LIFE SCIENCE GRADE 7

EWING PUBLIC SCHOOLS
2099 Pennington Road Ewing, NJ 08618

Board Approval Date: __September 19, 2022_____ Michael Nitti
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In accordance with The Ewing Public Schools' Policy 2230, Course Guides, this curriculum has been reviewed and found to be in compliance with all policies and all affirmative action criteria.

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Course Description and Rationale

The seventh grade life science course develops student understanding of key concepts to help them make sense of life science. Conceptual understanding is built upon students' science understanding from earlier grades. Learning aligned to the Next Generation Science Standards (NGSS) is three dimensional. Students develop understanding of the disciplinary core ideas through the use of science and engineering practices and by connecting crosscutting concepts of other experiences with physical and earth sciences. NGSS performance expectations (standards) in middle school life science couple particular practices with specific disciplinary core ideas. However, instruction includes the use of many overlapping science and engineering practices integrated into each unit and each unit requires students to engage in problem-based and inquiry learning.

Students use the eight NGSS Science and Engineering Practices to demonstrate understanding of the disciplinary core ideas:

- Asking questions (science) and defining problems (engineering)
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using math and computational thinking
- Constructing explanations (science) and designing solutions (engineering)
- Engaging in argument from evidence
- Obtaining, evaluating and communicating information

The following seven crosscutting concepts support the development of a deeper understanding of the disciplinary core ideas in life science and between the other science disciplines:

- Patterns
- Cause and effect: mechanism and explanation
- Scale, proportion and quantity
- Systems and system models
- Energy and matter: flows, cycles and conservation
- Structure and function
- Stability and change

There are four life science disciplinary core ideas addressed in the middle school:

LS1: From Molecules to Organisms: Structures and Processes
LS2: Ecosystems: Interactions, Energy and Dynamics
LS3: Heredity: Inheritance and Variation of Traits
LS4: Biological Evolution: Unity and Diversity

The course follows a block semester schedule, with students meeting daily for 82 minutes. The course content is arranged into three units of study:

- Ecology
- Cells
- Genetics and Evolution

Career Readiness, Life Literacies, and Key Skills

During this course, students will work on developing, to an age appropriate level, the following Career Readiness, Life Literacies, and Key Skills:

Disciplinary Concepts:

- Career Awareness and Planning
  - An individual's strengths, lifestyle goals, choices, and interests affect employment and income.
  - Developing and implementing an action plan is an essential step for achieving one's personal and professional goals.
  - Communication skills and responsible behavior in addition to education, experience, certifications, and skills are all factors that affect employment and income.
- Creativity and Innovation
  - Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
- Critical Thinking and Problem-solving
  - Multiple solutions exist to solve a problem.
  - An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.
- Digital Citizenship
  - Detailed examples exist to illustrate crediting others when incorporating their digital artifacts in one's own work.
  - Digital communities are used by Individuals to share information, organize, and engage around issues and topics of interest.
  - Digital technology and data can be leveraged by communities to address effects of climate change.
- Global and Cultural Awareness
  - Awareness of and appreciation for cultural differences is critical to avoid barriers to productive and positive interaction.

- Information and Media Literacy
    - Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or misrepresentation.
    - Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.
    - Sources of information are evaluated for accuracy and relevance when considering the use of information.
    - There are ethical and unethical uses of information and media.

- Technology Literacy
    - Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others. • Digital tools allow for remote collaboration and rapid sharing of ideas unrestricted by geographic location or time.

Technology Integration

<u>Computer Science and Design Thinking</u>

During this course, students will work on developing, to an age appropriate level, the following Computer Science and Design Thinking Skills:

Disciplinary Concepts and Core Ideas:

- Data & Analysis
    - People use digital devices and tools to automate the collection, use, and transformation of data.
    - The manner in which data is collected and transformed is influenced by the type of digital device(s) available and the intended use of the data.
    - Data is represented in many formats. Software tools translate the low-level representation of bits into a form understandable by individuals. Data is organized and accessible based on the application used to store it.
    - The purpose of cleaning data is to remove errors and make it easier for computers to process.
    - Computer models can be used to simulate events, examine theories and inferences, or make predictions.

