

NEW MILFORD PUBLIC SCHOOLS
New Milford, Connecticut



Honors Biology

June 2015

BOE Approved June 2016

New Milford Board of Education

David Lawson, Chairperson
Bill Dahl, Vice Chairperson
Wendy Faulenbach, Secretary
Tammy McInerney, Assistant Secretary
Angelia Chastain
Robert Coppola
David Littlefield
Brian McCauley
J.T. Schemm

Superintendent of Schools

Mr. Joshua Smith

Acting Assistant Superintendent

Dr. Genie Slone

New Milford High School Principal

Greg P. Shugrue

Authors of Course Guide

Robin Barboza-Josephson
Sara DelMastro
Karen Terhaar

New Milford Public Schools Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family, and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect, and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

New Milford High School Core Values and Beliefs

As a collective learning community, we at New Milford High School are grounded by our Core Values and Beliefs (WAVE):

- WORK** Work to become lifelong learners and peer collaborators who meet challenging goals by applying 21st century skills.

- ACHIEVE** Achieve through hard work, honest reflection, and self-advocacy through critical thinking and problem solving.

- VALUE** Value civic responsibility and the diversity within our community and global society.

- EMPOWER** Empower students and teachers to become curious, creative, innovative, and insightful.

New Milford High School 21st Century Learning Expectations

As a collective learning community, we at New Milford High School want our students to meet the following 21st Century Learning Expectations:

Communication:

Communicate information clearly and effectively in a meaningful way using a variety of methods.

Problem-Solving:

Analyze, synthesize, and evaluate to solve problems. Independently and collaboratively set and accomplish goals. Demonstrate innovation and adaptability in various environments.

Technology:

Students demonstrate technological literacy using relevant research tools to access and collect information to formulate new understanding.

Civic and Social:

Students demonstrate personal, social, and civic responsibility within our community and global society.

New Milford Public Schools Honors Biology

Biology is a lab-oriented course. Major concepts include general and biochemistry, ecology, cell structure and function, genetics, biotechnology and evolution. Students are encouraged to see the connections between concepts, their real-world applications, and the challenges they present. At the honors level, this course is more rigorous, and moves at a faster pace. Additional homework may be required. Students taking honors biology are encouraged to take the SAT Biology subject test.

Pacing Guide

| Unit # | Title | Weeks |
|---------------|---------------------------------|--------------|
| 1 | Cells and Cell Chemistry | 10 |
| 2 | Cell Processes | 5 |
| 3 | Genetics and Genetic Technology | 12 |
| 4 | Ecology | 4 |
| 5 | Evolution | 3 |

Key for National and State Standards

HS-LS = Next Generation Science Standards: Life Sciences

HS-ES = Next Generation Science Standards: Earth Sciences

HS-ETS = Next Generation Science Standards: Engineering, Technology, and Applications
of Science

RST = Common Core Reading Standards for Literacy in Science 6-12

WHST = Common Core Writing Standards for Science and Technology

**New Milford Public Schools
Curriculum**

| | |
|--|--|
| Committee Member(s): Robin Barboza-Josephson Sara Del Mastro Karen Terhaar | Course/Subject: College Prep Biology Grade Level: 10 # of Weeks: 10 |
| Unit Title: Unit 1 - Cells and Cell Chemistry | |

Identify Desired Results

Common Core Standards

- **HS-LS1-2** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]LS1.A

- **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.[Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.]

- **HS-LS1-5.** Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]

- **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. [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]

- **WHST.9-12.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
- **RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of 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.

| <p align="center">Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)</p> | <p align="center">Essential Questions Inquiry used to explore generalizations</p> |
|---|---|
| <ul style="list-style-type: none"> ● Specialized cells within organisms help perform the essential functions of life and maintain homeostasis. ● As matter and energy flow through living things, elements are combined in different ways to form different products. | <ul style="list-style-type: none"> ● How are organisms structured to ensure efficiency and survival? (LS1.A) |

| <p align="center">Expected Performances What students should know and be able to do</p> |
|--|
| <p>Students will know the following:</p> <ul style="list-style-type: none"> ● The similarities and differences between plant and animal cells. ● How the structure of the cell membrane allows cells to maintain homeostasis. ● The similarities and differences between prokaryotes and eukaryotes. ● The biochemical contribution of different organelle processes to the overall cell function ● The similarities and differences between bacteria and viruses ● The differences between bacterial reproduction and viral replication |

