

"Our mission is to prepare each student to be a successful and responsible member of society."

North Smithfield School District

Tenth Grade Science Curriculum

North Smithfield Scope and Sequence SCIENCE Curriculum: K-12

North Smithfield District Science Curriculum Committee
Clare Arnold, District Curriculum Director
Consultants: East Bay Educational Collaborative Science Specialist Team

Navigation icons: back, forward, search, etc.

	<ul style="list-style-type: none"> • What scientific evidence supports the Big Bang Theory? • What is the relationship between energy produced from nuclear reactions, the origin of elements, and the life cycle of stars? <p>Approximate time spent on unit: TBD</p>	<ul style="list-style-type: none"> • H-R Diagram Activity • Absorption Spectra Lab 	<ul style="list-style-type: none"> • Types of Galaxies • Universe • Big Bang Theory
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North Smithfield High School Course Design- Biology
Grade Level - Ten

Text: Biology, Miller & Levine, Pearson Publisher

RI Statements of Enduring Knowledge - (Established Goals):

LS 2 Matter cycles and energy flows through an ecosystem.

<p align="center">Related Rhode Island GSE's (Understandings)</p>	<p align="center">RI Assessment Targets Assessment Evidence ***High Priority</p>
<p>LS2 (9-11)-4 Students demonstrate an understanding of matter and energy flow in an ecosystem by ...</p> <p>4b explaining how the chemical elements and compounds that make up living things pass through food webs and are combined and recombined in different ways (e.g. nitrogen, carbon cycles, O₂, & H₂O cycles).</p> <p>LS2 (9-11)-3 Students demonstrate an understanding of equilibrium in an ecosystem by ...</p> <p>3a defining and giving an example of equilibrium in an ecosystem.</p> <p>3b describing ways in which humans can modify ecosystems and describe and predict the potential impact (e.g. human population growth; technology; destruction of habitats; agriculture; pollution; and atmospheric changes).</p> <p>3c describing ways in which natural events (e.g. floods and fires) can modify ecosystems and describe and predict the potential effects.</p>	<p>LS2 (9-11) POC+ SAE -4 <i>Trace the cycling of matter (e.g., carbon cycle) and the flow of energy in a living system from its source through its transformation in cellular, biochemical processes (e.g., photosynthesis, cellular respiration, fermentation).</i></p> <p>Text Reference: Prentice Hall Biology Chapter 2 & See Middle School Curriculum for sources of prior student knowledge experiences..</p> <ul style="list-style-type: none"> • Activity: McMush: Keys & Locks <p>Demo: Saliva & Starch</p> <p>Text Reference: Prentice Hall Biology Chapter 8</p> <ul style="list-style-type: none"> • Text references: Prentice Hall Biology 23-1, 23-4 • Lab Activity: Inferring Function from Structure • Lab Activity: Water loss in plants

LS2 (9-11)–4

Students demonstrate an understanding of matter and energy flow in an ecosystem by

...

4a diagramming the energy flow in an ecosystem that compares the energy at different trophic levels. (e.g. What inferences can you make about energy “loss” & use?).

4b explaining how the chemical elements and compounds that make up living things pass through food webs and are combined and recombined in different ways (e.g. nitrogen, carbon cycles, O₂, & H₂O cycles).

9b providing an explanation of how the human species impacts the environment and other organisms (e.g. reducing the amount of the earth’s surface available to those other species, interfering with their food sources, changing the temperature and chemical composition of their habitats, introducing foreign species into their ecosystems, and altering organisms directly through selective breeding and genetic engineering).

LS1 (9-11)-1

Students demonstrate understanding of structure and function-survival requirements by...

1a explaining the relationships between and amongst the specialized structures of the cell and their functions (e.g. transport of materials, energy transfer, protein building, waste disposal, information feedback, and even movement).

1b explaining that most multicellular organisms have specialized cells to survive, while unicellular organisms perform all survival functions. (e.g. nerve cells communicate with other cells, muscle cells contract, unicellular are not specialized).

Students demonstrate understanding of differentiation by...

