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Structure, Function and Information Processing

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-LS1-1. **Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.**

MS-LS1-2. **Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.**

MS-LS1-3. **Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.**

MS-LS1-8. **Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.**

DCI: LS1.A: Structure and Function	Student Learning Objectives	Suggested Assessments
• 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)	• Develop a list of traits common to all living things and construct a working definition of the word “organism.” • Describe and list the 6 Kingdoms of Life based on number and types of cells. • Observe, draw, label and measure cells based on specific guidelines. • Identify and describe the function of different cell organelles. • Observe osmosis and its effect on plant (Elodea) cells. • Compare/contrast plant and animal cells based on structure and function of organelles. • Observe blood vessels in a blackworm and record the pulse rate. Describe the flow of blood/oxygen in conjunction with the use of body muscles. • Observe the digestive tract of a blackworm.	• Microscope parts and usage assessment • Practice with measuring of small objects using the microscope • Field of view practice and assessment • Organisms from Macro to Micro Inquiries 7.1-7.3 including investigations of algal, plant and human cells • Inquires 3.1: Observing a Blackworm, 3.2: Determining the Pulse Rate of a Blackworm • Nonfiction text reading and comprehension • Cell structure vocabulary • Cell cycle comic/rubric • Cell Models • Science Journal observations,analysis, drawings and reflections

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	• Observe and categorize in the correct sequence the level of organization in the human body	
DCI: LS1.D: Information Processing	**Student Learning Objectives**	**Suggested Assessments**
• 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)	• Observe, draw, label and measure human nerve cells • Read and observe the sensory structure of a blackworm (photoreceptors)	• Organisms from Macro to Micro Inquiries 3.3 and 7.4 • Nonfiction reading passages from Lessons 3 and 7 in Organisms from Macro to Micro • Science Journal observations,analysis, drawings and reflections

Science and Engineering Practices	Crosscutting Concepts
• Developing and Using Models • Planning and Carrying Out Investigations • Engaging in Argument from Evidence • Obtaining, Evaluating and Communicating Information	• Cause and Effect • Scale, Proportion and Quantity • Systems and System Models • Structure and Function ***Connections to Engineering, Technology and Applications to Science*** • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1-1) ***Connections to Nature of Science*** • Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

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Available Resources

Organisms From Macro to Micro (Lesson 7)
Kids Discover: Exploring Cells
Various Diffusion demonstrations and animations
Various Osmosis demonstrations and animations
Explore Learning Gizmo online simulations
https://www.teacherspayteachers.com/Product/Cells-1781929

Unit Summary

In this unit, students will develop questions and find answers about ways that cells function in living systems. Students will gather information through various inquiries and activities and use this information to support explanations of the structure and function relationship of cells. They can communicate understanding of cell theory through a basic understanding of the role of cells in body systems and how those systems work to support the life functions of the organism. The understanding of cells provides a context for the plant process of photosynthesis and the movement of matter and energy needed for the cell. Students will construct an explanation to explain how environmental factors can affect cell function. Student understanding of cell form and function will lead them into future understanding of cell growth and reproduction, inheritance and energy flow.

Prior Knowledge and Skills

General Nature of Science and Problem Solving knowledge:

- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions.
- Asking questions, making observations, and gathering information are helpful in thinking about problems.
- Before beginning to design a solution, it is important to clearly understand the problem.
- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.
- Because there is always more than one possible solution to a problem, it is useful to compare and test designs.
- A situation that people want to change or create can be approached as a problem to be solved through engineering.
- People also use a variety of devices to communicate (send and receive information) over long distances.

Specific science knowledge:

- Students should have prior knowledge of the relative sizes of atoms and molecules and their role as building blocks of matter. Students will be expected to have a basic understanding of cell structure and function, Cell Theory, Sexual and Asexual Reproduction,and plant lifecycles from previous lessons and their own experiences with nature.
- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior and reproduction.