Students will be able to do the following:

- Explain the role cell organelles play in maintaining homeostasis for an organism.
- Explain how a cell responds to changes in its environment.
- Compare and contrast plant and animal cells.
- Explain the biochemical role of each organelle
- Explain the difference between bacterial reproduction and viral replication

Character Attributes

- cooperation
- Citizenship

Technology Competencies

- Students use technology to research , assemble, evaluate , and utilize information.
- Students use technology to present and analyze lab data in a report.

Develop Teaching and Learning Plan

Teaching Strategies:

- Provide note-taking templates
- Nonlinguistic representations of cellular organelles
- nonlinguistic representations of biochemical contributions of organelles
- cooperative group work
- inquiry activities
- modeling
- graphic organizers

Learning Activities:

- Build models of organic molecules
- Cell Model Project – students create a model as a class to demonstrate understanding of cell organelle structure, biochemical contribution, and function
- Microscope Lab – Prokaryote vs. Eukaryote (Animal / Plant) Cells – students will observe prepared slides and wet mount of a variety of plant and animal cells to compare their structure.
- Create Cell City Analogy Project – students create analogies comparing cell organelles to parts of a city based on structure and function.

| Assessments | |
|---|---|
| Performance Task(s) Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period) | Other Evidence Application that is functional in a classroom context to evaluate student achievement of desired results |
| <p>Goal: Determine the cost effectiveness of different enzymes in producing apple juice from applesauce.</p> <p>Role: Consultant hired by a large apple juice company</p> <p>Audience: CEO of apple juice company</p> <p>Situation: Test different enzymes and combinations of enzymes cost effectiveness in juice production</p> <p>Performance: Design and implement an experiment to gather data and report on results.</p> <p>Standards for Success: lab rubric</p> | <ul style="list-style-type: none"> ● Quizzes and tests ● Bio-illustrations of cells / cell parts ● Formative assessment through questioning ● lab analysis questions ● lab report ● Exit tickets ● Guided reading activities |
| Suggested Resources | |
| <ul style="list-style-type: none"> ● <i>Biology: The Dynamics of Life (2004)</i>. Columbus, OH. The Mc-Graw Hill Companies. ● ● | |

**New Milford Public Schools
Curriculum**

| | |
|--|---|
| Committee Member(s): Robin Barboza-Josephson Sara Del Mastro Karen Terhaar | Course/Subject: College Prep Biology Grade Level: 10 # of Weeks: 5 |
| Unit Title: Unit 2 - Cells Processes | |
| Identify Desired Results | |
| Common Core Standards | |
| <ul style="list-style-type: none"> ● HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.] ● HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.] ● 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. [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.] ● 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. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.] ● WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. | |

- **RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- **RST.9-10.5** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force*, *friction*, *reaction force*, *energy*).

| <p style="text-align: center;">Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)</p> | <p style="text-align: center;">Essential Questions Inquiry used to explore generalizations</p> |
|--|---|
| <ul style="list-style-type: none"> ● How sunlight is transferred to a usable energy form inside the cell ● As matter and energy flow through living things, elements are combined in different ways to form different products. ● Cell division and differentiation produce and maintain complex organisms composed of multiple systems that work together to meet the needs of the organism. | <ul style="list-style-type: none"> ● How are organisms structured to ensure efficiency and survival? (LS1.A) ● How are matter and energy transferred and conserved? (LS1.C) (LS2.B) ● How do organisms grow and development? (LS1.B) |

Expected Performances

What students should know and be able to do

Students will know the following:

