Unit 03: Cellular Structure and Function

Content Area: **Science**
Course(s):
Time Period: **Marking Period 2**
Length: **8-10 weeks**
Status: **Published**

Summary

Introduction:

The main focus of this unit is the structure and function of cells. Students will learn about the discovery of cell theory, specifically how cells are the basic structural and functional unit of life. Students will investigate the similarities and differences of prokaryotic and eukaryotic cells. Students will utilize microscopes to identify cellular components and to differentiate between plant and animal cells. Students will use evidence and reasoning to justify the type of cell they identify under a microscope. Students will learn how the structures inside cells have specific functions and how materials are transported into and out of the cell. This unit can be connected to climate change by investigating the impacts of climate change on each of the domains of life (eukarya, prokarya, and archaea) as well as how certain bacteria can be used to mitigate certain impacts of climate change.

Revision Date: July 2021

CS.9-12.8.2.12.ETW.4	Research historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product and present the competing viewpoints.
LA.WHST.9-10.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.WHST.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
LA.WHST.9-10.9	Draw evidence from informational texts to support analysis, reflection, and research.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand

	how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.
SCI.HS.LS1.A	Structure and Function
WRK.9.2.12.CAP	Career Awareness and Planning
WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.9.4.2.TL.1	Identify the basic features of a digital tool and explain the purpose of the tool (e.g., 8.2.2.ED.1).
TECH.9.4.2.IML.2	Represent data in a visual format to tell a story about the data (e.g., 2.MD.D.10).
TECH.9.4.2.IML.3	Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults (e.g., 6.3.2.GeoGI.2, 6.1.2.HistorySE.3, W.2.6, 1-LSI-2).
TECH.9.4.12.GCA.1	Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.
	Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.
	All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells.

Individuals select digital tools and design automated processes to collect, transform, generalize, simplify, and present large data sets in different ways to influence how other people interpret and understand the underlying information.

Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.

Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system.

Systems of specialized cells within organisms help them perform the essential functions of life.

Critical thinkers must first identify a problem then develop a plan to address it to effectively solve the problem.

A variety of diverse sources, contexts, disciplines, and cultures provide valuable and necessary information that can be used for different purposes.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Essential Questions/Enduring Understandings

Essential Questions:

What characteristics differ between cells?
How would the function of a cell be altered if a certain structure was removed or not functioning?
What are the similarities and differences between prokaryotic and eukaryotic cells?
How does a cell carry out life processes?
Why is it important that substances can move into and out of cells?

Enduring Understandings:

Cells transport substances into and out of the cell.
Cells create and use energy.
Each component of the cell structure has specific functions.
What are the structures of the cell?

Objectives

Students will know Key Vocabulary: cell, cell theory, organelles, prokaryotic cell, eukaryotic cell, selective permeability, phospholipid bilayer, diffusion, osmosis, active transport, passive transport.
Students will know the components of cell theory and the contributing scientists.
Students will know the similarities and differences between prokaryotic and eukaryotic cells.
Students will know the similarities and differences between plant and animal cells.
Students will know the structures and functions of cellular components.
Students will know the structural components of the plasma membrane.
Students will know how substances are transported into and out of the cell (active and passive transport).

Students will be skilled at using a microscope to observe and identify cells.
Students will be skilled at identifying types of cells and their functions.
Students will be skilled at observing how substances cross a semi-permeable membrane.
Students will be skilled at conducting online research to gather supporting scientific evidence and data.
Students will be skilled at analyzing experimental results to develop conclusions about trends in data.

Learning Plan

- Cell Theory Time line: students will read about cell theory and create a time line that maps the scientists and their experiments that lead to the creation of cell theory in chronological order.
- Introduction to the Microscope: students will learn about the parts of a microscope and how to properly use the microscope. Students will practice making wet mount slides which they will view under a light microscope and draw what they see.
- Prokaryotic and Eukaryotic Cell Venn Diagram: Students will compare and contrast prokaryotic and eukaryotic cells by creating a Venn diagram. Half of the group will read about prokaryotic cells and half the class will read about eukaryotic cells. Students will then pair and share with students of the other group.
- Organelles Activities (Task List): Students will complete a variety of activities from a "Task List." They may choose a specified number of activities from the list. Activities include; creating an advertisement for a specific organelle, "Cell as a City" model, organelle flashcards, cell structure cross word puzzle, and organelle coloring packet.
- Plant and Animal Cell Venn Diagram: students will compare and contrast plant and animal cells by creating a Venn diagram. Students will start individual, then pair and share, then review as a whole class.
- Plant and Animal Cell Lab: students will hypothesis if a specimen is a plant or an animal cell. Students will then observe the cells under a microscope. Students will draw and label defining students of each cell and use their observations to identify the cell type. Students will justify their conclusion with evidence and reasoning. This lab can be a formal lab report.
- Climate Change Current Event: students will research a peer reviewed science article about how a certain cellular domain is impacted by climate change or how a prokaryotic cell can be used as a solution to an aspect of climate change. Students will summarize the key findings of the paper and reflect upon how the information relates to the course.
- Plasma Membrane Coloring: Students will read about the structure and function of the plasma membrane. Students will then color and label a diagram of the plasma membrane. The class will explain how the structure of the plasma membrane results in selective permeability.
- Diffusion Lab: Students will complete a laboratory inquiry for which they will observe the movement of starch through a selectively permeable membrane. Students will predict which substance will move through the membrane (starch or iodine). Students will then record their observations and come to

conclusions about diffusion by supporting their results with the scientific principle of diffusion.
- Osmosis Lab: Students will observe osmosis by placing either gummy bears or eggs in solutions of various tonicities (hypotonic, isotonic, and hypertonic). Students will hypothesis how the size of each gummy bear will change as a result of being placed in a different solution. Students will measure and observe the bears over the course of three days. Lastly, students will come to conclusions about osmosis by relating how the movement of water into and out of the gummy bears models the movement of water into and out of cells.
- Transport Practice: Students will explain the processes of passive transport and active transport using models and flowcharts.

Assessment

Formative:

- Do Now Questions
- Exit Ticket Questions
- Participation to class discussions
- Worksheets
- Labs (Plant and Animal Cell Lab, Diffusion Lab, Osmosis Lab)
- Organelle Task List
- Quizzes
    - organelles
    - transport

Summative:

- Unit Assessment
- Formal Lab Reports: Plant and Animal Cell Lab, Diffusion Lab, Osmosis Lab)

Benchmark:

- CP Biology Midterm Exam

Alternative Assessment:

- Microbiology Microbe Project
- Organelle Task List Choice Work

Materials

Textbook: *Biology* by Biggs (Glencoe)
PowerPoint Presentations

Note packets (teacher developed)
Technology (student & teacher laptops, SmartBoard, document camera)
Worksheets
Safety Equipment (lab goggles, gloves)
Microscopes and slides
Lab Equipment (beakers, graduated cylinders, triple beam balance, starch, iodine, onion, methylene blue, toothpicks)
Colored pencils and markers

Integrated Accommodation and Modifications

https://docs.google.com/spreadsheets/d/1uDlwQcgdvbrOcLnMAKouOe1gQph5rWDWxM74UFeuACM/edit?usp=sharing