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Skills:

- Students will be expected to have a basic understanding of the compound microscope and the ability to observe, measure and estimate the size of objects based on the magnification and field of view. These skills will be reinforced during this unit through inquiries which explore the structure and function of living cells.

Anticipated instructional days for unit: 30 days

Technology, Differentiation and Assessment Strategies:

https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-ISfwl6uBTtic/edit

Growth, Development and Reproduction of Organisms

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-LS1-4.	**Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.**
MS-LS1-5.	**Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.**
MS-LS3-1.	**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.**
MS-LS3-2.	**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.**
MS-LS4-5.	**Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.**

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DCI: LS1.B: Growth, Development and Reproduction of Organisms	Student Learning Objectives	Suggested Assessments
• 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)	• Examine the reproductive structures of plants-male and female parts of a flower. • Explain the differences between asexual and sexual reproduction. • Compare/contrast mitosis and meiosis. • Evaluate the interdependencies of an organism and its habitat. Discuss how an organism's specific physical characteristics will affect its survival over time. • Test soil and grow vegetable plants for local community food bank. Make recommendations for soil improvement. • Describe how different features or adaptations of organisms make them suited to their environment.	• Inquiry 9.1 Dissecting a Perfect Flower • Nonfiction text reading and comprehension • including tests, quizzes, lab inquiries and projects • Plant Nutrition simulation: (www.scienceofsoil.com) • Meiosis and Mitosis Models • Hydroponic Model Building • Wisconsin Fast Plant growing system design and construction • Soil testing kits for pH and chemical analysis • Science Journal observations, analysis and reflections
DCI: LS3.A: Inheritance of Traits	**Student Learning Objectives**	**Suggested Assessments**
• 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)	• Be able to use a Punnett Square to accurately predict the offspring of specific parents. • Understand genetic terminology including: genotype, phenotype, homozygous, heterozygous. • Explain how chromosomes/DNA are important to all living organisms. • Understand the different stages of cell division and how it relates to chromosomes. • Discover by experimentation how Gregor Mendel established the fundamentals of heredity. • Analyze different personal inherited traits	• Nonfiction text reading and comprehension • Teacher-developed assessments including tests, quizzes, lab inquiries and projects • DNA models and simulations • Punnett square practice worksheets and quiz • Genetics Labs: Inquiry 19.1-19.3 from Organisms from Macro to Micro • Genetics Kit and Labs from Exploring Life Science • Science Journal questions and analysis • Claim, evidence and reasoning activities

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DCI: LS3.B: Variation of Traits	Student Learning Objectives	Suggested Assessments
• 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)	• Analyze different genetic disorders. • Discover by experimentation how Gregor Mendel established the fundamentals of heredity. • Be able to use a Punnett Square to accurately predict the offspring of specific parents.	• Nonfiction text reading and comprehension • Teacher-developed assessments including tests, quizzes, lab inquiries and projects • DNA models and simulations • Online resources including Brainpop, Explorelearning Gizmos and Discovery Education • Genetics Labs: Inquiry 19.1-19.3 • Genetics Kit and Labs from Exploring Life Science • Science Journal observations,analysis, drawings and reflections
DCI: LS4.B: Natural Selection	**Student Learning Objectives**	**Suggested Assessments**
• In *artificial* selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. (MS-LS4-5)	• Be able to use a Punnett Square to accurately predict the offspring of specific parents.	• Nonfiction text reading and comprehension from Organisms from Macro to Micro, Lessons 5, 9 and 18 • Punnett square practice worksheets • Science Journal observations and analysis, reflection questions

Science and Engineering Practices	Crosscutting Concepts
• Developing and Using Models • Planning and Carrying Out Investigations • Engaging in Argument from Evidence • Obtaining, Evaluating and Communicating Information	• Cause and Effect • Structure and Function ***Connections to Engineering, Technology and Applications to Science*** • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems.