- How the structure of the cell membrane allows it to maintain homeostasis.
- The various mechanisms of cell transport.
- How photosynthesis converts light energy into chemical energy.
- How cellular respiration breaks down molecules to obtain energy.
- How mitosis produces cells for growth and development.
-

Students will be able to do the following:

- Explain the role cell organelles play in maintaining homeostasis for an organism.
- Explain how a cell responds to changes in its environment.
- Create a model to demonstrate the relationship between photosynthesis and cellular respiration.
- Explain the role of mitosis in growth and development of an organism.
- Create a model to demonstrate mitosis.

| Character Attributes | |
|--|---|
| <ul style="list-style-type: none"> ● Cooperation ● Citizenship | |
| Technology Competencies | |
| <ul style="list-style-type: none"> ● Students use technology to assemble, evaluate, and utilize information. | |
| Develop Teaching and Learning Plan | |
| Teaching Strategies: <ul style="list-style-type: none"> ● use of demonstrations to reinforce content ● provide guided note-taking templates ● nonlinguistic representations (diagrams and animations of each cell process) ● cooperative learning ● inquiry activities ● graphic organizers | Learning Activities: <ul style="list-style-type: none"> ● Egg Osmosis Demonstration - students diagram and explain how cells react to their environments using an egg as a model ● Dialysis Tubing Activity ● Model mitosis using pipe cleaners |

| Assessments | |
|---|--|
| Performance Task(s) | Other Evidence |
| Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period) | Application that is functional in a classroom context to evaluate student achievement of desired results |
| <p>Goal: The goal is to develop a children's book that follows carbon through cellular respiration and photosynthesis showing energy transfer</p> <p>Role: You are the cartoonist hired to write the book</p> <p>Audience: Fellow students</p> <p>Situation: Your editor does not understand how photosynthesis and cellular respiration takes the energy from the sun and converts into a form your cells can burn</p> | <ul style="list-style-type: none"> ● Quizzes and tests ● Bio-illustrations of mitosis and meiosis ● Formative assessment through questioning ● lab analysis questions ● lab report ● Exit tickets ● Guided reading activities |

Performance: Draw a planning board for your book that outlines and explains the process frame by frame (cartoon board)

Performance: Draw the cartoon

Standards for Success: Poster Rubric for photosynthesis and cellular respiration

Suggested Resources

- *Biology: The Dynamics of Life (2004)*. Columbus, OH. The Mc-Graw Hill Companies.

**New Milford Public Schools
Curriculum**

| | |
|--|---|
| <p>Committee Member(s): Robin Barboza-Josephson Sara Del Mastro Karen Terhaar</p> <p>Unit Title: Unit 3 - Genetics & Genetic Technology</p> | <p>Course/Subject: College Prep Biology Grade Level: 10 # of Weeks: 12</p> |
| <p>Identify Desired Results Common Core Standards</p> | |
| <ul style="list-style-type: none"> ● 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. [<i>Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.</i>] ● HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [<i>Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.</i>] [<i>Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.</i>] ● 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. [<i>Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.</i>] ● 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. [<i>Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.</i>] [<i>Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.</i>] | |

- **HS-ETS1-2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **RST.9-10.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of 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.9-10.4** 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 9-10 texts and topics*.
- **WHST.9-10.1** Write arguments focused on discipline-specific content.
- **WHST.9-10.4** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

| <p align="center">Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)</p> | <p align="center">Essential Questions Inquiry used to explore generalizations</p> |
|---|--|
| <ul style="list-style-type: none"> ● The genetic code is universal. ● Genes are the instructions that code for proteins. ● The coded proteins are both functional and structural and define the organism's phenotype and physiology. ● Meiosis contributes to genetic variation in offspring. ● Mutations both through DNA replication and environmental factors are sources of genetic variation ● DNA can be engineered to alter genetic traits | <ul style="list-style-type: none"> ● What processes are responsible for life's unity and diversity? (LS3.A) (LS3.B) ● How do science and technology affect the quality of our lives? |
| <p align="center">Expected Performances What students should know and be able to do</p> | |
| <p>Students will know the following:</p> <ul style="list-style-type: none"> ● How an organism transfers the information contained in DNA to the proteins ● That proteins determine the structure and function of all organisms | |

