

Delaware Science Coalition



Grade 4 Structures of Life Unit Template



Copyright 2008 Delaware Department of Education

Preface: This unit has been created as a model for teachers in their designing or redesigning of course curricula. It is by no means intended to be inclusive; rather it is meant to be a springboard for teacher thought and creativity. The information we have included represents one possibility for developing a unit based on the Delaware content standards and the Understanding by Design framework and philosophy.

Brief Summary of Unit:

In this unit, students will work with living organisms to explore different functions including: growth, survival, and reproduction. Students compare and categorize properties of seeds, germinate seeds, and grow plants hydroponically to observe plant life cycles. Students care for a selection of organisms, and in doing so; they learn to identify properties of plant and animals and to sort and group organisms on the basis of observable properties.

Stage 1: Desired Results Delaware Science Content standards

Delaware Science Content Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1, 6, 7, and 8 found on the following web site: http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1: Nature and Application of Science and Technology

Understandings and Abilities of Scientific Inquiry

1. Understand that: Scientific investigations involve asking a focused scientific question. Investigations differ depending upon the question being asked.
 - Be able to: Generate focused questions and informed predictions about the natural world.
2. Understand that: Fair test design supports the validity of the investigation. Sometimes it is not possible to know everything that will have an effect on the investigation or control all conditions.
 - Be able to: Design and conduct simple to multi-step investigations in order to test predictions. Keep constant all but the condition being tested.
3. Understand that: The purpose of accurate data collection is to provide evidence to compare with the prediction.
 - Be able to: Accurately collect data using observations, simple tools and equipment. Display and organize data in tables, charts, diagrams, and bar graphs or plots over time. Compare and question results with and from others.
4. Understand that: The body of scientific knowledge grows as scientists ask questions, conduct investigations, develop explanations and compare results with what is already known.
 - Be able to: Construct a reasonable explanation by analyzing evidence from the data. Revise the explanation after comparing results with other sources or after further investigation.

5. Understand that: The purpose of communicating is to share and justify results. Scientists communicate their results to others, including the details that allow others to replicate the results.
 - Be able to: Communicate procedures, data, and explanations to a variety of audiences. Justify the results by using evidence to form an argument.
6. Understand that: The use of mathematics, reading, writing, and technology are important in conducting scientific inquiries.
 - Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Science, Technology, and Society

Students should know that:

1. Science and technology are related. Technology provides the tools needed for science to investigate questions and may provide solutions to society's problems, wants, or needs. Not all technological solutions are effective, uniformly beneficial, or equally available to everyone.

Students should be able to:

- Explore how plants are grown using hydroponics. Identify the benefits of hydroponic agriculture in meeting human wants and needs.
- Observe seeded and seedless varieties of fruits (i.e., watermelon). Provide reasoning for why seedless fruits have been developed by scientists.

Science Standard 6: Life Processes

Structure/Function Relationship

Students should know that:

1. Structures that function for similar purposes in living things may have different appearances.

Students should be able to:

- Compare and contrast structures that have similar functions in various organisms (e.g., eyes, ears, mouths). Explain that the function of the structure is similar although the structures may have different physical appearances (e.g., compare eyes of an owl with the eyes of a crayfish).
- Observe and identify structures of plants and describe the function of each structure. Explain that most plants produce many seeds, most of which do not germinate and grow into new plants.

Students should know that:

2. Organisms can be grouped based on similarities and differences in their structures and functions. These may include characteristics such as appendages, roots and leaves of plants, or the presence or lack of a backbone.

Students should be able to:

- Sort and group plants and animals according to similarities in structures or functions of structures. Explain why the plants and animals have been grouped in this manner.

Matter and Energy Transformations

Students should know that:

1. Plants need the Sun's energy to grow and survive.

Students should be able to:

- Recognize that plants need light energy from the sun to make food, while animals need to eat plants and/or other animals as their food.

Students should know that:

2. Animals need food to provide materials and energy for life, which they derive directly or indirectly from plants.

Students should be able to:

- Select a living organism and develop descriptions of how the organism responds to a variety of stimuli (i.e., light/dark, warm temperature/cold temperature) based on multiple observations and data collection (e.g., crayfish and Bess Beetles).
- Explain how individual organisms behave and use their structures to respond to internal and external cues such as hunger, drought, or temperature to improve their chances of survival.

Regulation and Behavior

Students should know that:

1. An organism displays behaviors in response to internal cues, such as hunger, and external cues, such as light, temperature, or interaction with living things.

