

**Section C:
Grade 8 Science
Quarter 1
Units of Study**

Grade 8 Science, Quarter 1, Unit 1.1
Characteristics of Living Organisms

Overview

Number of instructional days: 13 (1 day = 45 minutes)

Content to be learned

- Differentiate the functions of specialized cells.
- Understand the structure and function of cells, tissues, and organs.
- Understand genetic contributions in sexual and asexual reproduction.
- Understand change over time through natural selection/evolution.

Processes to be used

- Explain relationships between the structure and function of cells, tissues, organs, and organ systems.
- Recognize that cells perform specific functions.
- Compare sexual and asexual reproduction.
- Describe reproduction as a process that combines genetic material.
- Explain that genetic variations are passed on through reproduction.
- Gather evidence that demonstrates evolutionary relationships.
- Explain how natural selection leads to evolution.
- Describe how scientific thinking about species origination/extinction has changed over time.

Essential questions

- What are the structural relationships between cells, tissues, organs, and organ systems?
- What are the functional relationships between cells, tissues, organs, and organ systems?
- How are sexual and asexual reproduction similar and different with respect to genetic contribution?
- What are some ways natural selection provides a survival advantage in a specific environment?

Written Curriculum

Grade Span Expectations

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (5-8) FAF –4

Explain relationships between or among the structure and function of the cells, tissues, organs, and organ systems in an organism.

LS1 (7-8)–4 Students demonstrate understanding of differentiation by...

4a explaining that specialized cells perform specialized functions. (e.g., muscle cells contract, nerve cells transmit impulses, skin cells provide protection).

4b comparing individual cells of tissues and recognizing the similarities of cells and how they work together to perform specific functions.

4c explaining how each type of cell, tissue, and organ has a distinct structure and set of functions that serve the organism as a whole.

LS1 (5-8) POC -3

Compare and contrast sexual reproduction with asexual reproduction.

LS1 (7-8)–3 Students demonstrate an understanding of reproduction by ...

3a explaining reproduction as a fundamental process by which the new individual receives genetic information from parent(s).

3b describing forms of asexual reproduction that involve the genetic contribution of only one parent (e.g., binary fission, budding, vegetative propagation, regeneration).

3c describing sexual reproduction as a process that combines genetic material of two parents to produce a new organism (e.g., sperm/egg, pollen/ova)

LS3 - Groups of organisms show evidence of change over time (structures, behaviors, and biochemistry).

LS3 (5-8) POC-9

Cite examples supporting the concept that certain traits of organisms may provide a survival advantage in a specific environment and therefore, an increased likelihood to produce offspring.

LS3 (7-8) -9 Students demonstrate an understanding of Natural Selection/ evolution by ...

9a explaining that genetic variations/traits of organisms are passed on through reproduction and random genetic changes.

9b gathering evidence that demonstrates evolutionary relationships among organisms (e.g., similarities in body structure, early development, traits).

9d explaining how natural selection leads to evolution (e.g., survival of the fittest).

9e describing how scientists' understanding of the way species originate or become extinct has changed over time.

Clarifying the Standards

Prior Learning

In previous grades, students predicted, sequenced, and compared the life stages of plants and animals. They also identified and explained how the physical structures of an organism allow it to survive in its habitat and/or environment.

By this level, students have recognized that reproduction is necessary to produce offspring and to continue both plant and animal species. They recognize that cells are the building blocks of organisms. Students realize that specific traits affect a species' ability to survive as they cite possible causes for extinction and explain how fossils can be used to understand the history of life.

Current Learning

In grade 8, students deepen their knowledge of the cells and structural organization of an organism to include specialization, functions, and differences and similarities of systems. They also explore the ways that systems work together to serve an organism as a whole.

Students expand their understanding of reproduction to include the ways that asexual and sexual reproduction processes differ in the transfer of genetic information and material from parent(s) to offspring.

Genetic variations passed on through reproduction and random genetic changes are explored. Students develop understanding of how natural selection leads to evolution and how species originate, evolve, or go extinct over time. Students also examine evidence of evolutionary relationships among organisms.

Future Learning

At the high school level, students will extend their knowledge about the transfer of genetic information to include the molecular basis for heredity (DNA, etc.). They will learn how genetic information is passed from parent to offspring through the sorting and recombination of genes in sexual reproduction (phenotype, genotype, Punnett squares, probability, etc.). They will explore in more detail the functions of subcellular structures in both unicellular and multicellular organisms. Students will also extend their knowledge of natural selection by citing evidence of past and present life forms on earth (Gallapagos Islands, geographic isolation).