- The relationship between DNA and the chromosome
- How to predict the probability of genetic crosses
- How to use pedigrees to understand patterns of inheritance
- How DNA can be manipulated (engineered) to alter traits

Students will be able to do the following:

- Describe the structure of DNA and RNA
- Explain how DNA replicates itself
- Describe the general role of DNA and RNA in protein synthesis
- Use Punnett Squares to predict the probability of offspring genotypes and phenotypes.
- Analyze a pedigree to determine the pattern of inheritance
- Outline the steps to create a transgenic organism
- Apply the steps to create a glowing bacteria
- Application of punnett squares and pedigrees to predict genetic outcomes
- Support claim using evidence

Character Attributes

- Perseverance
- Cooperation
- Citizenship

Technology Competencies

- Students use technology to assemble, evaluate, and utilize information.
- Students use technology to prepare and publish the GMO article.
- Students use biotechnology equipment in the genetic transformation and DNA fingerprinting labs.

Develop Teaching and Learning Plan

Teaching Strategies:

- provide guided note-taking templates
- nonlinguistic representations
- modeling
- mini whiteboards to assess understanding
- class discussions about genetic technology and ethics
- identify similarities between DNA/RNA and mitosis/meiosis
- graphic organizers

Learning Activities:

- Meiosis modeling
- DNA structure modeling
- Protein synthesis activity
- Punnett square practice
- Pedigree analysis
- DNA Fingerprinting Lab
- Pglo Lab
- Paper Plasmid Lab
-

| Assessments | |
|---|---|
| Performance Task(s) | Other Evidence |
| <p>Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period)</p> | <p>Application that is functional in a classroom context to evaluate student achievement of desired results</p> |
| <p>Goal: Write an argumentative essay presenting the pros and cons of Genetic Modified Organisms</p> <p>Role: You are a reporter for your school newspaper.</p> <p>Audience: the student body</p> <p>Situation: A grocery store chain, known for selling all natural and organic foods wants to sell your school only organic apples but the food service manager wants to purchase new GMO apples that have been modified to prevent browning.</p> <p>Product or Performance: An article arguing in favor of or opposing the purchase of GMO apples.</p> <p>Standards for Success: Correct using the school wide communications rubric</p> | <ul style="list-style-type: none"> ● Quizzes and tests ● Bio-illustrations meiosis ● Formative assessment through questioning ● lab analysis questions ● lab report ● Exit tickets ● Guided reading activities |
| Suggested Resources | |
| <ul style="list-style-type: none"> ● <i>Biology: The Dynamics of Life (2004)</i>. Columbus, OH. The Mc-Graw Hill Companies. | |

**New Milford Public Schools
Curriculum**

| | |
|--|---|
| Committee Member(s): Robin Barboza-Josephson Sara Del Mastro Karen Terhaar | Course/Subject: College Prep Biology Grade Level: 10 # of Weeks: 4 |
| Unit Title: Unit 4 - Ecology | |
| Identify Desired Results | |
| Common Core Standards | |
| <ul style="list-style-type: none"> ● HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.] ● HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.] ● HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.] ● HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.] | |

- **SUPPLEMENTAL HS-LS2-7** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*
[Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]
- **HS-ETS-1** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- **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.
- **RST.9-10.9** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
- **WHST.9-10.7** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

| <p style="text-align: center;">Enduring Understandings Generalizations of desired understanding via essential questions (Students will understand that ...)</p> | <p style="text-align: center;">Essential Questions Inquiry used to explore generalizations</p> |
|---|--|
| <ul style="list-style-type: none"> ● Organisms and their environment are interdependent. ● Ecosystems can support a limited amount of organisms based on availability of living and nonliving resources. ● Energy is transferred through the ecosystem. ● Matter is cycled through the ecosystem. ● Human activity impacts biodiversity and function of the ecosystem. | <ul style="list-style-type: none"> ● How and why do organisms interact in their environment? What are the effects of these interactions? (LS2.A) (LS2.C) ● How are energy and matter transferred and conserved?(LS2.B) ● How do humans impact biodiversity? (LS4.D) |

