CURRICULUM

FOR

BIOLOGY

GRADE 10

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

ACKNOWLEDGMENTS

Dr. Susan Dube, Program Supervisor of Science and Technology Education

The Board acknowledges the following who contributed to the preparation of this curriculum.

Adrienne Barnes

Dr. Tiffany A. Beer, Director of Curriculum and Instruction

Subject/Course Title:
Biology
Grade: 10

Date of Board Adoption:
September 21, 2021

RAHWAY PUBLIC SCHOOLS CURRICULUM

Biology: Grade 10

PACING GUIDE

Unit	Title	Pacing
1	Introduction to Scientific Process and Biology	3 weeks
2	Natural Selection & Evolution	4 weeks
3	Cell Structure & Function	3 weeks
4	Cell Transport & Homeostasis	4 weeks
5	Cellular Energy	4 weeks
6	Cell Reproduction	4 weeks
7	Nucleic Acids & Protein Synthesis	4 weeks
8	Mendelian & Non-Mendelian Genetics	6 weeks
9	Genetic Technology	3 weeks
10	Viruses & Bacteria	3 weeks

ACCOMMODATIONS

504 Accommodations:

- Provide scaffolded vocabulary and vocabulary lists.
- Provide extra visual and verbal cues and prompts.
- Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.
- Provide links to audio files and utilize video clips.
- Provide graphic organizers and/or checklists.
- Provide modified rubrics.
- Provide a copy of teaching notes, especially any key terms, in advance.
- Allow additional time to complete assignments and/or assessments.
- Provide shorter writing assignments.
- Provide sentence starters.
- Utilize small group instruction.
- Utilize Think-Pair-Share structure.
- Check for understanding frequently.
- Have student restate information.
- Support auditory presentations with visuals.
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages).
- Provide study sheets and teacher outlines prior to assessments.
- Quiet corner or room to calm down and relax when anxious.
- Reduction of distractions.
- Permit answers to be dictated.
- Hands-on activities.
- Use of manipulatives.
- Assign preferential seating.
- No penalty for spelling errors or sloppy handwriting.
- Follow a routine/schedule.
- Provide student with rest breaks.
- Use verbal and visual cues regarding directions and staying on task.
- Assist in maintaining agenda book.

IEP Accommodations:

- Provide scaffolded vocabulary and vocabulary lists.
- Differentiate reading levels of texts (e.g., Newsela).
- Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.
- Provide extra visual and verbal cues and prompts.
- Provide links to audio files and utilize video clips.
- Provide graphic organizers and/or checklists.
- Provide modified rubrics.
- Provide a copy of teaching notes, especially any key terms, in advance.
- Provide students with additional information to supplement notes.
- Modify questioning techniques and provide a reduced number of questions or items on tests.
- Allow additional time to complete assignments and/or assessments.
- Provide shorter writing assignments.
- Provide sentence starters.
- Utilize small group instruction.
- Utilize Think-Pair-Share structure.
- Check for understanding frequently.
- Have student restate information.
- Support auditory presentations with visuals.
- Provide study sheets and teacher outlines prior to assessments.
- Use of manipulatives.
- Have students work with partners or in groups for reading, presentations, assignments, and analyses.
- Assign appropriate roles in collaborative work.
- Assign preferential seating.
- Follow a routine/schedule.

Gifted and Talented Accommodations:

- Differentiate reading levels of texts (e.g., Newsela).
- Offer students additional texts with higher lexile levels.
- Provide more challenging and/or more supplemental readings and/or activities to deepen understanding.
- Allow for independent reading, research, and projects.
- Accelerate or compact the curriculum.
- Offer higher-level thinking questions for deeper analysis.
- Offer more rigorous materials/tasks/prompts.
- Increase number and complexity of sources.

ELL Accommodations:

- Provide extended time.
- Assign preferential seating.
- Assign peer buddy who the student can work with.
- Check for understanding frequently.
- Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc…).
- Have student repeat directions.
- Make vocabulary words available during classwork and exams.
- Use study guides/checklists to organize information.
- Repeat directions.
- Increase one-on-one conferencing.
- Allow student to listen to an audio version of the text.

● Assign group research and presentations to teach the class. ● Assign/allow for leadership roles during collaborative work and in other learning activities.	● Give directions in small, distinct steps. ● Allow copying from paper/book. ● Give student a copy of the class notes. ● Provide written and oral instructions. ● Differentiate reading levels of texts (e.g., Newsela). ● Shorten assignments. ● Read directions aloud to student. ● Give oral clues or prompts. ● Record or type assignments. ● Adapt worksheets/packets. ● Create alternate assignments. ● Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted. ● Allow student to resubmit assignments. ● Use small group instruction. ● Simplify language. ● Provide scaffolded vocabulary and vocabulary lists. ● Demonstrate concepts possibly through the use of visuals. ● Use manipulatives. ● Emphasize critical information by highlighting it for the student. ● Use graphic organizers. ● Pre-teach or pre-view vocabulary. ● Provide student with a list of prompts or sentence starters that they can use when completing a written assignment. ● Provide audio versions of the textbooks. ● Highlight textbooks/study guides. ● Use supplementary materials. ● Give assistance in note taking ● Use adapted/modified textbooks. ● Allow use of computer/word processor. ● Allow student to answer orally, give extended time (time-and-a-half). ● Allow tests to be given in a separate location (with the ESL teacher). ● Allow additional time to complete assignments and/or assessments. ● Read question to student to clarify. ● Provide a definition or synonym for words on a test that do not impact the validity of the exam. ● Modify the format of assessments. ● Shorten test length or require only selected test items. ● Create alternative assessments. ● On an exam other than a spelling test, don't take points off for spelling errors.

UNIT OVERVIEW

Content Area: Biology

Unit Title: Introduction to Scientific Process and Biology

Target Course/Grade Level: 10

Unit Summary: In this unit, students are first introduced to the characteristics of organisms. They explore the differences between biotic and abiotic factors, as well as the characteristics of life. The nature of science and methods used in science are discussed with examples intended to spark student interest as they attempt to answer questions and solve problems concerning the living world using the same principles of the scientific process employed by scientists when developing answers to scientific questions and solving problems. Student will learn how biologists conduct scientific investigations in the lab and in the field by researching and analyzing biological experiments. Student will complete the unit by designing an experiment to investigate on their own.

