Unit Name: Biodiversity and Interdependence Among Organisms NGSS 8-15

Content Area: **Science**
Course(s):
Time Period: **Trimester 1**
Length: **11 Lessons**
Status: **Published**

Unit Overview

Unit Name: Biodiversity and Interdependence Among Organisms

Unit Summary:

This unit gives students the opportunity for hands-on study of organisms from most of the taxonomic groups of kingdoms. It focuses on the life cycles of several organisms, and contains an in-depth study of two species in particular- a species of cabbage plant and a species of butterfly whose life cycle revolves around the cabbage plant.

The activities of this unit include, among others: growing cabbage plants from seeds and caring for them in order to cross pollinate them and plant the resulting seeds during a Mendelian experiment to allow students to follow the complete life cycle through two generations of plants; view, observe and raise butterfly eggs throughout their entire life cycle and observe and document their feeding and reproductive habits; identify the sexual and asexual structures of a flowering plant.

This unit is mostly laboratory and project based. However, there are many important reading selections from both the STC and Pearson publications. The Pearson Interactive Science series listed in the bibliography is used mainly as a reinforcement for the lab activities and as an additional source of readings, vocabulary, and diagrams. In addition, many other sources of reading materials, videos, and other media are used to enhance the lesson, such as *National Geographic, Smithsonian Magazine, Science Scope* (NSTA), *BrainPop, YouTube, Science Illustrated,* and other relevant books and current events.

Essential Questions

Unit Essential Questions:

- How do plants and some protists and bacteria make their own food?
- How do animals, fungus, most bacteria, and some protists get their energy?
- What is the sun's role in photosynthesis?
- Are there certain types of the sun's light energy that plants use more than others?
- What are the characteristics of the electromagnetic spectrum emitted from the sun?
- What is the relationship between photosynthesis and aerobic and anaerobic respiration? How do materials such as nutrients, wastes, and gases move in and out of cells?
- Why is it important that certain materials freely move in and out of the cell while other materials are restricted? What is a plant?
- How do plants and animals depend on each other?

- What are monocots and dicots and how do they differ? How are organisms built?
- What are the "building blocks" of life?
- What is the difference between multi-cellular and unicellular organisms?
- How do cells fit in to the "big picture" of life?
- What is the difference between a prokaryotic and eukaryotic cell?
- What types of organisms are supported by eukaryotic and prokaryotic cells?
- What are the "parts" or organelles of cells and how do they differ between organisms in each of the six kingdoms?
- How does the light microscope work and what is the difference between light and electron microscopes. What is an organism?
- What are the needs of all living organisms?
- What are the molecules associated with all living organisms?
- What is the difference between living organisms and their associated non-living environments?
- What are the non-living components of an organism's environment that are necessary for life? For what use is a microscope used?
- How is a microscope used?
- What is the significance of each of the parts of a microscope?
- What is the proper method for using, storing, and carrying a microscope?
- What are the different types of microscopes and what are the characteristics of each? What is heredity?
- What are traits and how are they passed on from parent to offspring?
- What are genes?
- Where are traits contained within a cell?
- Who was the gentleman that discovered the mechanisms of heredity studying pea plants?
- What is Meiosis and how is Meiosis related to heredity?
- What is a phenotype and a genotype? What is fungus?
- What importance does fungus have in our everyday lives?
- What products do we as a society use daily that comes from fungus? What is DNA?
- What does DNA stand for and what type of molecule is it?
- Of what material is DNA made? What is Classification?
- How are organisms classified?
- What are the characteristics upon which organisms are based?
- What is a characteristic? How do living organisms grow?
- What is growth?
- How is growth measured?
- How do cells create other cells?
- What are the stages of Mitosis? What is an Animal?
- What differentiates an animal from the other five kingdoms?
- What do animals depend on for their survival? How does the body of any organism operate with its working systems?
- What are the working organ systems of mammals?
- How do the organ systems of mammals compare with those of other organisms?
- How do amphibian's body systems compare with those of mammals? What are protists?
- How are protists classified?
- Why are protists classified based on negative characteristics (what they are *not*) What is bacteria?
- If bacteria are microscopic, why is it dangerous to other organisms?
- How are bacteria useful to humans and other organisms?
- Why are bacteria so important to our existence?