Additional Research Findings

According to *Benchmarks for Science Literacy*, now is the time to begin the study of genetic traits and what offspring get from parents. This topic can be handled as a natural part of the study of human reproduction. Students should examine examples of lineages for which breeding has been used to emphasize or suppress certain features of organisms (for example, pineapples bred to fit in a can, sweeter-tasting corn) (p. 108).

Students at this level are mainly focused on the human body. Begin with as many different kinds of body cells as possible—nerve, bone, muscle, skin—and then move on to examining cells in other animals and plants. This activity can show students that cells are the fundamental building blocks of their own bodies

and of other living things as well. Once students see that tissue in other animals looks pretty much the same as tissue in humans, two important claims of science will be reinforced—the ubiquity of cells and the unity of nature (p. 112).

Conception, both natural and artificial, and the idea of birth control (introduced earlier, but not explained explicitly) are important issues for some middle-school adolescents. Films showing how embryos develop are likely to interest them (p. 133).

Students can now develop more sophisticated understandings of how organs and organ systems work together. It's a good time to ask *what if?* questions, such as 'What might happen if some other parts weren't there or weren't working?' Such questions encourage students to reflect on connections among organs (p. 137).

Students can relate knowledge of organs and organ systems to their growing knowledge of cells. The specialization of cells serves the operation of the organs, and the organs serve the needs of cells (p. 137).

According to the *Atlas of Science Literacy*, students of all ages have mistaken ideas about the structure and function of blood, the structure and function of the heart, the circulatory pattern, the circulatory/respiratory relationships, and the closed system of circulation. Misconceptions concerning the circulatory pattern, the circulatory/respiratory relationships, and the closed system of circulation are difficult to change (for example, the misconception that blood is blue) (Basic Functions, p. 41).

Before students have an early understanding of genetics, they may believe that a baby exists in the sperm, but requires the egg for food and protection, or that the baby exists in the egg and requires the sperm as a trigger to grow. Many U.S. adults accept the idea that plants and animals have evolved, but reject the idea that humans have evolved. This appears to be related both to religious beliefs and to a lack of understanding about the molecular basis of heredity (Human Identity, p. 37).

Notes About Resources and Materials

Websites

- www.cposcience.com
- www.science-class.net
- www.sciencespot.net
- www.discoveryeducation.com
- <http://www.middleschoolscience.com/>
- Challenge your students to create a "Wanted" poster about an organ. This website provides project guidelines, links for students, and project worksheets.
<http://sciencespot.net/Pages/otrail.html>
- Teach genetics and natural selection in the context of an environmental disaster that pollutes a stream. Note: This 15-page document is the most recent version (April 2001) of this activity and supercedes the earlier version contained in the Genetics Education Guide.
<http://genetics-education-partnership.mbt.washington.edu/download/toothpickfish.pdf>
- www.science-class.net/Biology/Genetics.htm
- Welcome to the Galapagos

<http://www.nsta.org/publications/interactive/galapagos/>

- PowerPoint on sexual and asexual reproduction
www.science-class.net/PowerPoints/Types%20of%20Reproduction_files/frame.htm

Books

- *Science Explorer: Cells, Tissues, Organs, Organ Systems*. Upper Saddle River, NJ: Prentice Hall.
Human Biology and Health, Chapter 1, Section 1
- *Science Explorer: Sexual and Asexual Reproduction*. Upper Saddle River, NJ: Prentice Hall.
Bacteria to Plants, pp. 59, 60, 83, 97, 98, 116
Cells and Heredity, Chapter 3, Section 3
- *Science Explorer: Natural Selection/Evolution*. Upper Saddle River, NJ: Prentice Hall.
Cells and Heredity, Chapter 5, Sections 1 and 3
Environmental Science, pp. 32–36

Grade 8 Science, Quarter 1, Unit 1.2
Heredity and Human Development

Overview

Number of instructional days: 8 (1 day = 45 minutes)

Content to be learned

- Understand how biotic and abiotic factors affect human body systems.
- Understand the stages of embryonic development.
- Analyze embryonic development in various life forms.

Processes to be used

- Predict and explain the effects of biotic factors on human body systems.
- Research and report on how biotic and abiotic factors cause disease and affect human health.
- Describe changes from one stage of embryonic development to the next.
- Compare and contrast embryonic development of various life forms.

Essential questions

- How do environmental factors affect human body systems?
- How do biological factors affect human body systems?
- What are the major changes that occur in embryonic development from a single cell to a newborn?
- What are some common embryonic developments in different life forms?
- How is embryonic development different in various life forms?

Written Curriculum

Grade Span Expectations

LS 4 - Humans are similar to other species in many ways, and yet are unique among Earth's life forms.

LS4 (5-8) INQ-10

Use data and observations to support the concept that environmental or biological factors affect human body systems (biotic & abiotic).