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	(MS-LS1-1) ***Connections to Nature of Science*** ● Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

Available Resources

Organisms from Macro to Micro
Exploring Life Science, Chapter 25
Scholastic.com/ScienceWorld
Explore Learning Gizmo simulations (explorelearning.com)

Unit Summary

In this unit students will formulate an answer to the question “How do living organisms pass traits from one generation to the next?” This unit contains two sub-ideas: Inheritance of Traits and Variations of Traits Students can use models to describe ways gene mutations and sexual reproduction contribute to genetic variation. Crosscutting concepts of cause and effect and structure and function provide students with a deeper understanding of how gene structure determines differences in the functioning of organisms.

Prior Knowledge and Skills.

Reproduction is essential to every kind of organism.
Organisms have unique and diverse life cycles.
Organisms have both internal and macroscopic structures that allow for growth, survival, behavior, and reproduction.

Anticipated instructional days for unit: 30 days

Technology, Differentiation and Assessment Strategies:

https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-ISfwl6uBTtic/edit

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Matter and Energy in Organisms and Ecosystems

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-LS1-6. **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.**

MS-LS1-7. **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 an organism.**

MS-LS2-1. **Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.**

MS-LS2-3. **Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.**

MS-LS2-4. **Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.**

DCI: LS1C:Organization for Matter and Energy Flow in an Organism	Student Learning Objectives	Suggested Assessments
• 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)	• Explain that this energy comes from nuclear reactions on the surface of the Sun. • Energy can change its form, for example from light to chemical energy • Describe the structure of a leaf and how the structure relates to photosynthesis. • Describe the process of cellular respiration and note the connection with how food is converted to energy in our bodies	• Organisms: From Macro to Micro (Chapters 10, 14 and 15) inquiries on Transpiration and Decomposers including mold and yeast • Discovery Education videos and corresponding quizzes on photosynthesis, cellular respiration and decomposition • Explore Learning Gizmo: Photosynthesis • Brainpop movies and quizzes • Science Journal observations,analysis, drawings and reflections • Claim, evidence and reasoning activities

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DCI: LS2.A: Interdependent Relationships in Ecosystem	Student Learning Objectives	Suggested Assessments
• 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)	• Create a pond and observe the changes that occur over time (succession). • Give examples of succession. • Observe and identify microorganisms living in your pond. • Investigate/identify characteristics of the Protist Kingdom. • Understand the meaning of ecological terms: ecosystem, community, population. • Identify different parts of a food web (arrow meaning, producer, consumer, etc.). • Compare natural and man-made (aquarium) ecosystems in terms of biotic and abiotic factors. • Exploring growth of Lemna within the constraints of limited environment • Construct a Biome model and observe the self-contained flow of nutrients	• Oh Deer! Lab • How Many Bears Can Live in this Forest? Lab • Chapter 4 and 12 Lab activities • Text readings questions • Teacher-developed quizzes/tests • Video • Gizmo • Nonfiction text reading and comprehension • Teacher-developed assessments including tests, quizzes, lab inquiries and projects • Online resources including Brainpop, Explorelearning Gizmos and Discovery Education • Science Journal observations,analysis, drawings and reflections • Biome project rubric • Claim, evidence and reasoning activities
DCI: LS2.B: Cycle of Matter and Energy Flow in Ecosystems	**Student Learning Objectives**	**Suggested Assessments**
• 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	• Model the flow of energy through and ecosystem while modeling major contributors within the ecosystems with words such as predator/prey, consumer, producer. • Create a pond and observe the changes that occur over time (succession). • Observe and identify microorganisms living in your pond. • Investigate/identify characteristics of the Protist Kingdom.	• Oh Deer! Lab • How Many Bears Can Live in this Forest? Lab • Chapter 4 and 12 Lab activities from Organisms from Macro to Micro • Explore Learning Gizmo: Pond Ecosystem • Energy Pyramid design and construction • Nonfiction text reading and comprehension from Organisms from Macro to Micro • Online resources including Brainpop and

