**Unit Name: The Cell Grade Level: 9**

**Subject/Topic Area(s): Biology/Cell Biology Time Frame: 3 weeks**

**Class Description/Developmental Needs of Students:**

Age range of students:14-17

Total Number of Students: 28

Number of Male Students:17

Number of Female Students:11

Percentage of students receiving free or reduced lunch: 0

Areas in which students live: Suburban

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| Ethnicity of students  (give numbers) | 6 African American or Black  3 American Indian/Alaskan Native  1 Asian or pacific Islander  10 White  8 Hispanic or Latino |
| Language proficiency of students (give numbers) | 26 Fluent English Proficient  2 English Learner |
| Identified special need categories represented (give numbers) | 2 Specific learning Disability  2 Other Health Impaired |

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| **DESIRED RESULTS** | |
| **Goals:**  **Biology/Life Sciences**  **Cell Biology**  1. The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism’s cells. As a basis for understanding this concept:  a. Students know cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.  c. Students know how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.  e. Students know the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins.  g. Students know the role of the mitochondria in making stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.  j\* Students know how eukaryotic cells are given shape and internal organization by a cytoskeleton or cell wall or both. | |
| **UNDERSTANDINGS:**  ***Students will understand that…***   * Cells are complex, and rely upon the interaction of many numerous organelles to function. * Cells have different functions, which dictate the organization of their organelles. * Cells ingest and secrete many different molecules, and these processes are carefully regulated at the cell membrane. | **ESSENTIAL QUESTIONS:**   * What are the fundamental units of living things and where do they come from? * How do organelles interact to promote the functions of cells? * How does the cell membrane regulate the passage of material into and out of the cell? |
| **KNOWLEDGE:**  ***Students will know…***   * Cells are the basic units of living organisms, and that they are made up of many organelles which have specific functions. * Cells can be divided into two general categories, prokaryotic and eukaryotic, and that each has defining characteristics. * Both Plant and Animal cells are eukaryotic, though each has its own defining characteristics. * Diffusion is the movement of molecules from an area of high concentration to an area of low concentration to an area of high concentration, down the concentration gradient. * Osmosis is the diffusion of water molecules across a semipermeable membrane. * Passive and active transport mechanisms can move molecules across the cell membrane, including ion channels, pumps, and endo- and exo- cytosis. * Active transport requires the input of energy in the form of ATP. | **SKILLS:**  ***Students will…***   * Identify organelles on various cell models and explain their functions. * Differentiate between eukaryotic and prokaryotic cells. * Identify the features that distinguish plant cells from animal cells. * Explain different types of diffusion that occur within cells. * Explain the role of ATP in membrane transport. |

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| **STAGE TWO: ASSESSMENT EVIDENCE** | |
| **PERFORMANCE TASKS** (STUDENTS WILL DEMONSTRATE STANDARD BY): **T**   * Use a compound light microscope to make observations about different cell types. * Identify different organelles in specimens and various models. * Use an interactive online module to answer questions about cell organelles. * Create analogies to explain the functions of cellular organelles. * Conduct experiments to test the diffusion of molecules across a semipermeable membrane. * Prepare solutions to test the osmotic effects of different solute concentrations on different cells. | **OTHER EVIDENCE** (FORMATIVE): **OE**   * Reading guide questions covering the Cell Theory. * Worksheets coloring and identifying parts of the cell, and answering questions about their functions. * Students practice creating analogies to describe the functions of different organelles. * Mid-unit quiz: Cells and Their Organelles. * Reading guide questions covering diffusion and membrane transport. |

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| **STAGE THREE: LEARNING PLAN**  (UNIT SEQUENCE) |
| **LEARNING ACTIVTIES** (WHERETO)**: L**   1. The unit on The Cell is introduced with reference to the summative assessment: a test covering the parts of a cell and the transport of material across the cell membrane. It is also mentioned that several performance tasks will be undertaken in the form of laboratory experiments to test transport of materials in and out of cells. The essential questions: What are the fundamental units of living organisms? How do organelles help a cell to function? How do molecules pass into and out of cells? (W) 2. Students will actively take notes from instructor-led presentation, introducing the unit and discussing The Cell Theory. Students will take notes in Cornell Notes format, working together to develop potential quiz questions and to summarize the main topics of the discussion. (E,R,O) 3. Students will perform the “Introduction to Microscopy” activity. They will explore several different and unusual cell types under different magnifications and record their observations. (H,E) 4. Students will investigate the structure of cells using an interactive computer program, models, and worksheets intended to engage a variety of learning types. (E,T) 5. Students will create an analogy poster, relating a cell to something more familiar. The students will explain how the organelles of a cell are like different parts of their analogy. (E,R,T) 6. Students will complete a mid-unit quiz to assess their understanding of the parts of different types of cells. (E2) 7. Students will complete a series of laboratory experiments, using prior knowledge to form hypotheses predicting the osmotic effects of various solutions on several different cells. (W,H,E,R,O) 8. Students will complete a unit test based on the understandings for this unit. (E2) |