LS4 (7-8)-10 Students demonstrate an understanding of human body systems by ...

10a predicting and explaining the effects of biotic factors (e.g., microbes, parasites, food availability, aging process) on human body systems.

10b predicting and explaining the effect of abiotic factors (e.g., drugs, environmental conditions) on human body systems.

10c researching and reporting on how biotic (e.g., microbes, parasites, food availability, aging process) and abiotic (e.g., radiation, toxic materials, carcinogens) factors cause disease and affect human health.

LS4 (5-8) POC-12

Describe the major changes that occur over time in human development from single cell through embryonic development to new born (i.e., trimesters: 1st – group of cells, 2nd - organs form, 3rd - organs mature).

LS4 (7-8)-12 Students demonstrate an understanding of patterns of human development by...

12b describing the changes from one stage of embryonic development to the next.

12c comparing and contrasting embryonic development in various life forms (e.g., humans, frogs, chickens, sea urchins).

Clarifying the Standards

Prior Learning

In prior grades, students recognized that the human body has five senses that aid in survival. They identified external and internal body structures of humans and other animals. They also identified biotic and abiotic factors and their effects on human body systems. Students identified and sequenced stages of human embryonic development and compared patterns of human development with those of other life forms.

Current Learning

Students predict and explain the effects of biotic and abiotic factors. They research and report on how those factors affect human health and body systems. They also describe changes in embryonic development and compare those changes among various life forms.

Future Learning

At the high school level, students will explore how biotic and abiotic factors can cause gene mutations or disease. Students will provide an explanation of how humans affect the environment and other organisms.

Additional Research Findings

According to *Benchmarks for Science Literacy*, students continue to learn about the healthy functioning of the human body and ways in which health may be promoted or disrupted by diet, lifestyle, bacteria, and viruses. Students should consider the effects of tobacco, alcohol, and other drugs on the way the body functions. They should start reading the labels on food products and considering the components of a healthy diet (p. 145).

Notes About Resources and Materials**Websites**

- Look at the right-hand side for materials such as worksheets.
www.sciencespot.net
- Lesson plans, media in the classroom, homework help
www.discoveryeducation.com
- The visible embryo
<http://www.visembryo.com/baby/index.html>
- Effects of smoking on the body
<http://www.smokefreereality.com/effects.php>
- Effects of air pollution on the body
http://www.arizonaenergy.org/AirEnergy/health_effects_of_air_pollution.htm
- Effect of lead on the body
<http://serendip.brynmawr.edu/bb/neuro/neuro00/web2/Patel.html>
- Effects of radiation on the body
<http://www.atomicarchive.com/Effects/radeffects.shtml>
- Effects of marijuana on the body
<http://health.howstuffworks.com/wellness/drugs-alcohol/marijuana.htm>
- Effects of caffeine on the body
<http://health.howstuffworks.com/wellness/drugs-alcohol/caffeine.htm>
- Effects of secondhand smoke on the body
<http://health.howstuffworks.com/wellness/drugs-alcohol/understanding-secondhand-smoke-ga2.htm>
- Effects of microbes on the body
http://www.actionbioscience.org/evolution/meade_callahan.html

- Effects of food availability on the body
<http://www.faqs.org/nutrition/Kwa-Men/Malnutrition.html>
- Effects of aging on the body
<http://www.cnn.com/2007/HEALTH/07/27/life.stages/index.html>

Books

- *Science Explorer: Abiotic and Biotic Factors*. Upper Saddle River, NJ: Prentice Hall.
Human Biology and Health, pp. 44, 60, 68–75, 77–81, 159–169, 124, 213–220, 249
Bacteria to Plants, pp. 48–54, 68–73
Environmental Science, pp. 17, 18
- *Science Explorer: Embryonic Development*. Upper Saddle River, NJ: Prentice Hall.
Human Biology and Health, pp. 238–239
Animals, p. 22

Grade 8 Science, Quarter 1, Unit 1.3
Processes Within an Ecosystem

Overview

Number of instructional days: 5 (1 day = 45 minutes)

Content to be learned

- Understand the processes of photosynthesis and respiration.
- Recognize the relationship between photosynthesis and respiration.
- Understand what is needed for photosynthesis and respiration.
- Identify the byproducts of photosynthesis and respiration.

Processes to be used

- Describe basic processes in the flow of energy in ecosystems.
- Recognize the names and chemical formulas of photosynthesis and respiration.
- Explain the relationship between photosynthesis and respiration.
- Explain the aspects of photosynthesis and respiration in relation to carbon dioxide, water, and oxygen exchange.