Approximate Length of Unit: 3 weeks

LEARNING TARGETS

NJ Student Learning Standards:

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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.
9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.
9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.
9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.
9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

9.3.ST- SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data

NJ SLS Companion Standards: Reading and Writing Standards for History, Social Studies, Science, and Technical Subjects:

NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.W8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:
Students will understand that…

- Biology is the organized study of living things and their interactions with their natural and physical environments.
- Biologists have formulated a list of characteristics by which we can recognize living things.
- Biologists use controlled experiments to obtain data that may or may not support a hypothesis.
- Biologists conduct investigations to increase knowledge about the natural world. Scientific results can help to solve real world problems.
- Scientific processes are used by biologists to answer questions or solve problems. Scientific processes include observing, asking questions, forming hypotheses, experimenting, collecting and evaluating data, forming conclusions, publishing results, engaging in argument, and forming theories.
- Scientific knowledge is a special kind of knowledge based on the collection of evidence. All scientific knowledge changes in light of new technologies and evidence gathered over time.
- Biologists do their work in laboratories and in the field. They collect both quantitative and qualitative data from their observations, experiments, and investigations.
- Scientists continuously revise predictions and explanations to account more completely for available evidence.

- Scientific models and understandings of fundamental concepts and principles are continuously refined as new evidence is considered.
- Communication is very important in science because scientists build on the work of others.

Unit Essential Questions:

- Why is the study of Biology important?
- How are the characteristics of living things used to distinguish between abiotic and biotic factors?
- What characteristics can be observed in a living organism?
- How do scientists use scientific processes to solve problems?
- How do scientists collect data and develop theories and models about how nature works?

Knowledge and Skills:

Students will know...

- Key definitions: adaptation, biology, development, energy, evolution, growth, homeostasis, organism, organization, reproduction, response, species, stimulus, control, data, dependent variable, independent variable, hypothesis, theory, ethics, technology.
- The characteristics of life common to all living things.
- The benefits of studying Biology.
- Laboratory safety procedures and the proper use of laboratory equipment.
- Various scientific processes such as observation, asking questions, collecting data, doing research, analysis, and drawing conclusions.
- Science is an ever-changing body of knowledge as new discoveries are made and knowledge is attained.

Students will be able to…

- Differentiate between living and nonliving things using the characteristics of life.
- Use claim, evidence, reasoning to defend when something may or may not be living at longer based on the characteristics of life.
- Relate organisms' adaptations due to abiotic and biotic factors in its environment.
- Conduct a controlled experiment using the scientific method to solve a problem.
- Identify key terms in experiments such as hypothesis, constants, control group, experimental group, dependent variable, and independent variable.
- Write a testable hypothesis.
- Collect and analyze data.
- Represent data in chart and graph form.
- Engage in argumentation using data from experiments.
- Explain how data from an experiment can have implications in the real world.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams as well as:

- use claim, evidence, reasoning to defend when something may or may not be living at longer based on the characteristics of life.
- write a testable hypothesis
- analyze the experimental design of an investigation
- draw conclusions based on given experimental results
- argue with evidence using the CER protocol

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Is Sammy Alive? Claim, Evidence, Reasoning Activity
- Abiotic vs. Biotic Schoolyard Assessment Activity
- Asking Questions & Writing Hypotheses: Burning Tea Bag Activity
- Independent vs Dependent Variable Identification Activities
- Control Group vs. Experimental Group Identification Activities
- Collecting Biological Data Laboratory
- Laboratory: Antibacterial Soaps vs. Non-Antibacterial Soaps and Bacterial Growth (can be done here or at the end of the Evolution & Natural Selection Unit).

RESOURCES

Teacher Resources:

- Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 1
- EdPuzzle
- Explore Learning - Gizmos

Equipment Needed:

- Chromebooks, poster paper, tea bags, lighter, agar plates, Bacillus subtilis, antibacterial cleansers, non-antibacterial cleansers, gloves, markers, tape, bacterial spreading wands

UNIT OVERVIEW

Content Area: Biology

Unit Title: Natural Selection & Evolution

Target Course/Grade Level: 10

Unit Summary: This unit introduces Darwin's theory of evolution by natural selection. The role of natural selection in the evolution of new species is presented. Students will compare and contrast the work of Jean-Baptiste Lamarck with Darwin's. Students will discuss Charles Darwin's original evidence for natural selection as well as learn about the evidence related to modern advancements in genetic technology and understanding.

Approximate Length of Unit: 4 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction other species.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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.
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9.3.ST- SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
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NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
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NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
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NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:
Students will understand that…

- There are many theories, both past and present, which have explained how organisms change over time.
- The basic idea of theoretical biological evolution is that species that are present on Earth currently developed from earlier, distinctly different species.
- After many years of experimentation and observation, Charles Darwin proposed the idea that species originated through natural selection.
- Natural selection is a mechanism of genetic change in populations.
- In a specific environment, individuals with certain traits are more likely to survive, reproduce, and pass these traits on to their offspring.
- Evolution has been observed in the lab and in the field.

- Much of the evidence for evolution comes from studies of fossils, embryology, physiology, and biochemistry.
- There are many patterns of evolution in nature. These patterns support the idea that natural selection is an important mechanism of evolution.
- Biologists use similarities in body structures, breeding behavior, geographical distribution, chromosomes, and biochemistry to determine evolutionary relationships.
- Cladograms and phylogenic trees can be used to describe and study evolutionary relationships.

Unit Essential Questions:

- How does evolution occur through natural selection?
- Why is natural selection and heredity integral in the process of evolution?
- What are some of the ways scientists study evolutionary relationships among organisms?
- How does fossil, physiological, embryological, and biochemical evidence support Darwin's theory of evolution by natural selection?
- How can changes in populations lead to speciation and macroevolution?
- How can the theory of evolution through natural selection be used to explain the way in which a particular organism came to have its current physical appearance and biochemistry?
- How are cladograms and phylogenic trees constructed?
- How are cladograms and phylogenic tress describe evolutionary relationships?
- How have human activities impacted the evolution of organisms?

Knowledge and Skills:

Students will know...