1c comparing the role of various sub-cellular structures in unicellular organisms to comparable structures in multicellular organisms (e.g. oral groove, gullet, food vacuole in Paramecium compared to digestive systems in multicellular organisms).

- Inquiry Lab: Factors Affecting Plant Growth

Text Reference:

Prentice Hall Biology Chapter 8

- Demo: Elodea & BTB
- Inquiry Lab: Observing Respiration

LS2 (9-11) INQ+SAE -3

Using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.

Text Reference:

Prentice Hall Biology Chapter 3

- United Streaming Video: Intro to Ecology: Ecosystems & Biomes
 - Teachers Domain: Video clip: geothermal vents
 - Web Activity: Geochemical Cycles
- Activity: Estuary Food Webs & Ecological Pyramids
- Teachers Domain: Video clip: geothermal vents
 - Web Activity: Geochemical Cycles

LS4 (9-11) NOS+INQ -9

Use evidence to make and support conclusions about the ways that humans or other organisms are affected by environmental factors or heredity (e.g., pathogens, diseases, medical advances, pollution, mutations).

Text Reference:

Prentice Hall Biology Chapter 4

- United Streaming Video: What Shapes an Ecosystem?
 - Constructed Response: Why can't you ignore the changing climate?
 - Inquiry Activity: Fish Kill Mystery
 - Lab: Dissolved Oxygen
- Common Task: “Curious Jen”

LS4 (9-11)-10**Students demonstrate an understanding of human body systems by ...**

10a explaining how the roles of the immune, endocrine, and nervous systems work together to maintain homeostasis.

10b investigating the factors that affect homeostasis (e.g. positive and negative feedback).

LS3 (9-11)-6**Students will demonstrate their understanding of the degree of genetic relationships among organisms by ...**

6a using given data (diagrams, charts, narratives, etc.) and advances in technology to explain how our understanding of genetic variation has developed over time.

LS3 (9-11) -7**Students demonstrate an understanding of Natural Selection/ evolution by...**

7a investigating how information is passed from parents to offspring by encoded molecules (e.g. evidence from electrophoresis, DNA fingerprinting).

7c citing evidence of how natural selection and its evolutionary consequences provide a scientific explanation for the diversity and unity of past and present life forms on Earth.

LS1 (9-11) –2**Students demonstrate an understanding of the molecular basis for heredity by ...**

2a describing the DNA structure and relating the DNA sequence to the genetic code.

2b explaining how DNA may be altered and how this affects genes/heredity (e.g. substitution, insertion, or deletion).

2c describing how DNA contains the code for the production of specific proteins.

LS3 (9-11) -8 Students demonstrate an understanding of Natural Selection/**LS1 (9-11) INQ+SAE+FAF -1**

Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA-replication, nerve cells).

- Text Reference: Chapter 7, section 3
- Cell Membrane animation: wisc-online.com
- Inquiry Activity: Smelly Balloons
- Web Activity: Osmosis & Diffusion, Active & Passive Transport
- Inquiry Lab: What do cucumbers have to do with osmosis?
- YouTube videos: elodea plasmolysis, red blood cell hemolysis and crenation
- Lab: Activity: Using the Microscope
- Inquiry Lab: Cell Diversity (Elodea, cheek cells, and various plant cells)
- Activity: Comparing a cell to a factory
- Lab: Why Are Cells Small?

LS4 (9-11) NOS+INQ -9

Use evidence to make and support conclusions about the ways that humans or other organisms are affected by environmental factors or heredity (e.g., pathogens, diseases, medical advances, pollution, mutations).

LS4 (9-11) SAE+FAF -10

Explain how the immune system, endocrine system, or nervous system works—and draw conclusions about how systems interact to maintain homeostasis in the human body.

Jigsaw Activity: Immune, Endocrine, and Nervous system

LS3 (9-11) NOS -6

Explain how evidence from technological advances supports

evolution by...

8a illustrating that when an environment changes, the survival advantage/disadvantage of some characteristics may change.

8b distinguish between microevolution (on small scale within a single population –e.g., change in gene frequency within a population) and macroevolution (on a scale that transcends boundaries of a single species – e.g., diversity of all beetle species within the order of insects) and explain how macroevolution accounts for speciation and extinction.