- Engineering Design
  - Engineering design is a systematic, creative and iterative process used to address local and global problems.
  - The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes.
  - Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features.
- Interaction of Technology and Humans
  - Economic, political, social, and cultural aspects of society drive development of new technological products, processes, and systems.
  - Technology interacts with society, sometimes bringing about changes in a society's economy, politics, and culture, and often leading to the creation of new needs and wants.
  - New needs and wants may create strains on local economies and workforces.
  - Improvements in technology are intended to make the completion of tasks easier, safer, and/or more efficient.
- Nature of Technology
  - Technology advances through the processes of innovation and invention which relies upon the imaginative and inventive nature of people.
  - Sometimes a technology developed for one purpose is adapted to serve other purposes.
  - Engineers use a systematic process of creating or modifying technologies that is fueled and constrained by physical laws, cultural norms, and economic resources. Scientists use systematic investigation to understand the natural world.
- Effects of Technology on the Natural World
  - Resources need to be utilized wisely to have positive effects on the environment and society.
  - Some technological decisions involve trade-offs between environmental and economic needs, while others have positive effects for both the economy and environment.

ELA Integration:

NJSLS.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5) (MS-ESS3-5)
NJSLS.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3) (MS-ESS2-3)
NJSLS.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-5)
NJSLS.WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts and information through the selection, organization and analysis of relevant content. (MS-ESS1-4), (MS-ESS2-2)
NJSLS.WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (MS-ESS2-5)
NJSLS.WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection and research. (MS-ESS3-1)
NJSLS.SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (MS-ESS2-2) (MS-ESS2-6)

Math Integration:

NJSLS.MP.2 Reason abstractly and quantitatively. (MS-ESS2-5), (MS-ESS3-5)
NJSLS.MP.4 Model with mathematics. (MS-ESS1-1) (MS-ESS1-2)
NJSLS.6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2) (MS-ESS3-5)
NJSLS.6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)
NJSLS.6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1) (MS-ESS1-2) (MS-ESS1-3)

Unit 1: Ecology (Pacing: 33 Days)

Why Is This Unit Important?

The environment is a hot topic in today's global society. The debate on environmental issues is shaping international relations, economic and political policy and is impacting how we as individuals live our daily lives. At the core of all environmental issues is the need to understand how organisms interact with their environment and the interrelationships that develop between species within the environment. This unit focuses on building this foundation of understanding.

The big idea in this unit is:

• All living things have to interact with other living or non-living things for survival.

Disciplinary Core Ideas:

LS1.C: Organization for Matter and Energy Flow in Organisms

- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)
- Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7)

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)

PS3.D: Energy in Chemical Processes and Everyday Life

- The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. *(secondary to MS-LS1-6)*
- Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. *(secondary to MS-LS1-7)*

Science and Engineering Practices:

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to describe phenomena. (MS-LS2-3)
- Develop a model to describe unobservable mechanisms. (MS-LS1-7)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-6)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)

Cross Cutting Concepts:

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Energy and Matter

- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)
- Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)
- The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

Stability and Change

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4)

Enduring Understandings:

- Biotic and abiotic factors of an ecosystem provide for the needs of the organism.
- There is interdependence between the levels of organization in an ecosystem.
- Analyze causes of changes of a population in an ecosystem and methods of determining population size.
- Explain major kinds of interactions among organisms in an ecosystem.
- Explain how energy flows in an ecosystem.
- Organisms interrelate and are interdependent within an ecosystem in predictable ways.
- All organisms must be able to obtain and use resources, grow, reproduce and maintain stable internal conditions within the ecosystem.
- Changes in environmental conditions can affect the survival of individual organisms and entire species.
- Living systems at all levels of organization demonstrate the complementary nature of structure and function.
- Energy, entering ecosystems as sunlight, is transferred by producers into chemical energy through photosynthesis. Food webs show the flow of energy in a community.
- Importance of conserving our resources (renewable and non-renewable).
- Human impact on the environment.

Essential Questions:

- What are the needs of organisms in an ecosystem?
- How are organisms interdependent in an ecosystem?
- Why are cycles of matter important to the survival of organisms in an ecosystem?
- Why is conservation of resources important?
- How do humans impact our environment (positively and negatively)

Acquired Knowledge:

- Biotic and abiotic factors in the ecosystem are essential for the survival of an organism.
- In an ecosystem, organisms are interdependent on each other to acquire energy.
- Populations change in an ecosystem due to immigration, emigration, death and birth.
- All organisms perform specific roles: producers, consumers and decomposers.
- The two types of changes in a community are primary and secondary succession.
- In an ecosystem, energy flows from the sun → producers → consumers → decomposers.
- All organisms are dependent on cycles of matter; water, carbon, oxygen and nitrogen.
- The impact of resource use, population growth and pollution on the world's population.