Content

Unit Enduring Understandings (Content):

- Kingdom Plantae includes eukaryotic, multicellular producers, such as trees, plants, and moss, both terrestrial and aquatic.
- Plant cells and certain protist cells are specialized to perform photosynthesis due to the presence of chloroplasts.
- Some Plants reproduce by producing seeds, while others reproduce by spores.
- Plant cells differ from members of other kingdoms due to their cell walls, central vacuole, and chloroplasts.
- Photosynthesis and aerobic respiration are complex processes that form a cycle between plants and animals that sustains each.
- The raw materials of photosynthesis are the products of aerobic respiration; the raw materials of aerobic respiration are the products of photosynthesis.
- Photosynthesis occurs when the chloroplasts, which contain the light-capturing pigment chlorophyll, combine light energy from the sun with carbon dioxide and water to create sugar, water, and oxygen as by-products.
- Most plants use red and blue light to photosynthesize; green light is "thrown away" or reflected from the plant. This is why most plants appear green. Photosynthesis and aerobic respiration are complex processes that form a cycle between plants and animals that sustains each.
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- Fermentation is a process that aerobic cells use to create energy when oxygen levels are low. Cell and organelle membranes are considered semi-permeable, allowing some materials thorough while restricting others.
- Diffusion is the process of materials moving along a concentration gradient from an area of high concentration to an area of low concentration across a cell membrane.
- Passive transport is a type of diffusion where materials are moving along a concentration gradient, but require energy to move across the cell membrane.
- Osmosis is the diffusion of water across a semi-permeable membrane.
- Active Transport occurs when materials move across a membrane from an area of low concentration to an area of high concentration, against a concentration gradient. This process requires energy from the cell and is common in neurons.
- Cells group together with similar cells to create tissues; groups of similar tissues form organs; organs function together to form organ systems; organ systems support entire organisms.
- The Cell Theory states the following: All living organisms are composed of cells; The cell is the basic unit of structure and function in living organisms; All cells arise from existing cells.
- Populations are groups or organisms that live in the same area at the same time; Communities are comprised of two or more populations occupying a given area at one time; Ecosystems consist of the community and all associated non-living components of an area.
- All organisms require, in some capacity, the following: food, water, air (varying gases), and shelter.
- Biomolecules, such as proteins, carbohydrates, lipids, and nucleic acids are produced, consumed, and

rearranged by living organisms for their individual metabolic needs and body structures.
    - Proper mounting, focusing, and usage techniques of the compound light microscope are important for understanding life science concepts.
- Microscopes are precision scientific tools that can help us view and comprehend objects that we would otherwise not see.
- Comprehension of the microscope as a "working system" is paramount to its proper and successful use in the laboratory.
- Meiosis is a process by which the gametes or sex cells (sperm and egg) are created through two nuclear divisions.
- The end result of Meiosis is four genetically different haploid germ cells. (sperm or egg)
- Heredity is the study of genetics.
- Gregor Mendel performed many simple, yet statistically-sound experiments on pea plants, in which he was able to demonstrate the relationship between "visible" genes and "hidden" genes. (Dominant and recessive)
- Mendel's experiments disproved "blending" of traits in certain organisms.
- Some organism's traits "mix" under inheritance patterns called "incomplete dominance" and "codominance".
- Genes are the instructional units of the DNA. (Hair color, eye color, attached ear lobes, etc)
- Alleles are alternate forms of a gene. (Brown vs. blonde hair, brown vs. blue eyes, etc.)
- Traits are physical characteristics of an organism.
- All organisms do not display dominant and recessive traits.
- Some traits do not have dominance over others and can occur together, these traits are considered "codominant".
- Punnett squares, devised by Sir Reginald Punnett, are useful tools designed to predict the outcome of a genetic cross.
- The predicted outcome of Monohybrid and Dihybrid crosses can be demonstrated by the use of Punnett Squares.
- Determine the sex of the offspring by creating a karyotype of the chromosomes.
- Kingdom Fungi includes eukaryotic, multicellular consumers that break down dead organic matter, and includes the mushrooms, molds, and mildews.
- Fungi reproduce using spores, or budding (sexual and asexual).
- DNA (deoxyribonucleic acid), and proteins constitute chromosomes.
- Chromosomes are found in the nucleus of eukaryotic cells and contain genetic instructions for the maintenance of the cell and the organism they support.
- Chromosomes contain genes, the instructional units of the chromosome.
- Molecules of DNA resemble a double helix, consisting of a backbone of alternating deoxyribose and phosphate molecules, and nitrogen bases connecting the two backbones at the deoxyribose molecules.
- The four nitrogen bases associated with the DNA molecule are guanine, cytosine, thymine, and adenine.
- Cytosine forms bonds with guanine and thymine bonds with adenine within a DNA molecule.
- DNA replication is considered "semiconservative".
- Cancer often results from a DNA mutation in dividing cells.
- Organisms are classified based on external physical characteristics
- Organisms are increasingly being classified based on their DNA similarities
- Classification is based on a hierarchal system: Kingdom, Phylum, Class, Order Family, Genus, Species
- Latin and Greek names and words are used to classify all living organisms
- All living organisms are classified in this system: Protists, Bacteria, Fungus, Plants, Animals
- Kingdom Archaebacteria include microscopic, prokaryotic, one-celled organisms that typically live in low-oxygen environments, salt flats, hot springs, and glacial ice.
- Kingdom Eubacteria include microscopic, prokaryotic, one-celled organisms that are typically