8c recognizing patterns in molecular and fossil evidence, to provide a scientific explanation for Natural Selection and its evolutionary consequences (e.g. survival, adaptation).

Students demonstrate an understanding of classification of organisms by ...

8d using data or models (charts, diagrams, table, narratives etc.) to analyze how organisms are organized into a hierarchy of groups and subgroups based on evolutionary relationships. (e.g. creating a taxonomic key to organize a given set of examples).

or refutes the genetic relationships among groups of organisms (e.g., DNA analysis, protein analysis).

Text Reference:

Prentice Hall Biology Chapter 10

- Web Activity: Cells Alive!
- Lab Activity: Comparing Plant and Animal Mitosis
- Investigation: Using Tissues as Evidence (Lung Cancer)
- Stem Cells : Final Word Activity

Text Reference:

- Lab: Cheek Cell DNA Extraction
- Modeling Activity: Build a DNA molecule
- Virtual Lab: Gel Electrophoresis
<http://learn.genetics.utah.edu>
- Investigation: Interpreting DNA Analysis (PH Forensics: Biodetectives)
- Modeling Activity: Transcription
- Modeling Activity: Translation
- Activity: Transcribe and Translate the insulin gene
Mutations creature activity Prentice Hall Biology Chapter 12 &13
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LS3 (9-11) INQ POC-7

Given a scenario, provide evidence that demonstrates how sexual reproduction results in a great variety of possible gene combinations and contributes to natural selection (e.g., Darwin's finches, isolation of a species, Tay Sachs disease).

Text Reference:

Prentice Hall Biology Chapter 11

- Activity: Punnett Squares: Calculating Probability
- Activity: Using Punnett Squares with sex-linked traits, incomplete dominance, codominance, blood type
- Human Genetics (ex: Cystic Fibrosis, Tay Sachs,

albinism, color blindness, sickle cell)

- Activity: Dihybrid Crosses
- Lab Activity: “Breeding Bunnies”
- Activity: “Oompah Loompah Genetics”
- Common Task: “Genes-R-Us”

LS3 (9-11) INQ FAF+POC -8

Given information about living or extinct organisms, cite evidence to explain the frequency of inherited characteristics of organisms in a population, OR explain the evolution of varied structures (with defined functions) that affected the organisms’ survival in a specific environment (e.g., giraffe, wind pollination of flowers).

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Text Reference:

Prentice Hall Biology Chapter 15

- Activity : Natural Selection: “Toothpicks In Hiding”
- Activity: Darwin’s Finches
- Activity: Superbug

Activity: Evolution: The Molecular Connection

Unit	Unit Topics-Essential Questions	Instructional Activities & Investigations (INQ) Reference GSE(s)	Big Ideas (Understandings)
1	<p>The Chemistry of Life*:</p> <ul style="list-style-type: none"> • Why are the properties of water important to life? • What is the importance of carbon compounds in biology? • Why are chemical reactions important to the study of biology? <p>What is the role of enzymes?</p> <p>This unit should be used to review and provide a quick bridge from what is learned in grade nine Physical Science and grade ten Biology since the material is fundamental to student understandings.</p> <p>Estimated 2-3 days</p>	<p>Text Reference: Prentice Hall Biology Chapter 2 & See Middle School Curriculum for sources of prior activities.</p> <ul style="list-style-type: none"> • Activity: McMush: Keys & Locks <p>Demo: Saliva & Starch</p>	<ul style="list-style-type: none"> • Prior knowledge of atomic structure and chemical bonding to biological compounds. • Properties of water • The result of enzyme activity on a substrate. • Enzymes act as biological catalysts.

