

2019 Core Knowledge Science Sequence

Grade 4 Unit 3: Structures and Functions of Living Things

Introduction

A key concept in biology is that structure is related to function. The structure of a bird's wing is related to the function of flying. The bright color associated with a flower's structure is related to the function of attracting insects for pollination as part of reproduction. All plants and animals have both external and internal structures that work together as systems that enable organisms to survive, grow, and reproduce. The structure-function relationship holds true for the fundamental unit of life, the cell. Groups of cells make up tissues, groups of tissues make up organs, and groups of organs are organ systems. At all levels, structure is related to function.

Organisms have sensory organs that detect different kinds of information about the environment (such as temperature, odor, sound, and light). In these sensory organs, the interaction of structure and function always supports the survival of the organism. Consider, for example, the structure and function of the eyes and ears of a cat, fox, or human being. The many structures that make up the eye and the ear, with each structure performing its particular function, help to detect and/or transmit information. Nerve signals alert the brain to the outside world. The brain supports survival, signaling immediately or storing the information as memory.

Note to Teachers and Curriculum Planners

- This unit extends learning about light and sound waves (see Grade 4 Unit 2 *Investigating Waves*) to focus on how the eyes and ears work, with an emphasis on the relationship between the structure and function.
- While students explore visual and auditory sensory structures, at this level they are not expected to comprehend the cellular mechanisms of vision or how the retina works.
- Students explore many examples of biological structures, but memorization of components of specific organ systems is not expected. Assessment is limited to macroscopic structures within plant and animal systems.
- Students are introduced to the concepts of stimulus and response; however, they are not expected to learn the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.

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2019 CORE KNOWLEDGE SCIENCE SEQUENCE	SUGGESTED LEARNING OBJECTIVES	LANGUAGE OF INSTRUCTION
<p>The Sequence guidelines identify specific content and skills for building knowledge coherently from grade to grade.</p>	<p>These suggested learning objectives may be modified to meet state and local standards as well as the needs of specific schools and classrooms.</p>	<p>This word list provides a sampling of the vocabulary to which students should be repeatedly exposed during instruction. The list is not intended for use in isolated drill or memorization.</p>
<p>A. Structure is Related to Function</p> <p><u>From cells to systems: Organization of living things</u></p> <ul style="list-style-type: none"> ● Cells: the smallest unit of life <ul style="list-style-type: none"> ○ Unicellular organisms have only one cell. ○ Multicellular organisms are made up of many cells. ● Organization of complex multicellular organisms: <ul style="list-style-type: none"> ○ Cells make up tissues, tissues make up organs, <p><u>Organs work together in systems</u></p> <ul style="list-style-type: none"> ● Different structures work together in systems to support survival, growth, behavior, and reproduction. For example: <ul style="list-style-type: none"> ○ In animals: The heart works with the lungs to carry oxygen in the blood throughout the body. ○ In plants: The roots work with other plant structures to distribute water throughout the plant. <p><u>Structure and function</u></p>	<ul style="list-style-type: none"> ● Describe an example of the relationship of structure and function in a plant. ● Create a model that explains the concept of the levels of biological organization. ● Describe an example of multiple organs working together within an animal as a system. ● Identify the function of specific structures in plants and animals (such as the leaves and roots of a plant, or the human heart and skin). ● Construct an argument that in animals any structural level (such as skin, nerves, and the heart) supports survival, growth, behavior, and reproduction. ● Construct an argument that in plants any structural level (such as leaves, roots, and flowers) supports survival, growth, behavior, and reproduction. ● Construct an argument from evidence to support a claim that all structures and functions of an organism are interrelated and essential. 	<p>structure function organism leaf root stem stalk bark biological organization level multi- uni- cell/cellular tissue organ organ system nerve oxygen behavior growth survive/survival reproduce/reproduction voluntary/involuntary response</p>