Acquired Skills:

- Students use evidence to develop a model in which they identify and describe the relevant components for models of photosynthesis and cellular respiration.
- Students identify and describe the components in the mathematical representations that are relevant to supporting the claims about photosynthesis and cellular respiration. The components could include relative quantities related to organisms, matter, energy and the food web in an ecosystem.
- Students use the mathematical representation(s) of the food web to describe biomass and energy present at each trophic level.
- Students support an explanation by providing an argument, including claims, evidence and reasoning to be evaluated.
- Students identify and describe the components in the given mathematical representations (which include trends, averages and graphs of the number of organisms per unit of area in a stable system) that are relevant to supporting and revising the given explanations about factors affecting biodiversity and ecosystems.
- Students will evaluate the success of various captive breeding programs vs. maintenance of natural habitats.

- Construct a model of a transport system for animals/eggs/offspring to ensure successful maintenance of biodiversity.
- Use clear, concise and meaningful methods to record and communicate one's work. Examples:
  - Keep a science journal.
  - Write lab reports.
  - Respond to reflection questions.
  - Make scientific drawings.
  - Design data tables, graphs, charts and models.

Assessments:

Formative Assessments:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessments:

- Populations and Communities Test
- Ecosystems and Biomes Test
- Living Resources Test
- Food web project
- Engineering design - Pelican nests

Benchmarks:

- Students will be assessed on their ability to analyze and interpret data to provide evidence for the effects of resource availability on organisms and population of organisms in an ecosystem.
- Students will be assessed on their ability to construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- Students will be assessed on their ability to develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem.
- Students will be assessed on their ability to construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- Students will be assessed on their ability to evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- Students will be assessed on their ability to construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
- Students will be assessed on their ability to develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through the organism.
- Students will be assessed on their ability to define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- Students will be assessed on their ability to evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- Students will be assessed on their ability to analyze data from tests to determine the similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- Students will be assessed on their ability to develop a model to generate data for iterative testing and modification of proposed object, tool, or process such that an optimal design can be achieved.

Alternative Assessments:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- What's in a Scene?
- What Happened Here?
- Where Did Your Dinner Come From?
- How Can You Move a Seed?
- How Do You Decide?
- What Happened to the Tuna?

In-Class Activities:

- What's the Population of Beans in a Jar?
- Can You Hide a Butterfly?
- Are You Part of a Cycle?
- How Much Rain is that?
- How Much Variety is there?
- Recycling Paper
- Career Exploration: Ecologist

Lab Activities:

- World in a bottle
- Counting Turtles
- Counting sunflower seeds
- Change in a Tiny Community
- Tree Cookie Tales
- Deer Predation
- Counting Crayfish
- Pond water food web
- Oil spill simulation

Closure and Reflection Activities:

- Global Climate Change – Show "Inconvenient Truth" Debate
- Test school water sources – water fountains
- Evaluate water usage in RMS
- Deer Populations – case studies – Kaibab/ Starvation or Predation

Technology Connections:

- Rabbit Population Growth: http://www.phschool.com/webcodes10/index.cfm?wcprefix=cep&wcsuffix=5012&area=vi ew&x=16&y=13
- Interacting Populations: http://www.phschool.com/webcodes10/index.cfm?wcprefix=ced&wcsuffix=5013&area=vi ew&x=10&y=18
- Water Cycle: http://www.phschool.com/webcodes10/index.cfm?wcprefix=cfp&wcsuffix=4024&area=vie w&x=18&y=15
- Continental Drift: http://www.phschool.com/webcodes10/index.cfm?wcprefix=cfp&wcsuffix=1015&area=vie w&x=4&y=8
- Biomes: http://www.phschool.com/webcodes10/index.cfm?wcprefix=cep&wcsuffix=5024&area=vi ew&x=18&y=11
- Logging: http://www.phschool.com/webcodes10/index.cfm?wcprefix=cep&wcsuffix=5032&area=vi ew&x=6&y=10
- Endangered Species in Your State: http://www.planetdiary.com/background/bioact1.html
- Comparing the Poles: http://www.divediscover.whoi.edu/polar/index.html
- Biology Project - Gone Fishing: http://www.coolclassroom.org/cool_projects/lessons/biology/biology.html
- Arctic Ocean – Food Web: http://www.divediscover.whoi.edu/arctic-ecosystem
- Ocean World: http://oceanworld.tamu.edu/students/
- Ecology – Kid's Corner: http://ecology.com/kidscorner/