- Key definitions: analogous structures, artificial selection, camouflage, embryo, homologous structure, mimicry, natural selection, vestigial structure, allelic frequency, convergent evolution, divergent evolution, speciation, cladogram, phylogeny.
- The four major categories of evidence for evolution.
- How natural selection leads to physical and chemical changes in organisms.
- The difference between a cladogram and a phylogenic tree.
- How human activities have altered the evolution of various species and even caused the extinction of organisms.

Students will be able to...

- Analyze how structural and physiological adaptations of organisms relate to natural selection.
- Summarize the effects of different types of natural selection on gene pools.
- Summarize the role of natural selection in convergent and divergent evolution.
- Interpret a phylogenetic tree.
- Construct and interpret a cladogram based on DNA evidence.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams related to the content described in the *Unit Understandings* section as well as:

- construct a cladogram based on DNA evidence.

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Is it fitter? Formative Assessment Probe
- Evidence for Evolution Dry Lab
- Habitat Change Formative Assessment
- GIZMO: Peppered Moth Simulation
- Anolis Lizards Activity
- Habitat Change Formative Assessment Probe
- "How the Cricket Lost Its Song" Activity
- Survival of the Sneakiest Comic and Analysis Questions

RESOURCES

Teacher Resources:

- Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 15
- EdPuzzle
- Explore Learning – Gizmos

Equipment Needed:

- Chromebooks, construction paper, hole punch, calculators

UNIT OVERVIEW

Content Area: Biology

Unit Title: Cell Structure & Function

Target Course/Grade Level: 10

Unit Summary: This unit may be split up throughout the year or taught as a collective at this time. At minimum, students should learn the difference between prokaryotic and eukaryotic cells and the cell theory. Throughout the school year, students can revisit or learn each specific organelles within the cell when its relevant to a biological process. After molecular genetics, students will build a cell model for assessment. Students will understand that cells are the foundation for all life forms. Birth, growth, development, death and all life functions begin as a cellular process.

Approximate Length of Unit: 3 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.
9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

9.3.12.AG- ENV.4 Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

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RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
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NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:

Students will understand that…

- There is a relationship between the structure of molecules and their function in cellular structure and metabolism.
- The cell is the basic unit of structure and function in all organisms.
- Cells have and do evolve over time.
- Living things are: made up of cells, reproduce, grow and develop, respond to stimuli, use materials and energy, evolve, and adapt to their environment.
- The cell theory states that all living things are composed of cells, cells are the basic unit of structure and function in living things, and that new cells are produced by existing cells.
- Within the cell are specialized organelles for the transport of materials (cell membrane), energy transformation (mitochondria), protein building (ribosomes), cellular control (nucleus), transport (endoplasmic reticulum, golgi apparatus, cell membrane), energy capture (chloroplast), support (cell wall in plants, fungi, and bacteria), cellular digestion (lysosomes), support (cytoskeleton).
- The levels of organization in multicellular organisms are individual cells, tissues, organs, and
- The levels of organization in multicellular organisms are individual cells, tissues, organs, and organ system.

- Cells in multicellular organisms develop in different ways to perform particular functions within the organism.

Unit Essential Questions:

- How do the similarities and differences in prokaryotic and eukaryotic cells provide evidence of their evolutionary relationships?
- How does compartmentalization organize a cell's functions?
- How has our understanding of cells changed over time?
- What scientific studies contributed to the cell theory?

Knowledge and Skills:

Students will know...

- Key definitions: magnification, resolution, cell theory, cell membrane, cytoplasm, cytoskeleton, ribosome, prokaryote, cell wall, flagellum, eukaryote, nucleus, organelle, compound microscope, electron microscope.
- Parts of a microscope and how each part works.
- How to properly care for and use a microscope.
- The cell theory and the scientists who contributed to it.

Students will be able to...

- Use a compound microscope to identify different parts in bacteria, animal, and plant cells.
- Compare prokaryotic and eukaryotic cells.
- Describe the evolution of prokaryotic and eukaryotic cells.
- Develop an analogy to describe prokaryotic and eukaryotic cell.
- Develop an analogy to explain how eukaryotic cells function.
- Identify essential organelles within cells and their functions.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze diagrams related to the content described in the *Unit Understandings* section as well as:
  - Complete a practical microscope use assessment
  - Build a model of a cell, its parts, and describe how they function and interact.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Is it Made of Cells? Formative Assessment Probe
- Prokaryotic and Eukaryotic Characteristics Chart Activity
- Prokaryotic and Eukaryotic Cell Venn Diagram
- How the Cell Operates Activity
- Cell City Activity
- Cell as a School Activity
- Parts of a microscope diagram
- Laboratory: Onion, Elodea, and Cheek Cells

- Cell Model Activity

RESOURCES

Teacher Resources:

- Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 7
- EdPuzzle
- Explore Learning – Gizmos

Equipment Needed:

- Chromebooks, microscopes, gloves, toothpicks, slides, cover slips, onion, Elodea, cell modeling materials

UNIT OVERVIEW

Content Area: Biology

Unit Title: Cell Transport & Homeostasis

Target Course/Grade Level: 10

Unit Summary: Students are introduced to the variety of ways that cells regulate the movement of materials across the cell membrane and thereby maintain homeostasis despite changes in their environmental surroundings. This concept is expanded to maintenance of homeostasis throughout the body.

Approximate Length of Unit: 4 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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.
9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.
9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.
9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.
9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.
9.3.ST- SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

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NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.W8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:

Students will understand that…

- Cells are enclosed in a semi permeable membrane that regulates their interactions with their surroundings and other cells, including the transport of molecules into, out of, and between the cell.
- Cellular function is maintained through the regulation of cellular processes in response to changes in internal and external conditions.
- All molecules within the plasma membrane have a certain structure related to their function.
- The cell membrane is non-polar.
- Passive transport moves a substance with the concentration gradient and requires no energy from the cell.
- Osmosis is the diffusion of water through a selectively permeable membrane.
- Cells are affected by hypertonic and hypotonic solutions.
- Active transport moves materials against the concentration gradient and requires energy to overcome the opposition to the concentration gradient.
- Cell size is limited largely by the diffusion rate of materials into and out of the cell, the amount of DNA available to produce proteins to maintain the metabolic function of the cell, and the surface area-to-volume ratio of the cell.