| Expected Performances | |
|---|--|
| What students should know and be able to do | |
| <p>Students will know the following:</p> <ul style="list-style-type: none"> ● How energy flows and matter cycles through ecosystems ● The difference between autotrophs and heterotrophs ● Predator / prey dynamics ● How limiting factors affecting carrying capacity ● The difference between logistic and exponential growth ● Factors that affect human population growth trends in developed versus developing countries. <p>Students will be able to do the following:</p> <ul style="list-style-type: none"> ● Describe the dynamics of energy flow through ecosystems ● Model energy flow through ecosystems using trophic pyramids ● Describe predator / prey dynamics ● Describe the factors affecting carrying capacity ● Describe how emigration, immigration, birth/death rate affect the growth of populations ● Explain how technology has affected size and growth rate of human populations ● Analyze age structure diagrams to predict the future needs of a country | |
| Character Attributes | |
| <ul style="list-style-type: none"> ● Citizenship ● Respect ● Responsibility ● Compassion | |
| Technology Competencies | |
| <ul style="list-style-type: none"> ● Students use technology to communicate, collaborate and solve an authentic problem. ● Students use technology to interpret, compare and evaluate population statistics. | |
| Develop Teaching and Learning Plan | |
| <p>Teaching Strategies:</p> <ul style="list-style-type: none"> ● provide guided note-taking templates ● nonlinguistic representations ● modeling predator prey dynamics ● mini whiteboards to assess understanding ● class discussions about humans impact on ecosystems ● compare and contrast exponential vs. logistic population growth ● identify similarities and differences in population growth of developed | <p>Learning Activities:</p> <ul style="list-style-type: none"> ● Cats in Borneo ● Invasive Species Research ● Predator -Prey graphing activity ● Analysis of human age structure diagrams activity |

| | |
|---|--|
| vs. developing countries <ul style="list-style-type: none"> ● cooperative group work ● graphic organizers | |
|---|--|

| Assessments | |
|--------------------|--|
|--------------------|--|

| Performance Task(s) | Other Evidence |
|--|--|
| Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period) | Application that is functional in a classroom context to evaluate student achievement of desired results |

| | |
|--|--|
| <p>Goal: Design an experiment that demonstrates the factors affecting carrying capacity in a yeast population</p> <p>Role: You are a scientist assigned the task of raising a large population of healthy yeast to be used in classrooms statewide for the CAPT population yeast lab</p> <p>Audience: Board of directors of Biocore</p> <p>Situation: You have one week to generate enough healthy yeast to be used science classrooms statewide</p> <p>Product or Performance: Lab report showing the factors that have the greatest impact on yeast growth</p> <p>Standards for Success: Lab report rubric</p> | <ul style="list-style-type: none"> ● Quizzes and tests ● Formative assessment through questioning ● lab report ● Exit tickets ● Guided reading activities ● graphing exercises |
|--|--|

| Suggested Resources |
|----------------------------|
|----------------------------|

| |
|---|
| <ul style="list-style-type: none"> ● <i>Biology: The Dynamics of Life (2004)</i>. Columbus, OH. The Mc-Graw Hill Companies. ● Parachuting Cats into Borneo Activity <p>http://www.ncsu.edu/project/bio181de/Black/ecosystems/ecosystems_news/catsborneo.htm</p> <ul style="list-style-type: none"> ● The Population Reference Bureau www.prb.org |
|---|

**New Milford Public Schools
Curriculum**

| | |
|--|---|
| Committee Member(s): Robin Barboza-Josephson Sara Del Mastro Karen Terhaar | Course/Subject: College Prep Biology Grade Level: 10 # of Weeks: 2 |
| Unit Title: Unit 5 - Evolution | |
| Identify Desired Results | |
| Common Core Standards | |
| <ul style="list-style-type: none"> ● HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.] ● HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.] ● HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.] ● 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. [Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] [Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.] | |