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parts of the ecosystem. (MS-LS2-3)	• Understand the meaning of ecological terms: ecosystem, community, population. • Identify different parts of a food web (arrow meaning, producer, consumer, etc.). • Compare natural and man-made (aquarium) ecosystems in terms of biotic and abiotic factors. • Exploring growth of Lemna within the constraints of limited environment • Construct a Biome model and observe the self-contained flow of nutrients	Discovery Education • Science Journal observations,analysis, drawings and reflections • Pond Model rubric
DCI: LS2.C: Ecosystem Dynamics, Functioning and Resilience	**Student Learning Objectives**	**Suggested Assessments**
• 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)	• Construct a Biome model and observe the self-contained flow of nutrients • study biomes and the various dynamic changes • Design a species that can live one hundred years and test it against the dynamic nature of the ecosystems	• Pond Succession readings and observations of pond models • Reflection questions about succession and pond model changes over time • Science Journal observations,analysis, drawings and reflections • Dynamic nature of ecosystem activity: http://www.sciencechannel.com/games-and-interactives/charles-darwin-game/
DCI: PS3.D: Energy in Chemical Processes and Everyday Life	**Student Learning Objectives**	**Suggested Assessments**
• 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	• Explain that this energy comes from nuclear reactions on the surface of the Sun. • Describe the structure of a leaf and how the structure relates to photosynthesis. • Describe the process of cellular respiration and note the connection with how food is converted to energy in our bodies	• Organisms: From Macro to Micro Chapters 5 and 10 nonfiction readings and questions/worksheets • Wisconsin Fast Plants lab activities and reflection questions • Organisms: From Macro to Micro Leaf Structure and Transpiration inquiries • Explore Learning Gizmo: Photosynthesis • Science Journal observations,analysis,

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)*		drawings and reflections

Science and Engineering Practices	Crosscutting Concepts
• Developing and Using Models • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions • Planning and Carrying Out Investigations • Engaging in Argument from Evidence	• Cause and Effect • Energy and Matter • Patterns • Stability and Change ***Connections to Engineering, Technology and Applications to Science*** • In**fluence of Science, Engineering, and Technology on Society and the Natural World** The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5) ***Connections to Nature of Science*** • **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3) • **Science Addresses Questions About the Natural and Material World** Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

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Available Resources

Organisms from Macro to Micro
Exploring Life Science, Chapter 25
Scholastic.com/ScienceWorld
Explore Learning Gizmo simulations (explorelearning.com)

https://refusetoreinventthewheel.wordpress.com/2015/06/12/let-them-eat-bread/
https://www.teacherspayteachers.com/Product/Photosynthesis-and-Cell-Respiration-Coloring-and-Cut-and-Paste-Activity-Bundle-2306308
http://www.sciencechannel.com/games-and-interactives/charles-darwin-game/

Unit Summary

In this units students will formulate an answer to the question, “How does a system of living and nonliving things operate to meet the needs of the organisms in an ecosystem?” Students can analyze and interpret data, develop models, and construct arguments and demonstrate a deeper understanding of resources and the cycling of matter and flow of energy in an ecosystem. They will also study patterns of the interactions among organisms within an ecosystem. They will consider biotic and abiotic factors in an ecosystem and the effects these factors have on population. They will evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Prior Knowledge and Skills

Populations live in a variety of habitats, and change in those habitats affects the organisms living there.
Organisms can survive only in environments in which their particular needs are met.
The food of almost any animal can be traced back to plants.
Organisms are related in food webs, in which some animals eat plants for food and other animals eat the animals that eat plants; eventually, decomposers restore some materials to the soil.
Matter cycles between the air and soil and among organisms as they live and die and among plants, animals, and microbes as these organisms live and die.
Organisms obtain gases and water from the environment and release waste matter (gas, liquid, or solid) back into the environment.