Unit Essential Questions:

- What cellular mechanisms allow substances to cross membranes?
- How does the polarity of the membrane affect the transport of materials in and out of the cell?
- What are the effects on a cell placed in hypotonic, hypertonic and isotonic solutions? Why do these reactions occur?

- What limits the size of a cell?

Knowledge and Skills:

Students will know...

- Key Definitions: active transport, passive transport, endocytosis, exocytosis, facilitated diffusion, hypertonic solution, hypotonic solution, isotonic solution, osmosis, concentration gradient, equilibrium, turgor pressure, plasmolysis, carrier proteins.
- The difference between passive transport processes such as diffusion, facilitated diffusion, and osmosis and active transport processes such as endocytosis and exocytosis.
- Why cell transport is vital to the survival of a cell.
- How the polarity of the cell membrane affects cell transport.
- What might happen to a cell if cell transport fails to occur accurately and efficiently.
- How homeostasis is established through the processes of cell transport.
- Why cells need to be small in order to successfully complete all metabolic processes and survive.

Students will be able to...

- Observe the process of diffusion and determine the environmental factors that affect the rate of diffusion through several demonstrations.
- Predict the effect of a hypotonic, hypertonic, or isotonic solution on a cell.
- Analyze the results of an experiment where cells are placed in hypotonic and hypertonic solutions.
- Distinguish between endocytosis and exocytosis.
- Evaluate evidence dealing with the endosymbiosis theory.
- Calculate and compare cell surface to volume ratios.
- Predict the transport of molecules across the membrane based on polarity and size.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams related to the content described in the *Unit Understandings* section as well as:
  - calculate cell surface to volume ratios.
- Plasma Membrane Models
- Osmosis in an Egg Lab Report
- Structure of the Cell Membrane Quiz

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Plasma Membrane and Cell Transport Modeling Activities and Analysis Questions
- Dialysis Tubing Cell Transport Demonstration and Analysis Questions
- Osmosis Beaker Problems
- Cell Membrane and Cell Transport Webquest
- Osmosis in an Egg Lab
- Cell Surface Area to Volume Ratio Lab and Activities

RESOURCES

Teacher Resources:

- Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 8
- EdPuzzle
- Explore Learning - Gizmos

Equipment Needed:

- Chromebooks, eggs, vinegar, corn syrup, distilled water, transport modeling/craft materials, potatoes, agar, iodine, phenolphthalein, beakers, balances, chart paper

UNIT OVERVIEW

Content Area: Biology

Unit Title: Cellular Energy

Target Course/Grade Level: 10

Unit Summary: In this unit, students will develop an understanding of energy processes on the cellular level. The biochemistry related to photosynthesis, aerobic respiration, and anaerobic respiration will be described. Students will learn that ATP is the energy currency of the cell and how ATP is made and used throughout the cell. The structure and function of the chloroplast and mitochondria will be explored and students will relate the structure to the roles of these organelles in the biochemical processes. Students will also explore the theory of endosymbiosis and relate this to the evolution and structure of mitochondria and chloroplasts. Finally, students will understand the similarities and differences in the processes as well as how the processes differ in prokaryotic verses eukaryotic cells and in different organisms.

Approximate Length of Unit: 4 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
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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.
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9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

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NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
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RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
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NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:
Students will understand that…
- All cells need chemical energy.
- All chemical energy in organisms is initially captured by plants from the sun.
- All matter in organisms is initially captured by plants.
- The overall process of photosynthesis produces sugars that store chemical energy.
- Photosynthesis requires a series of complex chemical reactions that take place in the chloroplast of a cell.
- The overall process of aerobic respiration converts sugar to ATP using oxygen in 2 main stages which take place in the mitochondria of the cell.
- Anaerobic respiration allows for the production of a small amount of ATP without the use of oxygen.
- The processes for attaining cellular energy differ between different types of cells and organisms.

Unit Essential Questions:
- Why do cells need energy?

- How do cells attain energy?
- What is the role of ATP in cells?
- What are the reactants and products of photosynthesis, aerobic respiration and anaerobic respiration?
- How does the structure of the chloroplast and mitochondria allow for the biochemical processes within each to occur?
- How did chloroplasts and mitochondria evolve?
- How are the processes of photosynthesis and aerobic respiration similar? How do they differ?
- How are the processes of aerobic and anaerobic respiration similar? How are they different?
- How do energy processes compare and contrast in prokaryotic and eukaryotic cells and between different organisms?

Knowledge and Skills:

Students will know...

- Key definitions: ATP, ADP, chemosynthesis, photosynthesis, chlorophyll, thylakoid, light dependent reactions, light independent reactions, photosystem, electron transport chain, ATP synthase, Calvin Cycle, cellular respiration, aerobic, anaerobic, glycolysis, Krebs Cycle, fermentation, lactic acid
- The chemical energy used for most cell processes is carried in ATP.
- Organisms break down carbon-based molecules (usually glucose and other carbohydrates) to make ATP.
- Photosynthetic organisms are producers.
- Photosynthesis in plant cells occurs in the chloroplast.
- The light dependent stage of photosynthesis captures energy from the sun and converts it to chemical energy in the bonds of ATP and NADPH.
- The light independent reactions uses the chemical energy stored in ATP and NADPH from the first stage to make sugars.
- Cellular respiration makes ATP by breaking down sugars.
- Glycolysis occurs in all cells and is needed for all cellular respiration processes.
- Aerobic respiration uses oxygen to make large amounts of ATP.
- The Krebs Cycle is the first major stage of aerobic respiration and produces ATP, NADH, and $FADH_2$.
- The electron transport chain is the second major part of aerobic respiration and uses NADH and $FADH_2$ from the Krebs Cycle to produce large amounts of ATP.
- Anaerobic respiration produces NAD^+ which allows glycolysis to continue to make small amounts of ATP.
- Fermentation is important in the production of many human made products.

Students will be able to...