<p>1</p>	<p style="text-align: center;">Introduction to Biology*:</p> <p>What do we know about living things vs. non-living things?</p> <p>This unit should be used to provide a review and quick bridge from what was learned in middle school in life sciences since the material is fundamental to student understandings. It may be incorporated into Unit 1 above review.</p> <p>Time –</p> <p>Relevant GSE's -</p> <p style="text-align: center;">See LS 1 -1 Middle School and other's from middle school</p>	<p>Text Reference: Prentice Hall Biology Chapter 1-3 & See Middle School Curriculum for sources of prior activities.</p> <p>Inquiry Activity: Sewer Lice</p>	<ul style="list-style-type: none"> • The distinct characteristics of living things. • Students will distinguish between living and nonliving things.
<p>2</p>	<p>Ecology/The Biosphere</p> <ul style="list-style-type: none"> • What is Ecology? • What is an ecosystem? • How does energy flow in an ecosystem? <p>Time –</p> <p>Relevant GSE's – LS 4.9b,2.4a,2.4b</p>	<p>Text Reference: Prentice Hall Biology Chapter 3</p> <ul style="list-style-type: none"> • Teachers Domain: Video clip: geothermal vents • Web Activity: Geochemical Cycles <p>Activity: Estuary Food Webs & Ecological Pyramids</p>	<ul style="list-style-type: none"> • Categorize the different levels of ecological organization. • Distinguish between different types of producers and consumers. • Diagram the energy flow in an ecosystem that compares the energy at different trophic levels.

3	<p>“Cycles of Matter & Carbon Compounds”</p> <ul style="list-style-type: none"> • How does matter cycle in an ecosystem? • How are nutrients important in living systems? • Why are the properties of water important to life? • What is the importance of carbon compounds in biology? • Why are chemical reactions important to the study of biology? <p>What is the role of enzymes?</p> <p>This unit should be used to review and provide a quick bridge from what is learned in grade nine Physical Science and grade ten Biology since the material is fundamental to student understandings.</p> <p>Estimated 2-3 days</p>	<ul style="list-style-type: none"> • United Streaming video: Intro to Ecology • Ecosystems & Biomes • Biochemical jigsaw activity & presentation 	<ul style="list-style-type: none"> • Chemical elements and compounds make up living things • They pass through food webs, and are combined and recombined in different ways.
4	<p>Ecosystems & Communities</p> <p>(Quick review of climate zones-middle school)</p> <ul style="list-style-type: none"> • How does the greenhouse effect maintain the biosphere’s temperature range? • How do humans contribute to greenhouse gasses, and how does that affect the biosphere’s temperature range? • How do natural events modify ecosystems. And how can we predict the potential effects? • What are the main factors that govern aquatic ecosystems? <p>Time –</p> <p>Relevant GSE’s –LS2.3a,2.3b,2.3c</p>	<p>Text Reference: Prentice Hall Biology Chapter 4</p> <ul style="list-style-type: none"> • United Streaming Video: What Shapes an Ecosystem? • Constructed Response: Why can’t you ignore the changing climate? • Inquiry Activity: Fish Kill Mystery • Lab: Dissolved Oxygen <p>Common Task: “Curious Jen”</p>	<ul style="list-style-type: none"> • The factors that determine the Earth’s three main climate zones. • Human actions affect greenhouse gasses. • Abiotic and biotic factors influence an ecosystem. • Compare and contrast community interactions. • Natural events affect ecosystems. • Biomes and aquatic ecosystems and the factors that affect their development.