Accommodations or Modifications for Special Education, ESL or Gifted Learners:

- Posters of different ecosystems
- Media Center videos on biomes with study guide
- Design and build pelican nests
- Food with concept maps
- Abbreviated text with study guides
- Design review games

List of Applicable Performance Expectations (PE) Covered in This Unit:

- MS-LS2-1
- MS-LS2-2
- MS-LS2.-3
- MS-LS2-4
- MS-LS2-5
- MS-LS1-6
- MS-LS1-7
- MS-ETS1-1
- MS-ETS1-2
- MS-ETS1-3
- MS-ETS1-4

Unit 2: Cells (Pacing: 20 Days)

Why Is This Unit Important?
This unit will lay the foundation for the use and interpretation of scientific explanations of the natural world. Students will understand the interrelations among central scientific concepts and use them to build and critique scientific arguments. Students will understand how all living things share the same characteristics. This unit will identify the cell as the basic unit of structure and function of all living things.

The big ideas embedded in this unit are:

- All living things share the same characteristics in varying complexities.
- Scientific processes are used to inquire, study and test concepts.
- Advances in technology lead to further developments in science.
- The cell is the basic unit of life.
- Function derives from structure.
- Components of a system work in concert to fulfill functions.

Disciplinary Core Ideas:

LS1.A: Structure and Function

- All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)
- In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)

LS1.D: Information Processing

- Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8)

Science and Engineering Practices:

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-LS1-2)
- Develop a model to describe unobservable mechanisms. (MS-LS1-7)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.

- Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3)

Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods.

- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS1-8)

Cross Cutting Concepts:

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)

Scale, Proportion, and Quantity

- Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)

Systems and System Models

- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3)

Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2)

Enduring Understandings: Students will understand:

- Organisms are composed of cells, ranging from one cell to many cells.
- Development of the cell theory.
- Cells - cell organelles functions.
- Organization of cells in many-celled organisms.
- Compounds found in cells and state their functions.
- Cell processes; movement of materials in and out of the cell, photosynthesis, respiration and cell division
- Living systems at all levels of organization demonstrate the complementary nature of structure and function.

Essential Questions:

- Why are cells important?
- How do cells function; organelles and cell processes?
- How are cells organized in multicellular organisms?
- How are organisms of the same kind different from each other?

Acquired Knowledge:

- Identify the importance of cells.
- Distinguish between unicellular and multicellular organisms.
- Explain how both unicellular and multicellular organisms display characteristics of living things.
- Describe the organization of cells in multicellular organisms. Each cell is comprised of organelles which perform a specific function for the survival of the cell.
- Living things are composed of elements, making up molecules, resulting in organelles and cells.

Acquired Skills:

- Students construct an explanation that includes the idea that organization of cells in unicellular and multicellular organisms depend on the functions of organisms. Each cell contains structures that perform specific functions of life through systems of specialized cells.
- Students construct a model that includes the organization of cells in unicellular and multicellular organisms. In the model, students describe the relationships between components of the cell and compare to a city's organization.
- Engage in argument using evidence to support the conceptual understanding that unicellular organisms exhibit the same cellular processes as multicellular organisms with cellular specialization into tissues, organs and organ systems.
- Use appropriate tools to generate data tables, graph, charts, models, etc. Examples:
    - o Use microscopes and magnifying lenses.
    - o Use the computer to construct data tables and graphs.
    - o Use probes and sensors to collect data.
    - o Use rulers, electronic and triple beam balances to collect data.
- Use clear, concise and meaningful methods to record and communicate one's work. Examples:
    - o Keep a science journal.
    - o Write lab reports.
    - o Respond to reflection questions.
    - o Make scientific drawings.
    - o Design data tables, graphs, charts and models.