- Observe the process of photosynthesis.
- Predict the effect of limiting light on the photosynthetic process and the consumption of carbon dioxide and production of oxygen in a plant.
- Plan and conduct an experiment to record and analyze data related to the rate of aerobic respiration under varying conditions.
- Analyze the results of an experiment where yeast cells undergo fermentation at varying rates.
- Calculate and compare rates.
- Distinguish between aerobic and anaerobic respiration.
- Evaluate evidence for the evolution of chloroplasts and mitochondria.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams related to the content described in the *Unit Understandings* section.
    - CER Protocol for the Evidence of Photosynthesis Lab
    - CER Protocol for the Aerobic Respiration Lab

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Giant Sequoia Tree Formative Assessment Probe
- Evidence of Photosynthesis Lab
- Chloroplast and Mitochondria Diagramming
- Endosymbiosis Activity
- Aerobic Respiration Presentation
- Aerobic Respiration Energy Carrying Molecules Tally Chart
- Aerobic Respiration Lab
- Anaerobic Respiration Presentation
- Fermentation Lab
- Photosynthesis and Aerobic Respiration Venn Diagram
- Comparing Photosynthesis, Aerobic Respiration, and Fermentation Chart

RESOURCES

Teacher Resources:

- Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 9
- EdPuzzle
- Explore Learning – Gizmos

Equipment Needed:

Chromebooks, elodea, aluminum foil, test tubes, test tube racks, test tube stoppers, lamps, light bulbs, BTB solution, straws, stop watches, graph paper (poster and regular sized), chart paper, construction paper, colored pencils, markers, yeast, sandwich bags, balloons.

UNIT OVERVIEW

Content Area: Biology

Unit Title: Cellular Reproduction

Target Course/Grade Level: 10

Unit Summary: Students will understand how body cells and sex cells reproduce through the process of mitosis or meiosis. They will differentiate between the two processes and understand how the events in each process affect the genetic make-up of the cells at the end of each process. Students will know that cancer results from a malfunction of the mitotic process that results in uncontrolled cell division. Students will describe chromosomal abnormalities, such as Down Syndrome, that occur when the meiotic process fails.

Approximate Length of Unit: 4 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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.
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9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.
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9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and

propose a resolution to a real-world problem.
9.3.ST- SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
9.3.HL- BRD.1 Summarize the goals of biotechnology research and development within legal and ethical protocols.

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NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:
Students will understand that…

- Cell function is maintained through the regulation of cell processes in response to changes in internal and external conditions.
- Somatic cells divide through the process of mitosis, resulting in daughter cells that have the same genetic composition as the original cell.
- The life cycle of a cell is divided into two general periods. A period of active growth and metabolism, known as interphase, and a period that leads to cell division known as mitosis.
- Mitosis is divided into four phases: prophase, metaphase, anaphase, and telophase.
- Cancer is caused by genetic and environmental factors that change the genes that control the cell cycle.
- Mutations in somatic (body) cells affect only the individual and may result in cancer.
- Mutations in gametes (sex cells) will impact the offspring and may affect the evolution of a species.
- In meiosis, one diploid (2n) cell produces four haploid (n) gametes, providing a way for offspring to have the same number of chromosomes as their parents when two haploid cells unite during fertilization.

- Crossing over allows for the exchange of genetic information between homologous chromosomes and occurs during Prophase I of meiosis. This process leads to genetic diversity in gametes and offspring.
- Random assortment and crossing over during meiosis provide for genetic variation among the members of a species. These variations play a role in the evolution of a species.
- The outcome of meiosis may vary due to a failure in the appropriate separation of chromosomes known as non-disjunction, which can create disorders.
- Nondisjunction may result in an abnormal number of chromosomes. Abnormal numbers of autosomes are usually lethal. Down Syndrome is an example of a genetic disease caused by nondisjunction.
- A karyotype can identify unusual numbers of chromosomes in an individual.

Unit Essential Questions:

- How do somatic cells divide to produce daughter cells that have the same genetic material as the original cell?
- How do cells become cancerous?
- How are the processes of mitosis and meiosis similar? How are they different?
- How is genetic information passed from one generation to the next during sexual reproduction?
- How does the processes of meiosis and fertilization maintain a constant number of chromosomes in a given species?
- How does meiosis lead to genetic variation in species?
- How do errors in meiosis lead to genetic abnormalities?

Knowledge and Skills:

Students will know...

- Key Definitions: anaphase, cell cycle, centriole, centromere, chromatin, chromosome, cytokinesis, interphase, metaphase, mitosis, prophase, sister chromatid, spindle fibers, telophase, cancer, gene, pollination, trait, zygote, crossing over, diploid, haploid, egg, sperm, genetic recombination, homologous chromosomes, meiosis, nondisjunction, asexual reproduction, sexual reproduction, fertilization, gamete.
- Why cells may become cancerous and how cancerous cells go through the cell cycle differently than healthy cells.
- The stages and major events of meiosis I and II.
- How failures in meiosis can lead to genetic abnormalities.

Students will be able to...

- Distinguish between the process of cellular growth (cell division) and development (cell differentiation).
- Identify stages of the cell cycle, mitosis, and meiosis through modeling activities.
- Demonstrate the significance of DNA replication to the cell cycle in both prokaryotes and eukaryotes.
- Distinguish between the events of a normal cell cycle and the abnormal events that result in cancer.
- Manipulate a model to demonstrate the events that occur in the various stages of meiosis including crossing over, separation of chromosomes, and nondisjunction.
- Analyze how meiosis and fertilization maintain a constant number of chromosomes within a given species.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams related to the content described in the *Unit Understandings* section as well as:
    - Accurately model and explain the stages of the cell cycle, mitosis, and meiosis.

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Identifying the Stages of Mitosis in an Onion Root Tip Laboratory
- Introduction to Mitotic Cells Internet Activity (http://bio.rutgers.edu/~gb101/lab2_mitosis/index2.html)
- Mitosis Webquest
- Meiosis Webquest
- Cell Cycle and Meiosis Models- Students develop and explain their own models of the cell cycle.
- Cancer presentation & revisions to models to display cancer
- Stem Cell Activity
- Diagrams Comparing Mitosis and Meiosis
- Mitosis and Meiosis Google Slides Sorting Activities
- Baby to Teen Activity

RESOURCES

Teacher Resources:

- Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 8 & 10
- EdPuzzle
- Explore Learning – Gizmos

Equipment Needed:

- Chromebooks,), craft materials for models: paper plates, pipe cleaners, buttons, pins, markers, glue, tape, pom-poms, etc.