Anticipated instructional days for unit: 30 days

Technology, Differentiation and Assessment Strategies:

https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-lSfwl6uBTtic/edit

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Interdependent Relationships in Ecosystems

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

DCI: LS2A: Interdependent Relationships in Ecosystems	Student Learning Objectives	Suggested Assessments
• 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) • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)	• Understand the meaning of ecological terms: biome, ecosystem, community, population, habitat, biotic and abiotic • Interpret and evaluate the components of a food web • Use a food web to predict changes in the populations of an ecosystem • Compare natural and manmade ecosystems in terms of biotic and abiotic factors	• Organisms: From Macro to Micro (Chapter 4) Creating Your Own Pond inquiry • Development of pond ecosystem models and comparison of physical and student-developed models • Organisms: From Macro to Micro (Chapter 11) Exploring Microorganisms lab inquiries • Creation of biome models • Science Journal observations,analysis, drawings and reflections • Organisms: From Macro to Micro (Chapter 12) Revisiting Your Pond • Claim, evidence and reasoning activities

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DCI: LS2.C: Ecosystem Dynamics, Functioning and Resilience	Student Learning Objectives	Suggested Assessments
• 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) • Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)	• Identify different parts of a food web (arrow meaning, producer, consumer, etc.). • Analyze multiple food webs and analyze how changes affect them • Create a pond and observe the changes that occur over time (succession). • Give examples of succession • Describe the impact numerous "Introduced Species" have had on different regions of the world (including the gypsy moth in North America). • Describe how different features or adaptations of organisms make them suited to their environment. • Evaluate the interdependencies of an organism and its habitat. • Discuss how an organism's specific physical characteristics will affect its survival over time.	• Food web diagrams and models • Energy pyramid diagrams and models • Prairie Ecosystem Gizmo from Explore Learning
DCI: LS4.D: Biodiversity and Humans	**Student Learning Objectives**	**Suggested Assessments**
• Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to MS-LS2-5)	• Identify different parts of a food web (arrow meaning, producer, consumer, etc.). • Describe the impact numerous "Introduced Species" have had on different regions of the world (including the gypsy moth in North America)..	• Organisms: From Macro to Micro (Chapter 4) Creating Your Own Pond • Organisms: From Macro to Micro (Chapter 11) Exploring Microorganisms • Disease project rubric • Creation of biome models • Organisms: From Macro to Micro (Chapter 12) Revisiting Your Pond Lab activities • Science Journal observations,analysis, drawings and reflections
DCI: ETS1.B: Developing Possible Solutions	**Student Learning Objectives**	**Suggested Assessments**

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• There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)	• Students will design, construct, test, and re-design (if necessary) a structure to solve a problem in the area of plant growth and nutrition	• Hydroponic/Wisconsin Fast Plant growing system design and construction • Science Journal observations,analysis, drawings and reflections

Science and Engineering Practices	Crosscutting Concepts
• Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence	• Patterns • Stability and Change ***Connections to Engineering, Technology and Applications to Science*** • The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5) ***Connections to Nature of Science*** • Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

Available Resources

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Organisms from Macro to Micro
Exploring Life Science, Chapter 25
Scholastic.com/ScienceWorld
Explore Learning Gizmo simulations (explorelearning.com)
Video: "How Wolves Change Rivers" (Sustainable Human)

Unit Summary

The Performance Expectations in Interdependent Relationships in Ecosystems help students formulate an answer to the question, "How do organisms interact with other organisms in the physical environment to obtain matter and energy?" To answer the question, middle school students construct explanations for the interactions in ecosystems and the scientific, economic, political, and social justifications used in making decisions about maintaining biodiversity in ecosystems. Students can use models, construct evidence-based explanations, and use argumentation from evidence. Students understand that organisms and populations of organisms are dependent on their environmental interactions both with other organisms and with nonliving factors. They also understand that the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. Crosscutting concepts of matter and energy, systems and system models, and cause and effect are used by students to support understanding the phenomena they study.

Prior Knowledge and Skills

Populations of organisms live in a variety of habitats. Changes in those habitats affect the organisms living there.
Organisms that live in the same community affect each other and compete for the same resources.
Humans activities may impact the organisms that share the same habitat.