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| **MONDAY** | **TUESDAY** | **WEDNESDAY** | **THURSDAY** | **FRIDAY** |
| Notes: Introduction to the Cell, The Cell Theory. Students work together to formulate quiz questions and summarize information.  Task: Introduction to Microscopy: Exploring the structure of different plant and animal cells, and discussion of results.  W,H,E,R,O | No class | Task: Computer Lab: Students work with interactive *Cells Alive!* site to practice learning the organelles of plant and animal (eukaryote) and bacteria (prokaryote) cells.  E,T | Task: Students develop an analogy poster, relating a cell to something more familiar. Students share their analogies with the class.  E,T,O | Formative assessment:  Mid-Unit Quiz. Parts of The Cell  E2,O |

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| **MONDAY** | **TUESDAY** | **WEDNESDAY** | **THURSDAY** | **FRIDAY** |
| Notes: Introduction to diffusion and osmosis. Students work together to formulate quiz questions and summarize information.  Task: Students explore the basic principles of diffusion by creating and testing hypotheses about the diffusion of molecules in different mediums and different kinetic energies.  H,E,R,T | No class | Task: Students conduct an experiment in small groups, applying knowledge of diffusion to create hypotheses about the movement of molecules across a semipermeable membrane.  E,R | Task: Students work in small groups, creating hypotheses and beginning a series of experiments to explore the osmotic effects of different solutions on the structure of plant cells. Day1: Celery.  E,R,O | Task: Students reflect on the outcome of the previous day’s experiments and create new hypotheses to test with a new specimen. Day 2: Elodea. Students then reflect on the outcome of the experiment.  E,R,E2,O |

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| **MONDAY** | **TUESDAY** | **WEDNESDAY** | **THURSDAY** | **FRIDAY** |
| Notes: Introduction to facilitated diffusion and active transport across the cell membrane. Students work together to formulate quiz questions and summarize information.  Task: Students begin multi-day lab experiment to test the osmotic effects of different solutions on an animal cell (chicken egg). Students work in small groups to develop hypothesis for first day’s experiment.  E,R,T,O | No Class | Task: Students take measurements for egg lab and reflect on results from first day. Students create hypotheses and set up second day experimental conditions.  Group learning activity: Students work collaboratively to complete worksheet on active diffusion, and then share results with class.  E,R | Task: Task: Students take measurements for egg lab and reflect on results from second day.  Group learning activity: Students work collaboratively to create quiz questions from their notes and activities, then test their classmates in preparation for the final unit assessment.  E,R,E2,T,O | Summative Assessment:  End of Unit Test, Cell Organelles and Membrane Transport  E2,O |

**REFLECTIONS**

Describe the effectiveness of this lesson in helping students meet the learning goals.

I believe the unit was effective in helping students meet the learning goals. It was a list of rote learning goals, so it was difficult to develop tasks that challenged the students on advanced levels of Bloom’s Taxonomy. I felt that there were two characteristics to this lesson that made it effective.

First, material was taught in a lot of different ways. Though it amounted to memorization of facts, students were presented with it in ways that appealed to many learning styles. Visual, auditory, and kinesthetic learners all had many opportunities to engage the material in ways that appealed to their styles. The use of technology and realia, as well as traditional lecture and textbook learning, helped to make the abstract concepts of the inner workings of a cell more concrete.

Secondly, there were several inquiry-based learning tasks in the laboratory. Having students work together to make predictions based on their prior knowledge, then test their hypotheses, was an effective way to engage students with the material. That process seemed to have students thinking about the concepts far more deeply than if they had simply tried to memorize the facts. Of course, the content in the second half of the unit, diffusion and osmosis, lent itself to lab activities, whereas the first half, cell parts, did not given the technology available.

How will you apply what you have learned in future instruction?

I will continue to look for ways to engage my students with the lesson on deeper cognitive levels, in pursuit of meeting the learning goals. This will include designing relevant performance tasks that require students to utilize a number of skills. I learned that this requires careful planning and preparation, as these projects may necessitate many resources including class time. Also, it is crucial to sequence tasks properly so that the understandings gained from one can be built upon by the next.

I will also continue to explore ways to present material in many different ways, using new technology when appropriate. By doing so, I will make the content accessible to the diverse learning styles of the students in my class. Tailoring the lessons to my students’ learning styles also allows them to engage the material more deeply and make sense of abstract concepts more easily.