UNIT OVERVIEW

Content Area: Biology

Unit Title: Nucleic Acids & Protein Synthesis

Target Course/Grade Level: 10

Unit Summary: In this unit, the structure of DNA is described and modeled by the students. The controversy surrounding the discovery of the structure of DNA is explained, noting the key scientists involved in the research. The process of DNA replication is presented, explained, and modeled by the students. Transcription and translation are also explained, diagrammed, and modeled by the students. The structure and function of the organelles involved in these processes are introduced or reviewed by the students depending on previous lessons. Point and frameshift genetic mutations are explained along with their potential effects which students then model and describe.

Approximate Length of Unit: 4 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS. LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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.
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9.3.ST- SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
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NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:
Students will understand that…

- DNA is the genetic material of all organisms. It is found in the nucleus of eukaryotic cells and floating in the cytoplasm of a prokaryotic cell.
- DNA is a type of nucleic acid and is composed of four kinds of nucleotides. Each nucleotide consists of a sugar, phosphate, and a nitrogen base. The sugar present in DNA is deoxyribose. The nitrogen bases present in DNA are adenine, thymine, cytosine, and guanine.
- A DNA molecule is shaped like a double helix which means it resembles a twisted ladder. It consists of two strands of nucleotides with sugars and phosphates making up the backbone of the molecule. These parts are found towards the outside of the molecule. The nitrogen bases are bonded together according to base pairing rules on the inside of the molecule.
- The nucleotides in DNA follow a base pairing rule. Guanine always pairs with cytosine and adenine always pairs with thymine. Because of this, DNA can replicate itself with great accuracy.

- The central dogma describes the process of protein synthesis as "DNA to RNA to Protein to Trait."
- Genes are small sections of a chromosome made up of DNA.
- Most sequences of three base pairs in the DNA of a gene code for a single amino acid in a protein.
- Messenger RNA is made during the process of transcription. DNA is used as a template to code for the order of nucleotides in an mRNA molecule. This process takes place in the nucleus of eukaryotic cells and the cytoplasm of a prokaryotic cell.
- Translation is the process in which an mRNA molecule is used as a template to code for the order of amino acids in a protein. This process takes place in a ribosome in both prokaryotic and eukaryotic cells.
- A mutation is a change in the nucleotide base sequence of DNA.
- Mutations can be harmful, beneficial, or inconsequential depending on the change.
- Mutations in somatic cells have the potential to cause cancer.
- Mutations in sex cells affect future generations by producing offspring with new characteristics.
- Enzymes are a type of protein made by the coding instructions in DNA.
- Enzymes are catalysts for reactions that happen within organisms.
- Enzymes have a specific shape that relates to their function.
- Enzyme function can be affected by environmental factors such as temperature, pH, salinity, and the concentration of substrate.
- Enzymes can become denatured in environments that are outside their optimal conditions to function.

Unit Essential Questions:

- How does the structure of DNA enable it to make a copy of itself accurately?
- What is the controversy surrounding the discovery of DNA?
- How does a change in DNA in a somatic cell affect an organism?
- How can a change in DNA in a sex cell affect the offspring of an organism?
- How is a sequence of nucleotides in DNA transcribed and translated to synthesize a protein?
- What organelles are involved in the process of protein synthesis?
- How does enzyme shape affect its function?
- How are enzymes affected by environmental changes?
- How does enzyme function impact organisms?

Knowledge and Skills:

Students will know...

- Key definitions: DNA replication, double helix, nitrogen bases, codon, anticodon, mRNA, tRNA, rRNA, transcription, translation, gene, frameshift mutation, point mutation, somatic cells, enzyme, substrate, product, active site, denature.
- The contributions of James D. Watson, Francis Crick, Erwin Chargaff, and Rosalind Franklin in the discovery and understanding of the structure of DNA.
- The shape and parts of a DNA molecule.
- The shape and parts of an RNA molecule.
- The base pairing rules for a molecule of DNA.
- How DNA codes for different proteins in organisms, especially enzymes.
- The impact different environmental factors have on enzyme function.
- As enzymes shape is critical to its function.
- A change in the shape of an enzyme is known as denaturing.

Students will be able to...

- Create a model of a DNA molecule and demonstrate how it replicates.
- Sequence the steps involved in protein synthesis: both transcription and translation.
- Describe basic differences between protein synthesis in prokaryotes and eukaryotes.

- Compare and contrast the effects of different kinds of mutations on cells and organisms.
- Describe the central dogma.
- Model enzyme function and explain what causes enzymes to denature.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams related to the content described in the *Unit Understandings* above.

- Enzyme Lab Report

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- DNA Extraction Lab
- DNA Modeling Activity
- Transcription & Translation Coloring Activity
- Human Face Traits Gene to Trait Activity
- Mutation Coding Activity
- Enzyme Close Reading Activity
- Enzyme Modeling Activity

RESOURCES

- Catalase Lab Experiment

Teacher Resources:

- **Textbook:** Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 3 & 11
- EdPuzzle
- Explore Learning – Gizmos

Equipment Needed:

- Chromebooks, strawberries, peas, chicken liver, salt, shampoo, beakers, coffee filters, sandwich bags, isopropyl alcohol, test tubes, hot plates, colored pencils, craft materials, hydrogen peroxide

UNIT OVERVIEW

Area: Biology

Unit Title: Mendelian & Non-Mendelian Genetics

Target Course/Grade Level: 10

Unit Summary: This unit introduces genetics through the presentation of Gregor Mendel's classic work. The focus is the probability of producing offspring with certain traits based on the parents' genotypes and/or phenotypes. Students will also examine non-Mendelian inheritance patterns and the principles of human genetics. These inheritance patterns include codominance, incomplete dominance, blood type, and sex-linked traits. Students will learn to read and analyze a pedigree.

Approximate Length of Unit: 6 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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.
9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.
9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.
9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.
9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and

propose a resolution to a real-world problem.
9.3.ST- SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

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NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.W8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:
Students will understand that…
- Genes are located on chromosomes and exist in different forms called alleles.
- Cells have matching pairs of homologous chromosomes called autosomes that code for all the traits of an organism except sex.
- Sex chromosomes contain genes that determine the sex of an individual as well as containing genes for other non-sex related traits.
- Mendel formulated the Law of Segregation to explain the masking of a recessive trait in the F1 generation and its reappearance in the F2 generation when parents who were pure for the each of the traits were crossbred.
- Mendel formulated the Law of Independent Assortment to explain that two traits are inherited independently as long as they are on separate chromosomes.
- Events in genetics are governed by the laws of probability. A Punnett Square is a tool that can be used to determine the probability of a certain genotype and/or phenotype being inherited by an individual.
- All genes on the same chromosome are linked and are inherited together. It is chromosomes rather than the individual genes that are assorted independently.