Anticipated instructional days for unit: 30 days

Technology, Differentiation and Assessment Strategies:

https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-lSfwl6uBTtic/edit

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Natural Selection and Adaptations

NGSS Performance Expectations

Students who demonstrate understanding can:

MS-LS4-1. **Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.**

MS-LS4-2. **Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.**

MS-LS4-3. **Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.**

MS-LS4-4. **Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.**

MS-LS4-6. **Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.**

DCI: LS4.A:Evidence of Common Ancestry and Diversity	Student Learning Objectives	Suggested Assessments
• 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	• Evaluate and decide, after using multiple resources, which pieces of evidence are the strongest supporters of evolution • Use simulated geological evidence to identify organisms and assess their relative complexity • Investigate the evolution of specific body structures in order to infer the existence of evolution as the causal process	• Geological Dig activity and Science Journal entries • Exploring Life Science (Chapter 25) Section Review • Interpretation and development of cladograms • Human Evolution: Skull Analysis Gizmo from Explorelearning.com • The Arthropod Story web activity:

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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)	• Compare various diagrams of fetal development in an assortment of organisms	http://evolution.berkeley.edu/evolibrary/article/arthropodstory • Claim, evidence and reasoning activity
DCI: LS4.B: Natural Selection	**Student Learning Objectives**	**Suggested Assessments**
• Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)	• Investigate how the structure of an organism is crucial to its survival • Read about an example of evolution that was "observable" over a short period of time and relate it to Darwin's Theory of Evolution • Explore how mutations in organisms may lead to changes which provide an evolutionary advantage to a species	• Bird's beak inquiry • Natural Selection worksheets • Charles Darwin reading and essay on Daphnia Evolution (Organisms from Macro to Micro, Lesson 13) • Peppered Moth lab activity • Evolution: Mutation and Selection Gizmo from Explorelearning.com
DCI: LS4.C: Adaptation	**Student Learning Objectives**	**Suggested Assessments**
• 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)	• Observe an adaptation in humans that has provided an evolutionary advantage over other animals • Observe and identify anatomical structures in organisms that set them apart in their ability to survive in their particular environment • Select a particular organism (vertebrate) to research and present information about its adaptations and the habitat to which it has adapted	• Human Body adaptations lab (opposable thumb) • Video: Body by Design: Form and Function questions sheet • Research project: Anchor Activity (Lesson 13 in Organisms from Macro to Micro)

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Science and Engineering Practices	Crosscutting Concepts
• Analyzing and Interpreting Data • Using Mathematics and Computational Thinking • Constructing Explanations and Designing Solutions ***Connections to Nature of Science*** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-LS4-1)	• Patterns • Cause and Effect ***Connections to Nature of Science*** • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1),(MS-LS4-2)

Available Resources

Organisms from Macro to Micro
Exploring Life Science, Chapter 25
Scholastic.com/ScienceWorld
Explore Learning Gizmo simulations (explorelearning.com)

Unit Summary

The Performance Expectations in Natural Selection and Adaptations help students formulate answers to the questions: “How does genetic variation among organisms in a species affect survival and reproduction? How does the environment influence genetic traits in populations over multiple generations?” Middle school students can analyze data from the fossil record to describe evidence of the history of life on Earth and can construct explanations for similarities in organisms. They have a beginning understanding of the role of variation in natural selection and how this leads to speciation. They have a grade-appropriate understanding and use of the practices of analyzing graphical displays; using mathematical models; and gathering, reading, and communicating information. The crosscutting concept of cause and effect is central to this topic.

Prior Knowledge and Skills

Different organisms vary in how they look and function because they have different inherited information.
The environment also affects the traits that an organism develops.
Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.
For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

Anticipated instructional days for unit: 30 days

Technology, Differentiation and Assessment Strategies:
https://docs.google.com/document/d/1KITFsbhtE1NLWTV9D2MLB0_MBHYxbq-lSfwl6uBTtic/edit

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