associated with animal and plant bodies, and can be beneficial or detrimental.

- Kingdom Protista includes both unicellular and multicellular eukaryotic organisms that do not fit into any of the other five kingdoms. Examples include the plant-like protists, such as kelp, algae, and diatoms; the fungus-like protists such as slime and water molds; and the animal-like protists, such as amoebas, ciliates, and other protozoa.
- Kingdom Plantae includes eukaryotic, multicellular producers, such as trees, plants, and moss, both terrestrial and aquatic.
- Kingdom Fungi includes eukaryotic, multicellular consumers that break down dead organic matter, and includes the mushrooms, molds, and mildews.
- Kingdom Animalia includes the eukaryotic, multicellular consumers, and includes many diverse invertebrates and vertebrates.
- Kingdom Animalia is divided into many diverse phyla, each with unique characteristics.
- The Cell cycle is the process of one cell becoming two during interphase, mitosis, and cytokinesis.
- During interphase of the cell cycle, the DNA is replicated and organelles are prepared for distribution.
- During Mitosis, the nucleus is involved in a process where the chromosomes and cell organelles are rearranged and prepared for distribution in each of two new cells that will ultimately form.
- The end result of Mitosis is two identical somatic (body) cells.
- Kingdom Animalia includes the eukaryotic, multicellular consumers, and includes many diverse invertebrates and vertebrates.
- Kingdom Animalia is divided into many diverse phyla, each with unique characteristics.
- Chordates are the most complex phyla of Kingdom Animalia because of the presence of complex nerve cords and associated nervous system, as well as other body structures.
- Invertebrates and vertebrates are animals with very different body plans and structures
- Invertebrates are animals without backbones
- Vertebrates are animals with backbones
- Animals are very diverse, and include Mollusks, Annelids, Arthropods, Echinoderms, Fishes, Amphibians, Reptiles, Birds, and Mammals.
- Chordates are the most complex phyla of Kingdom Animalia because of the presence of complex nerve cords and associated nervous system, as well as other body structures.
- Human body systems are complex working systems composed of individual organs, each of which has a particular function to sustain the organ system and hence, the organism.
- Human organ systems include the following systems: integumentary, muscular, skeletal, circulatory, respiratory, nervous, lymphatic, digestive, endocrine, urinary, and male and female reproductive.
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- Kingdom Eubacteria include microscopic, prokaryotic, one-celled organisms that are typically associated with animal and plant bodies, and can be beneficial or detrimental.

Skills

Unit Learning Targets (Skills):