- Some alleles can be expressed through incomplete dominance or codominance. This makes additional phenotypic outcomes possible.
- There may be multiple alleles for one trait.
- Some traits are polygenic; meaning there are multiple genes in different locations and/or on different chromosomes controlling that trait.
- The majority of human traits are controlled by multiple allele or polygenic inheritance. The inheritance patterns of these traits are highly variable.
- A pedigree is a family tree of inheritance.
- Most human genetic disorders are inherited as rare recessive alleles, but a few are inherited as dominant alleles.
- Sex-linked traits are determined by the inheritance of sex chromosomes. X-linked traits are usually passed from carrier females to their male offspring.
- Nondisjunction may result in an abnormal number of chromosomes. Abnormal numbers of autosomes are usually lethal. Down Syndrome is an example of a genetic disease caused by nondisjunction.
- A karyotype can identify unusual numbers of chromosomes in an individual.

Unit Essential Questions:

- What laws resulted from Gregor Mendel's research and experiments with garden pea plants?
- How is a Punnett Square used to predict the possible outcomes for offspring of a genetic cross?
- How are Mendel's laws of heredity related to the events of meiosis?
- How can a pedigree be used to determine the likelihood that a trait is being carried and/or may be inherited by an individual?
- How do traits expressed through incomplete dominance or codominance inheritance patterns affect the outcome of a phenotype in an individual?
- What role does multiple allelic and polygenic inheritance play in the diversity of human genotypes and phenotypes?
- Why are X-linked, sex-linked traits more likely to result in female offspring being carriers while male offspring are affected?
- Why are X-linked, sex-linked traits likely to be passed from mothers to their sons?
- Why are Y-linked, sex linked traits passed from fathers to sons only?
- How can a karyotype be interpreted to detect chromosomal abnormalities?

Knowledge and Skills:

Students will know...

- Key definitions: allele, dominant, recessive, genetics, genotype, phenotype, heredity, heterozygous, homozygous, hybrid, law of independent assortment, law of segregation, trait, monohybrid cross, dihybrid cross, P generation, F1 generation, F2 generation, heredity, genetics, testcross, carrier, zygote, fetus, pedigree, autosome, codominant alleles, incomplete dominance, multiple alleles, polygenic inheritance, sex chromosome, sex-linked traits, karyotype
- How to calculate probability of a specific trait in the offspring based on parental genotypes.
- Common human genetic disorders that are caused by the inheritance of recessive alleles.
- Common codominant, multiple allelic, sex-linked, and polygenic traits in humans and other organisms.

Students will be able to...

- Relate Mendel's two laws to the results he obtained in his experiments with garden peas.
- Analyze Punnett Squares for monohybrid and dihybrid crosses to determine the probability of certain genotypes and/or phenotypes being inherited by an individual.
- Relate Mendel's two laws of heredity to the events of meiosis.
- Interpret a pedigree.

- Determine and make predictions for genotypes and phenotypes of individuals based on a pedigree.
- Distinguish between alleles for incomplete dominance and co-dominance.
- Analyze the pattern of inheritance for human blood type, a multiple allelic trait.
- Analyze the pattern of inheritance for sex-linked traits.
- Distinguish between conditions that result from extra autosomal or sex chromosomes.
- Analyze a karyotype for chromosomal abnormalities

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams related to the content described in the *Unit Understandings* section as well as:
    - model inheritance patterns through Punnett squares and pedigrees.
    - analyze Punnett Squares for monohybrid and dihybrid crosses to determine the probability of certain genotypes and/or phenotypes being inherited by an individual.
    - distinguish between alleles for incomplete dominance and co-dominance.
    - analyze Punnett Squares to determine the pattern of inheritance for human blood type and sex-linked traits.

- EOC Biology 2010 Operational Performance Task Tom Ato's New Crop

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Monohybrid Cross Problems Packet
- Guinea Pig Breeding Problems
- Probability Penny Lab
- Dihybrid Crosses and Mendel's Laws of Inheritance Problems Packet
- Incomplete Dominance and Codominance Practice Problems
- Sex-linked Trait Problems Packet
- Pedigree Problems Packets
- Modeling a Pedigree Activities

RESOURCES

Teacher Resources:

- **Textbook:** Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 10 & 12
- EdPuzzle
- Explore Learning – Gizmos

Equipment Needed:

- Chromebooks, pennies, calculators

UNIT OVERVIEW

Area: Biology

Unit Title: Genetic Technology

Target Course/Grade Level: 10

Unit Summary: This unit describes artificial selection/breeding, advances in DNA technology, and the significance of the Human Genome Project. This unit includes activities that help build student understanding of the use of restriction enzymes, cloning, Gel Electrophoresis/DNA Fingerprinting, bacterial transformation and the production of human proteins (especially insulin).

Approximate Length of Unit: 3 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS. LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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.
9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.
9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change.
9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations.
9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task.
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and

propose a resolution to a real-world problem.
9.3.ST- SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.
9.3.HL- BRD.1 Summarize the goals of biotechnology research and development within legal and ethical protocols.

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NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
NJSLSA.W8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:
Students will understand that…
- Plant and animal breeders selectively breed organisms with a desirable trait which increases the frequency of a desired allele in a population. This is referred to as artificial selection.
- Scientists have developed methods to move genes from one species into another.
- Transgenic organisms can make the genetic products of other organisms using the foreign DNA.
- Bacteria, plants, and animals can be genetically engineered to be of increased use to humans.
- Many species of animals have been cloned. The first cloned mammal was a sheep.
- The Human Genome Project has sequenced the chromosomal DNA of the human genome.
- Gel Electrophoresis and DNA fingerprinting is used to identify individuals.
- Gene therapy technology can be used to treat genetic disorders.