- **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. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]
- **HS-LS4-4** Construct an explanation based on evidence for how natural selection leads to adaptation of populations.[Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading 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 of other species. [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]
- **HS-LS4-6** Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*[Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]
- **RST.9-10.2** Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- **WHST.-10.2** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

| <p style="text-align: center;">Enduring Understandings</p> <p style="text-align: center;">Generalizations of desired understanding via essential questions (Students will understand that ...)</p> | <p style="text-align: center;">Essential Questions</p> <p style="text-align: center;">Inquiry used to explore generalizations</p> |
|--|---|
| <ul style="list-style-type: none"> ● Change in the genetic makeup of a population over time is evolution. ● Natural Selection is the driving force of evolution. ● Natural selection leads to | <ul style="list-style-type: none"> ● What is the role of genes in the evolution of all populations? (LS4.B) ● What evidence shows that different species are related? (LS4.A) ● What is the driving force of |

| | |
|--|--|
| adaptation. <ul style="list-style-type: none"> Human activity impacts biodiversity and function of the ecosystem. | evolution? (LS4.B) <ul style="list-style-type: none"> How do humans impact biodiversity? (LS4.D) |
| Expected Performances What students should know and be able to do | |
| Students will know the following: <ul style="list-style-type: none"> The role genetic mutation plays in natural selection and evolution How evolution provides a scientific explanation for fossil records How adaptations increase chances for survival Evolution at the allele level Factors that are associated with speciation and extinction Evidences of evolution. Students will be able to do the following: <ul style="list-style-type: none"> Explain how genetic mutation and natural selection play a role in evolution Explain how evolution provides a scientific explanation for fossil records Describe how adaptations increase chances for survival Explain evolution at the allele frequency level Describe the factors associated with speciation Describe the Hardy-Weinberg principle Identify homologous / analogous /vestigial structures and explain the significance of each in relation to evolution | |
| Character Attributes | |
| <ul style="list-style-type: none"> Responsibility Citizenship Compassion Respect | |
| Technology Competencies | |
| <ul style="list-style-type: none"> Students use technology to analyze the historical significance of natural selection. Students use technology to research and evaluate cases of natural selection. | |
| Develop Teaching and Learning Plan | |
| Teaching Strategies: <ul style="list-style-type: none"> provide guided note-taking templates nonlinguistic representations modeling natural selection class discussions about humans impact on ecosystems cooperative group work graphic organizers | Learning Activities: <ul style="list-style-type: none"> 5 Island Nature Preserve Rat Speciation Performance Task Darwin's Expedition and Discoveries discussion Peppered Moth Online Simulation Activity Natural Selection - Musical Chairs |

| Assessments | |
|--|--|
| Performance Task(s) Authentic application to evaluate student achievement of desired results designed according to GRASPS (one per marking period) | Other Evidence Application that is functional in a classroom context to evaluate student achievement of desired results |
| <p>Goal: To produce a report that presents the possible speciation of the rat population on 5 very different Nature Preserve islands</p> <p>Role: Scientist hired by the caretakers of the 5 Island Preserve concerned about the recent rat invasion.</p> <p>Audience: The caretakers of the 5 Island Preserve worried about the possible long term repercussions of the newly arrived rat population</p> <p>Situation: A ship has sunk off the coast of the 5 Island Preserve (a very unique and pristine group of islands) and the rat population on the ship has rafted to all the islands</p> <p>Product or Performance: A report presented in book or poster form that shows the possible speciation that could occur in this newly introduced rat population</p> <p>Standards for Success: Rat Island rubric</p> | <ul style="list-style-type: none"> ● Quizzes and tests ● Formative assessment through questioning ● lab analysis questions ● Exit tickets ● Guided reading activities |
| Suggested Resources | |
| <ul style="list-style-type: none"> ● <i>Biology: The Dynamics of Life (2004)</i>. Columbus, OH. The Mc-Graw Hill Companies. ● Peppered Moth Simulation http://peppermoths.weebly.com/ | |