- View *Elodea* leaves under microscope and identify parts
- Plant organs, such as leaves, roots, and stems will be studied in detail and differences between monocots and dicots will be noted. Extract and separate photosynthetic pigments from plant leaves
- Distinguish between chlorophyll, carotenoids, and xanthophyll pigments
- View the by-products of photosynthesis (oxygen) being produced in aquatic plant cells.
- Recognize the process of diffusion and osmosis using salt water and distilled water.
- Measure the amount of solute and/or solution that diffuses from one side of a semi-permeable membrane to the other
- Predict the movement of particles of difference substances within a hypotonic vs. a hypertonic environment
- View movies of cells expelling and engulfing large amounts of particles during exocytosis and endocytosis respectively.
- Identify the hierarchy of atomic and cellular relationships
- Realize the important differences between eukaryotic and prokaryotic cells
- Relate the function of cellular organelles to parts of a city.
- Act out roles of organelles in the cell, both plant and animal cells
- Successfully use the microscope to view various plant and animal cells
- Create a wet-mount slide with green algae or *Elodea*
- Identify carbohydrates, lipids, nucleic acids, and proteins based on their molecular structure
- Ascertain the presence of lipids, carbohydrates, and proteins using various tests
- Study vocabulary: microscope parts and their functions
- Display the correct order or operations when using a microscope
- Make a wet-mount slide
- Prediction of traits of offspring from parents if genetics are known.
- Recognition of the differences between cells undergoing Mitosis and Meiosis.
- Identification of genes specifically located on the chromosomes.
- Determination of phenotypes from given genotypes using a Punnett Square.
- Identify several types of fungus and lichens based on external characteristics: *Club Fungi, Thread Fungi, Sac Fungi, and Imperfect Fungi*
- Identify spores, the reproductive structures of fungi.
- Students create a DNA double-helix model using pop-beads with students focusing on the placement of bonds between phosphate, deoxyribose, and the four nitrogen bases
- Perform an extraction of DNA from student's cheek cells.
- Use a dichotomous key to identify organisms based on their external characteristics
- Identify organisms based on characteristics of each of the Six Kingdoms: Archaebacteria, Eubacteria, Protista, Fungi, Plantae, and Animalia
- View a variety of cells and tissues from organisms of all six kingdoms under the microscope, including archaebaacteria, eubacteria, protist, fungus, plant, and animal, and discuss how cells form tissues and organs.
- Create cell models displaying the chromosomes in various stages of mitosis
- Identify the animal and plant cell in each phase of the cell cycle
- Recognize that the chromosomes are made up of the DNA and associated proteins within the nucleus of eukaryotic cells.
- Identify structures on preserved specimens that allow them a better chance of survival
- Careful and deliberate dissections of vertebrates, both virtual and real, allow us to view the relationship between our bodies and the bodies of other organisms.

- Learn the proper methods for dissecting an amphibian (grass frog) and an mammal (fetal pig), including organ removal, study, and identification on a virtual dissections using the *Frog Guts* program
- Identify dissecting tools based on their proper use during dissection. These tools include a blunt probe, sharp probe, surgical scissors, scalpel, eye dropper, forceps.
- Identify each organ's function and structure
- Determine each organ's system based on its function
- Recognize organs that function within two or more organ systems
- Identify the structure and function of the following systems in mammals and amphibians: integumentary, muscular, immune, skeletal, circulatory, respiratory, nervous, lymphatic, digestive, endocrine, urinary, and male and female reproductive.
    - Identify structures on plastic models of humans and frog: eye, ear, heart, lungs, and digestive system.
    - View and draw live and preserved protists using digital microscopes and laptop computers including *Euglena, Amoeba, Paramecium.*
    - Learn and perform proper techniques for culturing bacteria
    - Practice proper hand-washing techniques by using powder that is sensitive to fluorescent light. Powder, which simulates location of bacterial colonies on hands, is rubbed on hands; hands are placed under a black light, which makes the powder visible. Students then wash their hands and hands are then placed back under the black light to make "invisible bacteria" visible.

Assessments

Evidence of Learning:

The majority of this unit is an inquiry-based hands-on approach to learning. It consists of laboratory activities which vary in their intensity, approach, skill, and evaluative measurements. For example, some of the lab activities are "walk-through" labs, where the student is guided through a procedure and a process, and is asked to make connections among the main concepts presented in the activity and associated readings. Other lab activities consist of a problem that is presented to the student, which he or she must solve by designing an experiment (which is then peer and teacher evaluated before proceeding with the lab activity) and collecting data. Regardless of the lab activity, students are evaluated based on the quality and presentation of the collected data in graphic organizers; the efficacy and accuracy of the experimental design; the connections made between the experimental design, the data collected, and the conclusion of the laboratory report- i.e. "tying it all together to see the big picture"; and lab etiquette and adherence to safety rules.