Assessments:

Formative Assessments:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessments:

- Looking Inside Cells
- Identify and describe the functions of the major organelles of a plant cell and animal cell
- Prepared slides observations
- Egg cell diffusion
- Model of DNA
- Stages of cell-division (mitosis and meiosis)

Benchmark Assessment:

- Students will be assessed on their ability to conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- Students will be assessed on their ability to develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
- Students will be assessed on their ability to use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

Alternative Assessments:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets/Activities:

- How Large Are Cells?
- What is a Compound?
- How do Molecules Move?
- Video: Inside a Cell – Journey inside a cell
- Analyze the functions of the different organelles in a plant cell/animal cell
- Compare the functions of the organelles with the parts of a city/school

In-Class Activities:

- Mini-Lab: Understanding a cell - Observe a prepared plant cell and animal cell - Compare the plant cell and animal cell - Design a cell-city
- Career Exploration: Molecular & Cellular Biologist

Lab Activities:

- How are the cells organized? www.cellsalive.com

Closure and Reflection Activities:

http://www.phschool.com/webcodes10/index.cfm?wcprefix=cep&wcsuffix=3012&area=vi ew&x=2&y=10
http://www.phschool.com/webcodes10/index.cfm?wcprefix=ced&wcsuffix=3014&area=vi ew&x=12&y=13
http://www.phschool.com/webcodes10/index.cfm?wcprefix=cep&wcsuffix=1042&area=vi ew&x=0&y=17
http://www.phschool.com/webcodes10/index.cfm?wcprefix=cep&wcsuffix=3023&area=vi ew&x=5&y=14

Instructional Materials:

- Textbooks
- Lab materials
- Worksheets
- Overhead
- PowerPoints

Technology Connections:

- PHSchool.com with corresponding topic
  - Prentice Hall Interactive Presentations in classroom
- Inspiration Software
- Cell Biology Animation: http://www.johnkyrk.com/
- Cells Alive – Interactive Plant and Animal Cells:
- http://www.cellsalive.com/cells/cell_model.htm
- The Cell cycle: http://www.cellsalive.com/cell_cycle.htm
- Animal Cell Mitosis: http://www.cellsalive.com/mitosis.htm
- Animal cell Meiosis: http://www.cellsalive.com/meiosis.htm
- Cell Cams - Track real time cell growth: http://www.cellsalive.com/cam0.htm

Accommodations or Modifications for Special Education, ESL or Gifted Learners:

- Concept web with pictures inserted
- Design a review game
- Take notes or complete guided notes from the textbook provided power point at
- the beginning of each chapter – PHSchool.com Web Code crd3031
- Cell Theory Rap

List of Applicable Performance Expectations (PE) Covered in This Unit:

- MS-LS1-1
- MS-LS1-2
- MS-LS1-3

Unit 3: Genetics and Evolution (Pacing: 30 Days)

Why Is This Unit Important?

What makes us the way we are? What role does nature versus nurture play in what we do? These are not easy questions to answer. For some they are emotionally charged. This unit will explore the foundation of these issues by focusing on the basic structure of how organisms reproduce, develop and have predictable life cycles. Students will begin to explore and develop their basic understanding of the influence of the genetic information organisms possess on traits and how those traits are passed to their offspring during reproduction.

Disciplinary Core Ideas:

LS1.B: Growth and Development of Organisms

- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. *(secondary to MS-LS3-2)*
- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

LS3.A: Inheritance of Traits

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B: Variation of Traits

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2)
- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

LS4.A: Evidence of Common Ancestry and Diversity

- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)
- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

LS4.B: Natural Selection

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)

LS4.C: Adaptation

- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)

Science and Engineering Practices:

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3)
- Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1)

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

- Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4)

Cross Cutting Concepts:

Patterns

- Patterns can be used to identify cause and effect relationships. (MS-LS4-2)
- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1),(MS-LS4-3)

Cause and Effect

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4),(MS-LS4-6)

Enduring Understandings: Students will understand:

- That all organisms reproduce, either through sexual or asexual reproduction.
- The role of the law of segregation in determining an organism's traits.
- The role of alleles in the expression of a trait.
- The function of probability in the expression of traits.
- The roles of scientists and technology in the development of genetic theory.
- The varying mechanisms for the expression of traits; incomplete dominance, recessive and dominant traits.
- The role of meiosis in genetics and production of gametes.
- The role of DNA and the processes of transcription and translation have on the expression of genetic traits through protein synthesis.
- Through constructing Punnett Squares to determine the probability of the expression of genetic phenotypes and genotypes.
- That there are predictable patterns of inheritance and verify those patterns through the use of a Punnett Square.