<p style="text-align: center;">5</p>	<p style="text-align: center;">Cells</p> <ul style="list-style-type: none"> • What are the functions of major cell structures? • How does the structure of an organelle determine its function? • How do specialized cells help an organism to function and survive? <p>Time –</p> <p>Relevant GSE's –LS1.1a,1.1b,1.1c</p> <p>LS4-10a, 10b</p>	<p>Text Reference: Prentice Hall Biology Chapter 7</p> <ul style="list-style-type: none"> • Lab: Activity: Using the Microscope • Inquiry Lab: Cell Diversity (Elodea, cheek cells, and various plant cells) • Activity: Comparing a cell to a factory 	<ul style="list-style-type: none"> • Proficiency in using a compound microscope. • Past investigations by scientists led to cell theory. • Prokaryotic and eukaryotic cell structure and function. • Identify, sketch, and examine cell structures with the use of a compound microscope. • Compare cell structure and function to the operation of a factory. • Examine, compare and contrast specialized cells. • The “cell as a factory • Compare protists to multi-cellular organisms with emphasis on differentiation and specialization • Explain how the roles of the immune, endocrine, and nervous systems work together to maintain homeostasis • Investigate the factors that affect homeostasis (positive and negative feedback)
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<p>6</p>	<p style="text-align: center;">Homeostasis & Transport</p> <p>How does a cell regulate what enters and exits the cytoplasm?</p> <p>How is the structure of a cell membrane structured to regulate what enters and leaves the cell?</p> <p>How does the structure of a cell membrane maintain homeostasis?</p> <p>Time –</p> <p>Relevant GSE's – LS1.1a</p>	<p>Text Reference: Prentice Hall Biology</p> <ul style="list-style-type: none"> • Text Reference: Chapter 7, section 3 • Cell Membrane animation: wisc-online.com • Inquiry Activity: Smelly Balloons • Inquiry Lab: What do cucumbers have to do with osmosis? • (Web source) Demonstration: A microscopic view of Osmosis in plant & animal cells 	<ul style="list-style-type: none"> • The structures in a cell membrane. • The functions of membrane structures. • The processes of diffusion and osmosis. • Applying the terms isotonic, hypertonic, and hypotonic to cells in various solutions. • Formulating hypotheses regarding the effects of osmosis on cells. • Conduct an experiment demonstrating the process of osmosis in a fresh water cell. • Distinguish between active and passive transport.
<p>7</p>	<p style="text-align: center;">Photosynthesis</p> <p>How are plant cells specialized for their particular functions?</p> <p>How are plant structures adapted for their particular functions?</p> <p>How does the structure of a leaf enable it to perform photosynthesis?</p> <p>How are chemical elements and compounds combined and recombined in photosynthesis?</p> <p>Time –</p> <p>Relevant GSE's –LS2.4a,2.4b</p>	<p>Text Reference: Prentice Hall Biology Chapter 8</p> <ul style="list-style-type: none"> • Text references: Prentice Hall Biology 23-1, 23-4 • Lab Activity: Water loss in plants • Inquiry Lab: Factors Affecting Plant Growth • Lab: Transpiration Rate & Stomata • RI-ITEST Module: Harvesting Light for Photosynthesis 	<ul style="list-style-type: none"> • The structure of a plant leaf cross-section under the microscope. • The functions of leaf structures and their specialized cells and their role in photosynthesis. • The relationship between pigments and wavelengths of light. • The chemical processes involved in the light reactions and Calvin Cycles of photosynthesis. • The recombination of chemical elements and compounds in photosynthesis.

<p>8</p>	<p style="text-align: center;">Cellular Respiration</p> <p>How do organisms obtain energy from the food that they eat? What is the relationship between photosynthesis and respiration? Time – TBD Relevant GSE's –LS2.4a,2.4b</p>	<p>Text Reference: Prentice Hall Biology Chapter 8</p> <ul style="list-style-type: none"> • Demo: Elodea & BTB <p>Inquiry Lab: Observing Respiration Lab: Why are cells small? Lab: Clothespin/Muscle Fatigue</p>	<ul style="list-style-type: none"> • Compare and contrast photosynthesis and cellular respiration. • Compare and contrast aerobic and anaerobic respiration.
<p>9</p>	<p style="text-align: center;">Cell Growth & Division</p> <p>Why are cells small? How is genetic information passed from one cell to the next? How are cancer cells different from other cells? How are stem cells different from other cells? Time – TBD</p> <p>Relevant GSE's –LS1.1</p>	<p>Text Reference: Prentice Hall Biology Chapter 10</p> <ul style="list-style-type: none"> • Web Activity: Cells Alive! • Lab Activity: Comparing Plant and Animal Mitosis • Investigation: Using Tissues as Evidence (Lung Cancer) • Stem Cells : Final Word Activity • Lab: Why Are Cells Small? • Jigsaw Activity: Immune, Endocrine, and Nervous system 	<ul style="list-style-type: none"> • What limits the sizes of cells. • Observing mitotic cells and distinguishing the different stages of mitosis in plant and animal cells. • Sequence the stages of mitosis and the events that occur at each stage. • Connect the disruption of the cell cycle with cancer development. • Analyze the costs and benefits of stem cell research and therapy.