Essential questions

- What is the relationship between photosynthesis and respiration?
- What is the relationship between the sun, organisms, food webs, ecosystems, and the environment?
- What components make up the flow of energy in an ecosystem?
- How does matter cycle among and between organisms and the physical environment?

Written Curriculum

Grade Span Expectations

LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (5-8) SAE- 6

Given a scenario trace the flow of energy through an ecosystem, beginning with the sun, through organisms in the food web, and into the environment (includes photosynthesis and respiration).

LS2 (7-8) –6 Students demonstrate an understanding of energy flow in an ecosystem by ...

6b describing the basic processes and recognizing the names and chemical formulas of the substances involved in photosynthesis and respiration.

6c explaining the relationship between photosynthesis and respiration.

LS2 (5-8) SAE-7

*Given an ecosystem, trace how matter cycles among and between organisms and the physical environment (includes water, oxygen, food web, decomposition, recycling but **not** carbon cycle or nitrogen cycle).*

LS2 (7-8)-7 Students demonstrate an understanding of recycling in an ecosystem by ...

7c explaining the inverse nature or complementary aspects of photosynthesis/respiration in relation to carbon dioxide, water and oxygen exchange.

Clarifying the Standards

Prior Learning

In previous grades, students developed understanding of food webs and sequenced energy flow in an ecosystem. They learned that energy flow in an ecosystem begins with the sun, and they became aware of the relationship between plants and animals in a habitat. Students understood the basic processes and substances involved in photosynthesis and respiration.

Current Learning

Students recognize the names and chemical formulas of the substances involved in photosynthesis and respiration. They also explain the inverse and complimentary relationships of these substances. They know that the materials needed for photosynthesis allow plants to manufacture their own food and provide the basic source of nourishment for some organisms.

Future Learning

At the high school level, students will create diagrams of the energy flow in an ecosystem, comparing different trophic levels. They will recognize that energy flow has chemical components and elements that pass through organisms and ecosystems, making a continuous cycle for energy, organisms, and the environment over time.

Additional Research Findings

According to the *Atlas of Science Literacy*, middle-school and high-school students have difficulty thinking of the human body as a chemical system and have little knowledge of the elements composing the living body. In particular, middle-school students think organisms and materials in the environment are very different types of matter. Students see these substances as fundamentally different and not transformable into each other.

Students of all ages hold misconceptions about plant nutrition. They think that plants get their food from the environment rather than by manufacturing it internally and that food for plants is taken in from the outside. These misconceptions are particularly resistant to change. Even after traditional instruction, students have difficulty accepting that plants make food from water and air, and that this is their only source of food. Understanding that the food made by plants is very different from other nutrients such as water or minerals is a prerequisite for understanding the distinction between plants as producers and animals as consumers.

Middle-school students have some awareness of the cyclical processes within an ecosystem. Some students make the mistake of seeing only chains of events rather than recognizing the matter involved in processes such as plant growth or animals eating plants.

Students may get stuck in thinking that matter is always created or destroyed rather than transformed. Other students recognize one form of recycling through soil minerals, but fail to incorporate water, oxygen, and carbon dioxide into matter cycles. Even after specially designed instruction, students cling to their misinterpretations. Instruction that emphasizes the flow of matter through the ecosystem as a basic pattern of the environment may help correct these difficulties (pp. 77–79).

Some students of all ages struggle to identify the energy sources for plants and animals. They may confuse energy and other concepts such as food, force, and temperature. As a result, students may not appreciate the uniqueness and importance of energy conversion processes like respiration and photosynthesis.

Notes About Resources and Materials

Websites

(Lesson plans, PowerPoint presentations, etc)

- www.cposcience.com
- www.sciencespot.net
- www.discoveryeducation.com
- www.science-class.net/Biology/Photosynthesis.htm (click on “warm ups”)
- www.science-class.net/PowerPoints/PandR_files/frame.htm
- www.science-class.net/Lessons/Photosynthesis_Cell_Resp/photosynthesis_elodea.pdf
- www.science-class.net/Lessons/Photosynthesis_Cell_Resp/evidence_of_photosynthesis.pdf
- Respiration in yeast (lab)
http://www.science-class.net/Lessons/Photosynthesis_Cell_Resp/respiration%20in%20yeast.pdf
- Evidence of photosynthesis (lab)

http://www.science-class.net/Lessons/Photosynthesis_Cell_Resp/evidence_of_photosynthesis.pdf

Books

- *Science Explorer: Cells, Tissues, Organs, Organ Systems*. Upper Saddle River, NJ: Prentice Hall.
Cells and Heredity, Chapter 2, Sections 1 and 2
Human Biology and Health, pp. 130–135
Environmental Science, pp. 51–53