Students should know that:

2. There are similarities and differences in how organisms respond to internal and external cues. These behaviors may include strategies for acquiring food, building shelters, or evading predators.

Students should be able to:

- Observe, record, and describe changes in the health or behavior of an organism as a result of changes in its environment.

Science Standard 7: Diversity and Continuity of Living Things

Reproduction, Heredity and Development

Students should know that:

1. Physical characteristics are passed on from parent to offspring. Organisms with two parents inherit characteristics of both.

Students should be able to:

- Compare the similarities and differences of offspring to their parents (e.g. crayfish, bean sprouts). Know that offspring receive characteristics from both parents.

Students should know that:

2. An organism's physical appearance can change without the change being passed on to its offspring (e.g., dyed hair, loss of a claw).
 - Recognize that some characteristics acquired by the parents are not inherited by the offspring (i.e., a lost claw does not mean offspring are born with only one claw).
3. Most plants go through a life cycle of germination, growth, development, reproduction, and death.
 - Construct the life cycle of a bean plant through the use of diagrams. Describe the plant in different stages of its life cycle from seed, to seedling, to mature plant, to death, and explain how the structures of the plant change over time. Recognize that these stages of the life cycle are predictable and describable.
 - Research the life cycle of an organism. Diagram the life cycle of the organism and describe how the organism changes over time. Compare the life cycle of this organism to the life cycle of various other organisms. Recognize that all organisms go through a life cycle

Diversity and Evolution

Students should know that:

1. Organisms of the same type vary in appearance. These variations may provide an advantage in reproduction and survival.

Students should be able to:

- Describe how similar structures found on different organisms (e.g., eyes, ears, mouths) have similar functions and enable those organisms to survive and reproduce in different environments (e.g., eyes of owls versus eyes of crustaceans).
- Recognize that there are variations among organisms of the same kind. Observe organisms of the same kind and describe how their physical appearances differ.

Technology Applications

Students should know that:

1. Through the use of biotechnology, scientists engineer plants and manipulate growing conditions to meet human needs and wants (e.g., fruits without seeds, hydroponics).

Students should be able to:

- Explore how plants are grown using hydroponics. Identify the benefits of hydroponic agriculture in meeting human wants and needs.
- Observe seeded and seedless varieties of fruits (i.e., watermelon). Provide reasoning for why seedless fruits have been developed by scientists.

Science Standard 8: Ecology

Interactions within the Environment

Students should know that:

1. All living organisms interact with the living and nonliving parts of their surroundings to meet their needs for survival.
2. Adaptations in organisms enable them to live and reproduce in certain environments. Those organisms that are best suited for a particular environment, have adaptations that allow them to compete for available resources and cope with the physical conditions of their immediate surroundings.

Energy Flow and Material Cycles in the Environment

Students should know that:

1. Plants need energy from the Sun, water and nutrients for growth and survival.

Big Ideas

1. Observation and Evidence: Observe the different properties of seeds
2. Processes to observe the life cycle of organisms
3. Describe organisms in terms of their physical structures and functions
4. Accurate data collection is to provide evidence to compare with the prediction
5. Change: Observe how water brings about change in a seed
6. Control and Conditions: Investigate the effects of water, light and nutrients on the growth of seeds and plants
7. Accurately collect data using observations, simple tools, and equipment. Display and organize data in tables, charts, diagrams, and bar graphs. Compare and question results with and from others.
8. Compare and contrast the behavior of different organisms
9. Identify and describe the structures of an organism that allow it to survive in its environment/habitat
10. Reasoning and Explanation: Comparing/contrasting different kinds of organisms and their structures/functions

Unit Enduring Understandings

Students will understand that...

1. Seeds have specific structures and functions.
2. A seed is a (*dormant*) living organism.
3. Seeds undergo changes in the presence of water.
4. Plants need water, light, and nutrients to grow.
5. Individual organisms behave and use their structures to respond to internal and external stimuli to improve their chances of survival.
6. Similar structures found on different organisms (e.g., eyes, ears, mouths) have similar functions and enable those organisms to survive and reproduce in different environments.
7. There are similarities and differences with regards to the life cycles of different organisms.
8. Plants can be grown using hydroponics.
9. Organisms need water, food, air, and space to survive.
10. An organism's structure is shaped by its function.

Unit Essential Question(s)

1. How does structure relate to function in living systems?
2. How do responses to internal and external cues aid in an organism's survival?
3. How do organisms change as they go through their life cycles?
4. How are organisms of the same kind alike and different from each other?
5. How does an organism depend on its basic needs for its survival and growth.