Essential Questions:

- In what ways are traits passed from parent to offspring?
- In what ways are variations among organism of the same species produced?
- What is the relationship between how an organism reproduces and the variation of traits in the offspring?
- What is a mathematical method for predicting the possible outcomes of a crossing?
- What is the history of the development of the science of genetics?
- What are the molecules and mechanism involved in protein synthesis?
- What is the relationship between protein synthesis and the expression of traits?

Acquired Knowledge:

- DNA, genes, tRNA, mRNA and ribosomes are the major molecule players in protein synthesis.
- The structural and chemical properties of DNA allow for genetic information to be both encoded in genes and replicated.
- Heredity information is contained in genes, which are located in the chromosomes of each cell and each gene carries out a single unit of information.
- Variations in organisms occur because of different allele combinations passed on from both parents.
- Punnett Squares are used to predict possible allele combinations of offspring.
- Gregor Mendel is recognized for researching the "Theory of Heredity".
- To make proteins, mRNA copies information from DNA in the nucleus. mRNA and tRNA use this information to produce proteins.
- Mutations during protein synthesis change the phenotype of the organism.

Acquired Skills:

- Create a model of the structure of DNA
- Make Punnett Squares to predict possible allele combinations of offspring
- Create a concept map showing the steps in protein synthesis

Assessments:

Formative Assessments:

- Group discussions/presentations:
  - Propose higher order questions
  - Present information to students and ask a question
  - Have students discuss their answers with their peers at their table and discuss together as a group

Summative Assessments:

- Genetics Test (Test)
- Modern Genetics Test (Test)
- Pipe Cleaner Baby Lab (Lab)
- Smile Lab (Lab)
- DNA, RNA and Snork Lab (Lab)
- SpongeBob Genetics Quiz (Quiz)
- Dog Traits Lab (Lab)

Benchmark Assessment:

- Students will be assessed on their ability to use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristics of animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- Students will be assessed on their ability to construct a scientific explanation based on evidence of how environmental and genetic factors influence the growth of organisms.
- Students will be assessed on their ability to develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- Students will be assessed on their ability to develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- Students will be assessed on their ability to gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Alternative Assessments:

- Modified project requirements and rubrics

Suggested Learning Experiences and Instructional Activities:

Anticipatory Sets:

- What does the father look like?
- Class Survey
- What's the Chance?
- How tall is tall?
- How many Chromosomes?

In-Class Activities and Laboratory Experiences:

- Make the right call
- Can you crack the code?
- Family Puzzle
- Pedigree Lab
- Guilty or Innocent
- Paper Pets
- Bikini Bottoms Activities
- Spongebob Activities
- Flip Out
- Genetics Practice Problems
- How well does a Punnett Square Predict Actual Ratios
- Punnett Square with Guinea Pig traits
- Punnett Square Practice
- A quick switch
- DNA coloring Transcription and translation
- Blood type
- How DNA controls the working of the cell
- The Genetic Code
- Career Exploration: Geneticist
- Biologists Report Project

Closure and Reflection Activities:

- What have you learned?
- How are members of your family similar/different?
- What is a mutation?
- What is a genetic disorder?

Instructional Materials:

- Textbooks
- Lab materials
- Worksheets
- Overhead
- PowerPoints

Technology Connections:

- Power Point Lecture presentations
- Code of Life Video
- Mitosis versus Meiosis: http://www.pbs.org/wgbh/nova/baby/divi_flash.html
- Putting DNA to Work: https://www.koshlandsciencemuseum.org/sites/all/exhibits/exhibitdna/index.jsp
- Space Medicine:
- http://science.nasa.gov/science-news/science-at-nasa/2002/30sept_spacemedicine/
- Protein Synthesis: http://www.phschool.com/webcodes10/index.cfm?wcprefix=cep&wcsuffix=3034&area=vi ew&x=11&y=14
- Pedigree: http://www.phschool.com/webcodes10/index.cfm?wcprefix=cep&wcsuffix=3042&area=vi ew&x=17&y=12
- DNA Fingerprinting: http://www.phschool.com/webcodes10/index.cfm?wcprefix=ceh&wcsuffix=3040&area=vi ew&x=13&y=17

Accommodations or Modifications for Special Education, ESL or Gifted Learners:

- Modified tests (as needed)
- Teacher copy of notes/handouts (as needed)
- Peer tutor
- Study sessions (before school or lunch)
- Option for retest/improve grade (with parent signature and meeting with teacher)
- Grade sheet signed (as needed)
- Vocabulary Picture cards (to reinforce)
- Conference with student (as needed)
- Alternate assignment (when applicable)

List of Applicable Performance Expectations (PE) Covered in This Unit:

- MS-LS1-4
- MS-LS1-5
- MS-LS3-1
- MS-LS3-2
- MD-LS4-5

Sample Standards Integration

Career Readiness, Life Literacies, and Key Skills

9.4.8.CI.3:

For example, in Unit 1, students explore the resistance to accepting cause and effect relationships between certain industrial practices and their resulting impacts on our environment.

9.4.8.CT.2:

For example, in Unit 2, students will generate and compare multiple solutions to solutions designed to mitigate disease and infections.

9.4.8.IML.7:

For example in Unit 3, students analyze information from multiple sources to develop a model to describe evolutionary processes.

8.1 Computer Science and Design Thinking

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.

For example in Unit 3, students will access, manage, evaluate, and synthesize information to develop and present a synopsis of the Evolution of Genetics (Then and now)

LGBT and Disabilities Law:

In Unit 3 the Biologists Report Project has students explore the contributions of Biologists from varying minorities including those who are LGBTQ and have disabilities.

Career Exploration:

In each unit there is a career Exploration project:

- Unit 1 – Ecologist
- Unit 2 – Molecular and Cellular Biologist
- Unit 3 - Geneticist

Interdisciplinary Connections

NJSLS.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3), (MS-LS1-4), (MS-LS1-5),(MS-LS1-6),(MS-LS2-1), (MS-LS2-2),(MS-LS2-4),(MS - LS3 - 1),(MS - LS3 - 2), (MS - LS4-1), (MS-LS4-2) ,(MS - LS4-3),(MS - LS4 - 4) (MS-LS4-5)

NJSLS.RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS - LS1 - 5),(MS - LS1 - 6)

NJSLS.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. (MS - LS3 - 1),(MS - LS3 - 2)

NJSLS.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS2-1),(MS-LS3-1),(MS-LS3-2), (MS-LS4-1),(MS-LS4-3)

NJSLS.RST.6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS1-3), (MS-LS1-4), (MS-LS2-5), (MS-LS4-3),(MS-LS4-4)

NJSLS.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

NJSLS.SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS - LS2 - 2), (MS - LS4 - 2),(MS - LS4 - 4)

NJSLS. SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS - LS2 - 2), (MS - LS4 - 2),(MS - LS4 - 4)

NJSLS.SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS - LS1 - 2), (MS - LS1 - 7) , (MS - LS2 - 3), (MS - LS3 - 1),(MS - LS3 - 2)

NJSLS.WHST.6-8.1 Write arguments focused on discipline content. (MS-LS1-3), (MS-LS1-4), (MS-LS2-4)
NJSLS.WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS - LS1-5),(MS-LS1-6), (MS-LS2-2), (MS-LS4-2),(MS-LS4-4)

NJSLS.WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-LS1-1)

NJSLS.WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (MS-LS1-8), (MS-LS4-5)

NJSLS.WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5),(MS-LS1-6), (MS-LS2-2),(MS-LS2-4), (MS-LS4-2),(MS-LS4-4)

These standards are met through the completion of the benchmark performances in all 3 units. For example in:

- Unit 1: Pick a non-science career that would be commonly affected by the environment. Describe how the environment affects this career.
- Unit 2: Cell Story: Write a story playing the role of the parent cell talking to the baby cell explaining all the structures' functions found inside the cell.
- Unit 3: Reading journals/articles about legal issues with cloning and genetic engineering:
    - Persuasive Essay: Cloning
    - Persuasive Essay: DNA evidence with Pros/Cons

NJSLS.MP.2 Reason abstractly and quantitatively. (MS-ESS2-5),(MS-ESS3-5)

NJSLS.MP.4 Model with mathematics. (MS-ESS1-1) (MS-ESS1-2)

NJSLS.6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2) (MS-ESS3-5)

NJSLS.6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)

NJSLS.6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1) (MS-ESS1-2) (MS-ESS1-3)

- These standards are met through the completion of the benchmark performance in Unit 3, students analyze and interpret data to provide evidence for the effects of resource availability on organisms and population of organisms in an ecosystem.