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<ul style="list-style-type: none"> At any level of organization, each internal and external structure of an organism reflects its function. <ul style="list-style-type: none"> Examples in animal life: <ul style="list-style-type: none"> poison fangs of snakes armor of dinosaurs ink organ of squids Examples in plant life: <ul style="list-style-type: none"> color of flowers thorns of cactus huge leaves in rainforest <p>NGSS references:</p> <ul style="list-style-type: none"> 4-LS1-1 DCI LS1.A Structure and Function Cross-cutting Concept: Systems and System Models Science and Engineering Practice: Engaging in Argument from Evidence 		
<p>B. STRUCTURE AND FUNCTION OF EARS AND EYES</p> <p><u>The Visual System</u></p> <ul style="list-style-type: none"> Major structures and functions: <ul style="list-style-type: none"> Light enters through the eye after being reflected off of objects, Structures in the eyes focus and receive the light. The optic nerve takes electrical signals to the brain. 	<ul style="list-style-type: none"> Observe and describe how the eye gathers light. Draw a diagram to explain reflection. Identify the basic parts of the human visual system and their functions. Identify the basic parts of the human auditory system and their functions. Develop a model to show that sound waves interact with special organs that allow living things to detect sound. 	<p>senses light waves eye pupil reflect vision/visual system optic nerve brain nervous system hearing/auditory system outer ear</p>

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<p><u>The Auditory System</u></p> <ul style="list-style-type: none"> Major structures and functions: <ul style="list-style-type: none"> The outer ear captures sound waves. Middle ear: Sound waves hit the eardrum and are passed to three small bones Inner ear: Vibrations moves tiny hairs that create nerve signals. The auditory nerve sends signals to the brain. <p>NGSS references:</p> <ul style="list-style-type: none"> 4-LS1-2 4-PS4-2 DCI LS1.A Structure and Function DCI LS1.D Information Processing DCI PS4.B Electromagnetic Radiation Cross-cutting Concepts: <ul style="list-style-type: none"> Systems and System Models Cause and Effect Science and Engineering Practices: <ul style="list-style-type: none"> Engaging in Argument from Evidence Developing and Using Models 	<ul style="list-style-type: none"> Conduct an investigation to gather information about how the senses work together to send information to the brain. Construct a model to show how eyes and ears work together to detect information. 	<p>middle ear inner ear auditory nerve</p>
<p>C. Stimulus, Response, and Survival</p> <p><u>Detecting and responding to environmental stimuli</u></p> <ul style="list-style-type: none"> Stimulus and response: <ul style="list-style-type: none"> Stimulus: something that causes living tissue to respond 	<ul style="list-style-type: none"> Describe the relationship between stimulus and response. Give examples of stimuli and responses in an animal. Identify examples of different sensory organs in an animal. Discuss examples of stimuli and responses in a plant. 	<p>sense/sensory stimulus (stimuli) environment response behavior cause and effect structure function tropism</p>

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<ul style="list-style-type: none"> ○ Response: the reaction an organism has to a stimulus ● Organisms have sensory organs that detect different kinds of information about the environment (such as temperature, odor, sound, and light). ● In most animals, sensory organs transmit information to the brain. <ul style="list-style-type: none"> ○ The brain processes this information as perceptions and stores them as memories. ● Plants also respond to stimuli. <ul style="list-style-type: none"> ○ Example: A plant can sense the direction of light and grow toward it. ● Response to stimuli helps survival, growth, reproduction, and behavior. <p>[NOTE: See Section B above for more detailed guidelines/connections about the human visual system.]</p> <p>NGSS references:</p> <ul style="list-style-type: none"> ● 4-LS1-2 ● DCI LS1.A Structure and Function ● DCI LS1.D Information Processing ● DCI PS4.B Electromagnetic Radiation ● Cross-cutting Concept: Systems and System Models ● Science and Engineering Practice: Developing and Using Models 	<ul style="list-style-type: none"> ● Use a model to describe how an organism's senses help it to survive, grow, reproduce, and behave. ● Diagram and explain of stimulus and response in animals and plants. ● Discuss functions in organisms and the structures that support those functions. 	<p>eye seeing sight light waves ear hearing sound waves input/output</p>
<p>Science Biographies Helen Keller Louis Braille</p>		

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Other individuals to consider studying during this domain of study:

Julia Brace

Louis Frisino

Laura Bridgman

As noted above, this unit references the following standards that are a part of the [NGSS Grade 4 Topic 4. Structure, Function, and Information Processing](#).

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. *[Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]* [Evidence Statements](#)

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. *[Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.]* *[Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]* [Evidence Statements](#)

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. *[Clarification Statement: Emphasis is on systems of information transfer.]* *[Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]* [Evidence Statements](#)