Unit Essential Questions:
- How can selective breeding and artificial selection affect the gene pool of a species?
- How can a gene be removed from one species and inserted into the genome of another?

- How are proteins produced from foreign DNA inserted into a transgenic organism?
- How might the Human Genome Project be used to cure genetic disorders through gene therapy?
- How is gel electrophoresis used to create a DNA fingerprint that can identify a single individual and his or her kin?
- What are some of the major bioethical issues related to genetic technology?

Knowledge and Skills:

Students will know...

- Key definitions: inbreeding, clone, genetic engineering, plasmid, recombinant DNA, restriction enzymes, transgenic organism, vector, gene therapy, human genome, DNA fingerprinting, gel electrophoresis.
- The steps used to engineer transgenic organisms.
- The steps of gel electrophoresis and how it is used to make a DNA fingerprint.
- The applications and benefits of genetic engineering.
- The ethical and moral concerns surrounding genetic engineering.

Students will be able to...

- Evaluate the importance of plant and animal breeding to humans.
- Analyze how completely mapping and sequencing the human genome will advance the human race.
- Describe how recombinant DNA is formed and used in medical engineering.
- Describe how gel electrophoresis is used in genetic/medical engineering.
- Analyze a DNA fingerprint to identify an individual and/or their family members.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams related to the content described in the *Unit Understandings* section.
    - Recombinant DNA/Bacterial Transformation Modeling Activity

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Biotechnology Presentation
- Biotechnology Close Reading Activity
- Artificial Selection Laboratory Activity
- Cloning Activity
- Recombinant DNA/Bacterial Transformation Modeling Activity
- DNA Fingerprinting Activities

RESOURCES

Teacher Resources:

- **Textbook:** Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 13

- Biotechnology Gizmos
- Biotechnology EdPuzzles

Equipment Needed:

- Chromebooks, modeling materials: colored copy paper, colored pencils

UNIT OVERVIEW

Area: Biology

Unit Title: Viruses and Bacteria

Target Course/Grade Level: 10

Unit Summary: This unit introduces students to the forms and characteristics of viruses. Students will understand and be able to provide evidence as to why viruses are not alive. Students will learn the structures, ecology, and the importance of bacteria in the living world. Students will be able to differentiate between viruses and bacteria. Students will also revisit the topics of natural selection and bacterial antibiotic resistance.

Approximate Length of Unit: 3 weeks

LEARNING TARGETS

NJ Student Learning Standards:
HS-LS4-2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-LS4-3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

Interdisciplinary Connections and Standards:
Career Readiness, Life Literacies, and Key Skills:
9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
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.
9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
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propose a resolution to a real-world problem.
9.3.ST- SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
9.3.ST- SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

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NJSLSA.R10. Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
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NJSLSA.W1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
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NJSLSA.W8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
NJSLSA.W9. Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.

Unit Understandings:
Students will understand that…

- Pathogens are defined as disease causing agents that can enter the human body and multiply to create infection.
- Bacteria are pathogens that produce disease in one or two general ways.
- Some bacteria damage cells by breaking down the cell for food, while other release toxins (poisons) that travel throughout the body interfering with normal biological activities.
- Like bacteria, viruses produce disease by disrupting the body's normal equilibrium.
- Once a virus is inside a host cell, two different processes may occur.
- The virus may attack the host by producing a lytic or lysogenic infection.
- Antibiotics are compounds that kill bacteria without harming human cells.
- Antibiotics have no effect on viruses.
- Antiviral drugs have been developed to fight certain viral diseases.
- Antiviral drugs inhibit the ability of viruses to invade and multiply in living cells.
- Viral spread is controlled through prevention by vaccination.
- Through natural selection bacteria can become antibiotic resistant.

Unit Essential Questions:

- How do pathogens multiply and cause disease in the human body?
- How do bacteria cause disease?
- How do pathogens disrupt human homeostasis?
- How do viruses replicate?
- What are the lytic and lysogenic cycles of viruses?
- How do antivirals work to destroy viruses?
- How do vaccines work in preventing viral infections and spread?
- What are some major human bacterial and viral diseases that are of historical significance?
- How can bacteria become resistant to antibiotics?
- How do humans use bacteria and viruses to their benefit?

Knowledge and Skills:

Students will know...

- Key definitions: bacteriophage, capsid, host cell, lysogenic cycle, lytic cycle, pathogen, virus, toxin
- The three shapes of bacteria.
- Major diseases caused by bacteria and viruses.
- How to determine if a disease is bacterial or viral.
- Bacteria are pathogens that reproduce disease in one or two general ways.
- How antibiotics can recognize a specific bacterium and stop its reproduction.
- Basic viral structure.
- Viruses produce diseases by disrupting cell metabolism.
- Vaccines can prevent viral infection and spread.
- Humans use bacteria and viruses in beneficial ways in the medical field, food industry, and in chemical production.

Students will be able to...

- Describe basic bacterial structure.
- Describe basic viral structure.
- Model how viruses reproduce and evolve.
- Describe the important roles bacteria play in organisms and in the environment.
- Use evidence to determine if a disease is bacterial or viral.
- Describe specific examples of human use of bacteria and viruses to their benefit in the medical, chemical, and food industries.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- **End of Unit Assessment**: This assessment will include multiple choice and open-ended questions that require students to draw and analyze graphs and diagrams related to the content described in the *Unit Understandings* section as well as:
    - Analyze evidence to determine if a disease is bacterial or viral.

- Antibacterial and Non-Antibacterial Cleansers and Bacterial Growth Laboratory Report

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Antibacterial and Non-Antibacterial Cleansers and Bacterial Growth Laboratory (teacher may decide to do this lab at the start of the school year or during the evolution unit)
- Comparing Bacteria and Viruses Venn Diagrams
- Bacteria vs. Viruses Presentation
- Viral Reproduction Presentation
- Viral Structure, Reproduction, and Evolution Modeling Activity

RESOURCES

Teacher Resources:

- **Textbook:** Biology: The Dynamics of Life Textbook and Teachers Resource Materials, Chapter 18
- EdPuzzle
- Explore Learning – Gizmos

Equipment Needed:

- Chromebooks, Virus Model Supplies: Styrofoam cups, colored push pins, seamstress pins, construction paper, pipe cleaners, plastic wrap, paper plates, rubber bands.