Knowledge & Skills

Students will know....

- The seed of a plant is found in the part called the fruit.
- That seeds have three structures including the seed coat, cotyledon, and embryo.
- Seeds are living but in a dormant stage.
- Seeds undergo germination when water is present.
- That plants and organisms need water, light, and nutrients to grow.
- Hydroponics is the process of growing plants in water.
- The life cycle of bean plants and crayfish.
- Crayfish have distinguishable structures and functions.
- The behavior of an organism means what an animal does or how it acts.
- The habitat of an organism is where the organism lives.
- That all living organisms need air, food, water, and space to survive.
- Bess Beetles are insects.
- The structures of an organism have functions that help it to survive in its habitat.

Students will be able to (Grade Level Expectations)...

Select a living organism and develop descriptions of how the organism responds to a variety of stimuli (i.e., light/dark, warm temperature/cold temperature) based on multiple observations and data collection (e.g., crayfish and Bess Beetles).

Explain how individual organisms behave and use their structures to respond to internal and external cues such as hunger, drought, or temperature to improve their chances of survival.

Observe, record, and describe changes in the health or behavior of an organism as a result of changes in its environment.

Compare and contrast structures that have similar functions in various organisms (e.g., eyes, ears, mouths). Explain that the function of the structure is similar although the structures may have different physical appearances (e.g., compare eyes of an owl with the eyes of a crayfish).

Observe and identify structures of plants and describe the function of each structure.

Sort and group plants and animals according to similarities in structures or functions of structures. Explain why the plants and animals have been grouped in this manner.

Recognize that plants need light energy from the sun to make food, while animals need to eat plants and/or other animals as their food.

Compare the similarities and differences of offspring to their parents (e.g. crayfish, bean sprouts). Know that offspring receive characteristics from both parents.

Recognize that some characteristics acquired by the parents are not inherited by the offspring (i.e., a lost claw does not mean offspring are born with only one claw).

Construct the life cycle of a bean plant through the use of diagrams. Describe the plant in different stages of its life cycle from seed, to seedling, to mature plant, to death, and explain how the structures of the plant change over time. Recognize that these stages of the life cycle are predictable and describable.

Research the life cycle of an organism. Diagram the life cycle of the organism and describe how the organism changes over time. Compare the life cycle of this organism to the life cycle of various other organisms. Recognize that all organisms go through a life cycle.

Describe how similar structures found on different organisms (e.g., eyes, ears, mouths) have similar functions and enable those organisms to survive and reproduce in different environments (e.g., eyes of owls versus eyes of crustaceans).

Recognize that there are variations among organisms of the same kind. Observe organisms of the same kind and describe how their physical appearances differ.

Explore how plants are grown using hydroponics. Identify the benefits of hydroponics agriculture in meeting human wants and needs

Generate focused questions and informed predictions about the natural world.

Design and conduct simple to multi-step investigations in order to test predictions. Keep constant all but the condition being tested.

Accurately collect data using observations, simple tools and equipment. Display and organize data in tables, charts, diagrams, and bar graphs or plots over time. Compare and question results with and from others.

Construct a reasonable explanation by analyzing evidence from the data. Revise the explanation after comparing results with other sources or after further investigation.

Communicate procedures, data, and explanations to a variety of audiences. Justify the results by using evidence to form an argument.

Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Stage 2: Assessment Evidence
(Design Assessments To Guide Instruction)

Suggested Performance Task(s)

The Structures of Life unit is assessed through the use of an end-of-unit summative assessment. This assessment is intended to uncover student misconceptions, which will then inform instruction. Both the student guide and teacher rubrics are included. To access the end-of-unit summative assessment, go to the web site listed below. Click on the [Delaware Science Comprehensive Assessment Program](http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml).

http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Key Transfer Ideas

1. To understand the process of seed germination.
2. To understand the ways seeds use structures to travel from their parent plants to different locations.
3. To read and interpret a bar graph.
4. To understand and explain the functions of plant structures.
5. To understand the role of the sun as the source of energy for plant growth.
6. To compare the life cycles of different organisms and state basic similarities.
7. To determine length using a centimeter units.
8. To understand the habitat and behavior of a crayfish.
9. To understand the structure-function relationship of organisms.

Student Expectations:

- Observe dry seeds and explain what seeds need to germinate.
- Observe soaked seeds. Describe changes between the dry and soaked bean seeds using correct terminology for the seed parts.
- Label structures on a bean seed.
- Describe the function of the seed coat, cotyledon, and embryo.
- Analyze a bar graph to describe plant growth using evidence from the bar graph.
- Identify and describe the function of the leaf, stem, flower, root and seed.
- Recognize the Sun as the source of energy for plants.
- Identify structures that allow plant seeds to disperse.
- Compare life cycles of plants and animals.

