solution on cells based on concentrations.

**Learning Goal:****Estimated time: 3 weeks**

3. Students will understand the cellular processes of respiration, photosynthesis, and chemosynthesis.

**Targets:**

Students will be able to...

- define cellular respiration and differentiate between aerobic and anaerobic respiration.
- summarize the inputs and outputs of aerobic respiration with the equation:  $6O_2 + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2 + \text{Energy (ATP)}$ .
- define photosynthesis.
- summarize the inputs and outputs of photosynthesis with the equation:  $6H_2O + 6CO_2 + \text{Energy (Light)} \rightarrow 6O_2 + C_6H_{12}O_6$ .
- define chemosynthesis.
- compare and contrast autotrophs and heterotrophs.
- describe the environment in which the cells performing chemosynthesis reside.
- explain how the structure of the mitochondria relates to the process of aerobic respiration.
- explain how the structure of the chloroplast relates to the process of photosynthesis.
- summarize the inputs and outputs of chemosynthesis:  $6CO_2 + 6H_2O + 3H_2S \text{ (Reduced Chemical)} \rightarrow C_6H_{12}O_6 + 3H_2SO_4$  (Reaction between Carbon Dioxide and Hydrogen Sulfide provides energy for the process vs. light providing the energy for photosynthesis).
- compare and contrast the processes of photosynthesis and respiration.
- design and conduct investigations to determine effects of certain factors on photosynthesis and cellular respiration.

**Learning Goal:****Estimated time: 2 weeks**

4. Students will understand how cells come from existing cells.

**Targets:**

Students will be able to...

- explain that prokaryotic cells are unicellular organisms that reproduce asexually through binary fission.
- compare and contrast prokaryotic and eukaryotic cells.
- describe the structure and function of the nucleus, centrioles, centrosomes, spindles fibers.
- explain that DNA can be in two forms: chromatin for the majority of the cell's life and chromosomes for cell division.
- explain that cells resulting from asexual reproduction are genetically identical to each other and the parent cell.
- model what happens to the nucleus during the division of eukaryotic cells (mitosis).
- explain the process of mitosis in terms of the formation, movement, number and division of chromosomes that results in two identical diploid cells.
- translate information on the process of mitosis into a diagram or other visual display.
- conduct an investigation using microscopes or other technology to determine the relative length of time each phase takes in an organism such as onion root cells.