<p>10</p>	<p style="text-align: center;">Introduction to Genetics</p> <p>How are genetic traits passed on from one generation to the next? Why do some traits appear more often than others? How is information passed from parents to offspring by encoded molecules?</p> <p>Time –</p> <p>Relevant GSE's – LS3.6a,3.7b, 3.7a</p>	<p>Text Reference: Prentice Hall Biology Chapter 11</p> <ul style="list-style-type: none"> • Activity: Punnett Squares: Calculating Probability • Activity: Using Punnett Squares with sex-linked traits, incomplete dominance, codominance, blood type • Human Genetics (ex: Cystic Fibrosis, Tay Sachs, albinism, color blindness, sickle cell) • Activity: Dihybrid Crosses • Lab Activity: "Breeding Bunnies" • Activity: "Oompah Loompah Genetics" • Common Task: "Genes-R-Us" • Pipe Cleaner "Babies"- Genetic Recombination Activity • Meiosis Simulation Activity 	<ul style="list-style-type: none"> • Punnett Squares demonstrate the principles of dominance and recessiveness, segregation and independent assortment, and to calculate probability. • Distinguish between genotype and phenotype, and homozygous and heterozygous alleles. • Modeling the process of meiosis in the creation of gametes. • Compare and contrast mitosis and meiosis • .Molecular evidence and genetics
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<p>11</p>	<p style="text-align: center;">DNA & RNA</p> <ul style="list-style-type: none"> • How is information passed from parents to offspring? • What is the overall structure of the DNA molecule? • How is the information encoded in DNA used to create traits? <p>Time –</p> <p>Relevant GSE's –LS1.2a,1.2b,1.2c</p>	<p>Text Reference:</p> <ul style="list-style-type: none"> • Lab: Cheek Cell DNA Extraction • Modeling Activity: Build a DNA molecule • Virtual Lab: Gel Electrophoresis http://learn.genetics.utah.edu • Investigation: Interpreting DNA Analysis (PH Forensics: Biodetectives) • Modeling Activity: Transcription • Modeling Activity: Translation • Activity: Transcribe and Translate the insulin gene Mutations creature activity Prentice Hall Biology Chapter 12 &13 	<ul style="list-style-type: none"> • Information is passed form parents to offspring by encoded molecules. • The process of DNA replication. • Transcribing RNA from DNA. • Translating RNA into amino acids. • Manipulating DNA to create mutations. • What are mutagens?
<p>12</p>	<p style="text-align: center;">Evolution</p> <ul style="list-style-type: none"> • Why is there such biodiversity on Earth? • What is the evidence supporting the theory of evolution? • What are the differences between macro & micro evolution? • How do environmental changes affect natural selection/evolution? • How is classification based on evolutionary relationships? <p>Time –</p> <p>Relevant GSE's –LS3-7c, LS3-8b, LS3-8c, LS3-8d</p>	<p>Text Reference: Prentice Hall Biology Chapter 15</p> <ul style="list-style-type: none"> • Activity : Natural Selection: “Toothpicks In Hiding” • Activity: Darwin’s Finches • Activity: Superbug <p>Activity: Evolution: The Molecular Connection</p>	<ul style="list-style-type: none"> • Genetic variation leads to diversity in a population. • Diversity allows for natural selection in a population when there is competition for resources. • Favorable adaptations lead to increased fitness in a population. • What is the evidence of evolution theory? • What is macro & micro evolution? • How is classification based on evolutionary relationships.

<p>13</p>	<p style="text-align: center;">Classification</p> <p>This unit could be used to provide a summative overview of what has been learned all year in biology to what has been learned in middle school and grade nine. Particular emphasis should be class discussion of the following question.</p> <ul style="list-style-type: none"> • Has what we have learned, such as DNA sequencing, changed our view of the evolutionary relationships that were important in the past for classification systems of living organisms? <p>Time –</p> <p>Relevant GSE's -</p>	<p>Text Reference: Prentice Hall Biology Chapter 18 (p.521)</p> <p>Activity sample: Analyzing Data: p.528 #3</p>	
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