- Measure length in centimeters.
- Describe the role of molting in a crayfish.
- Explain how the ability of a crayfish to survive is affected by its physical structures, behaviors and phase in the life cycle.
- Explain the territorial nature of crayfish and their behaviors.
- Explain how structures on animals allow for them to survive.

Other Evidence

Possible Formative Assessments from Investigations

Investigation 1: Origin of Seeds

Part 1: Student sheet #2 – Comparing Seeds

Part 2: Student sheet #5 – Response Sheet (Origin of Seeds)

Part 3: Student sheet #6 – The Soaked Seed

Investigation 2: Growing Further

Part 2: Student sheet #8 – Response Sheet (Growing Further)

Part 3: Student sheet #10 – Bean Life Cycle

Investigation 3: Meet the Crayfish

Part 3: Student sheet #15 – Response Sheet (Meet the Crayfish)

Investigation 5: Bess Beetles

Part 2: Student sheet #33 – Comparing Beetles and Crayfish

Stage 3: Learning Plan

(Design Learning Activities To Align with Goals and Assessments)

Key learning events needed to achieve unit goals

The Regents of the University of California. Foss Kit: Structures of Life. Delta Education. 2000.

Investigation 1: Origin of Seeds

Part 1 – Seed Search: Students will start a seed hunt using various fruits. Students will locate the seeds, describe the seed properties, and estimate the number of seeds in each fruit.

Part 2 – The Sprouting Seed: Students will use two different types of sprouting devices to investigate the effects of water on seeds.

Part 3 – Seed Soak: Students will calculate and compare the mass of seeds that have been soaked and those that are dry to determine how much water a seed has soaked up.

Investigation 2: Growing Further

Part 1 – Germination: Students will compare/contrast different seeds that have begun to germinate. Students will then begin to identify and describe the structures of a seed including seed coats, cotyledons, stems, leaves, embryos, and roots.

Part 2 – Hydroponics: Students will begin to observe the growth of the bean seedlings in a hydroponics setup.

Part 3 – Life Cycle of the Bean: Students grow their seedlings in a nutrient solution to observe their development through the life cycle. Students will also sequence through illustrations the different stages in the life cycle of the bean plant.

Investigation 3: Meet the Crayfish

Part 1 – Meet the Crayfish: Students will observe and record the structures and functions of crayfish through direct interaction.

Part 2 – Crayfish Habitat: Students will set up crayfish habitats and begin to learn on how to care for and feed a living organism in the classroom.

Part 3 – Crayfish at Home: Students investigate and observe the behavior of crayfish in their current habitat. Students will then observe any behavior changes as the habitat is changed with shelter added and the incorporation of other crayfish.

Part 4 – Crayfish Territory: Students will perform on-going observations of the territorial behavior of crayfish.

Investigation 5: Bess Beetles

Part 1 – Bess Beetles at Home: Students begin to observe Bess Beetles and become familiar with beetle structures and behaviors. Students also are introduced to the habitat of the Bess Beetle that will provide the needs of the beetles while in the classroom.

Part 2 – Comparing Crayfish and Beetles: Through the use of Venn diagrams or other graphic organizers, students compare and contrast the structures of crayfish and beetles. In addition, students learn about the functions of the various structures they observe **Part 4** – Choosing Your Own Investigation: Students will decide from a list of questions compiled that they can research or investigate directly, regarding the structures and functions of other plants of animals to pursue as a project.

Resources & Teaching Tips (Consider the two questions below when completing this section.)

- **What text/print/media/kit/web resources best support this unit?**

FOSS Science Stories:

Investigation 1:

Part 1 – Seeds are Everywhere (page 1-4)

Part 2 – The Most Important Seed (page 4-5)

Part 3 – Barbara McClintock (page 6-9)

Investigation 2:

Part 2 – Hydro-growing (page 10-11)

Part 3 – Seeding Space (page 12-16)

Investigation 3:

Part 2 – Answering Kids Questions: Crayfish, Crawfish, Crawdaddy
(page 17-19)

Part 3 – Life Cycle of a Crayfish (page 20-21)

Website: www.fossweb.com

- What tips to teachers of the unit can you offer about likely rough spots/student misunderstandings and performance weaknesses, and how to troubleshoot those issues?

Accommodation/Differentiation ideas and tips