Other evidence for learning includes several short 5-10 question quizzes, and end-of-unit lab practical (hands-on) test, end-of-unit paper test based on the labs, and several creative projects, which may include posters, skits, songs and poems, presentations, and Invention Fair projects

Lessons/Learning Scenarios

Individual Lessons :

Lesson 1: "What are Organisms?" Trimester One

Objectives:

- Students develop a list of traits common to all living organisms
- Construct a working definition of the word "organism"
- List some of the physical characteristics of the organisms shown on photo-cards
- Assign each organism a genus and species name
- Determine the appropriate place for each organism on the class habitat poster

Learning Activities:

- Students make a list of all characteristics common to all living organisms from their own observations
- Students use Latin or Greek terms to assign a name to each organism they identify on their photo-cards

Concepts:

- A working definition is one that changes to accommodate new information
- An organism is a complete, living thing
- An organism may be composed of one or more cells
- All living things undergo the fundamental life processes: obtaining food, digestion, cellular respiration, reproduction, excretion, movement, and response
- Scientists name and classify organisms for identification and organizational purposes

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 2: "The WOW-Bug: Getting a Closer Look" Trimester One

Objectives and Learning Activities:

- Students learn the functioning parts of a microscope, and practice manipulating them to obtain an image with a high resolution and acceptable degree of magnification
- Measure the diameter of the field of view under different magnifications of the compound light microscope
- Learn how to handle, safely manipulate, and recapture parasitic wasps, WOWbugs
- Observe parasitic wasp grooming behavior
- Draw, label, and measure a parasitic wasp
- Create scientific drawings using specific guidelines

Concepts:

- The compound light microscope is a tool that extends our sense of sight
- The compound light microscope uses two convex lenses to produce a clear, magnified image that is upside down and backward

- Different combinations of lenses provide a range of magnifications
- At different magnifications the field of view changes size; the size is directly related to the total magnification
- Slides facilitate the observation of microscopic organisms and object
- Scientists communicate through scientific drawings that incorporate clear labels, magnification scale, and perspective
- The WOWBug is a parasitic wasp, intermediate in size between macroscopic and microscopic
- Grooming is vitally important to all organisms for maintaining their bodies in prime condition

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 3: "Investigating *Lumbriculus:* The California Blackworm" Trimester One

Objectives and Learning Activities:

- Students observe, sketch, and measure a California Blackworm and compare its structure to that of a related organism, the common earthworm
- Measure and record the average pulse rate of a California Blackworm
- Make observations of a blackworm fragment each week for three weeks to look for signs of change

Concepts:

- *Lumbriculus* has a segmented body that is similar to that of an earthworm
- Blood pulsates through the dorsal blood vessels of *Lumbriculus* from the posterior to the anterior end.
- A *Lumbriculus* fragment can regenerate a lost head, tail, or both
- *Lumbriculus's* most common method of reproduction is asexual through fragmentation, followed by regeneration of new body parts

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 4: "Creating a Pond" Trimester One

Objectives and Learning Activities:

- Students construct a pond and observe, sketch, and label its layers
- Observe, sketch, and label the organisms
- Observe and document the living organisms in the pond, directly and with magnification
- Observe and explain the reasons for the changes in species composition of the pond over a three-week

period
- Pond is left to proceed through succession and is observed again in several week's time later to species composition and frequency

Concepts:

- An ecosystem is a community that includes living organisms and their environment, which function together as a unit
- A macroorganism is an organism one can see without the aid of a microscope
- A microorganism is an organism one cannot see without the aid of a microscope
- A pond ecosystem includes both macro and micro organisms of a very diverse nature

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 5: "Exploring Cells" Trimester One

<u>Objectives and Learning Activities:</u>

- Observe, draw, label, and measure cells based on specific guidelines
- Observe and identify certain organelles of plant and animal cells
- Observe the effect of salt solution on Elodea leaf cells
- Compare the structure of various cells for evidence that they are suited to their functions
- Students create a poem, skit, video, poster, or other project that illustrates their understanding of the roles of each of the organelles within a eukaryotic cell
- Students learn the difference between prokaryotic and eukaryotic cells

Concepts:

- The cell is the basic unit of structure and function of all living organisms
- There are many types of cells, each one having a different function
- The more complex an organism is, the more specialized the cells are
- An organelle is a well-defined structure found in a cell that has a specific function
- There are basic differences between plant and animal cells pertaining to their structure and function
- Plant cells contain chloroplasts, organelles responsible for the process of photosynthesis

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 6: "Exploring Microorganisms" Trimester Two

Objectives and Learning Activities:

- Students observe species of living microorganisms, protists, and identify each as plant-like, animal-like, or fungus-like.
- Students view slideshow and movie with high-quality images and videos of protists and bacteria
- Observe, draw, label, and estimate the length of several species of protist
- Create a cartoon with a protist as the main character

Concepts:

- Protists are a group of mostly one-celled organisms (some multicellular) with well-defined nuclei
- Protists can possess plant-like, animal-like, or fungus-like characteristics
- Protists can be classified by their mode of locomotion
- Microbes, such as protists and bacteria, can usually only be seen using a microscope
- Protists and bacteria are very important both economically and ecologically
- Bacteria don't have a true nucleus,(prokaryotes) whereas protists do (eukaryotes)

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 7: "Growing and Viewing Bacteria and Bacterial Cultures" Trimester Two

Objectives and Learning Activities:

- Students will view bacteria under light microscope
- Draw, label, and describe bacteria from microscope slides
- Students undergo an activity where they will make the bacteria on their hands visible. They wash their hands and recheck their level of bacterial contamination with a UV light
- Students culture bacteria from common classroom objects and observe colony growth for one week

Concepts:

- Bacteria are very prolific. Most bacteria are beneficial to humans, although some can be dangerous to other living organisms
- Bacteria are normally microscopic, but can be grown in cultures if given the correct nutrients

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 8: "Observing *Daphnia*" Trimester Two

Objectives and Learning Activities:

- Observe, sketch, and measure a *Daphnia* and identify its major structures
- Determine the heart rate of *Daphnia* under various conditions, such as when chemicals, such as caffeine, are added to their environment

Concepts:

- *Daphnia* are crustaceans, a class of organisms possessing an exoskeleton, gills, two pairs of antennae, and many jointed appendages
- *Daphnia's* transparent exoskeleton allows for observation of its internal structures
- *Daphnia's* heart rate varies when subjected to certain chemicals

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 9: "Observing *Hydra*" Trimester Two

Objectives and Learning Activities:

- Students observe, sketch, and measure a *Hydra* and label its prominent features
- Observe a *Hydra's* methods of obtaining food and reacting to touch
- Observe *Hydra* consuming a *Daphnia* by catching it with its nerve net within its tentacles
- Observe a *Hydra's* method of sexual reproduction

Concepts:

- *Hydra* are simple invertebrates with hollow, cylindrical bodies and tentacles
- *Hydra* capture food using nematocysts (stinging cells) within the tentacles
- *Hydra* have a simple network of nerves that are capable of responding to various stimuli
- *Hydra* usually reproduce asexually by budding
- *Hydra* move by floating and catapulting

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 10: "Investigating Fungi (Molds)" Trimester Two

Objectives and Learning Activities:

- Decide on conditions that are favorable to grow fungus, specifically mold
- Compare the rate of mold formation on two types of bread- one with preservatives and one without
- Create and document growth within a fungal garden
- Observe and read about the life cycle of mold
- View and draw several types of fungus, including molds

Concepts:

- Fungi comprise a kingdom of organisms that rely on feeding on other, usually dead organic matter, and are considered a type of heterotroph called decomposers
- Fungi reproduce by releasing spores that are produced both sexually and asexually, depending on species
- Molds are a type of fungus; there are many types, including mushrooms and yeast
- A combination of warmth, moisture, and darkness is optimal for fungal growth
- Preservatives in food are composed of chemicals that inhibit formation of fungi

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Reading selection discussion

Lesson 11: "Fungi- Yeast" Trimester Two

Objectives and Learning Activities:

- Students observe evidence of living yeast
- Determine the needs of the yeast cells to come out of dormancy and what occurs when those needs are met
- Students design and conduct an experiment to investigate which substances will promote and which will inhibit yeast activity
- Explain how different species of yeast benefit and harm humans
- Use the needs of yeast to create a living dough to make fresh, soft pretzles

Concepts:

- Yeast cells metabolize glucose (sugar) into ethanol, carbon dioxide when oxygen is absent, and into water and carbon dioxide when oxygen is present
- Yeast cells release carbon dioxide rapidly when they are metabolizing glucose
- Certain substances inhibit yeast activity, others promote it
- Sugar is a substance that promotes yeast activity, salt inhibits and can kill the yeast cells
- Some species of yeast are beneficial to humans, some a re not

Assessments:

- Laboratory Report, including data tables, charts, diagrams, and graphs, where applicable
- Class Discussion (Pre-lab, Post-lab)
- Pretzel Lab

- Reading selection discussion

Standards

NGSS Standard Correlation:

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. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied 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. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [*Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.*]

MS-LS1-3: Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [*Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.*]

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. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]

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. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [*Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.*]

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. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.[Clarification Statement: Emphasis is on predicting consistent patterns of interactions in

different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [*Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.*]

MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

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. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]

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. [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]

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. [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]

Resources

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