

OVERVIEW

LIVING SYSTEMS



CONTENT GOALS

The **Living Systems Module** consists of three sequential investigations, each designed to introduce students to transport systems in multicellular organisms. Students use readings, videos, and investigations to study the circulatory, respiratory, digestive, and excretory systems in humans and the vascular system in plants. They conduct and analyze controlled experiments related to these systems and to the production of food by plants.

FOSS EXPECTS STUDENTS TO

- Learn that the basic unit of life is the cell.
- Learn that all cells have basic needs—water, food, gas exchange, and waste disposal.
- Learn how materials are transported to cells in multicellular organisms.
- Learn the structures and functions of the circulatory, respiratory, digestive, and excretory systems in humans.
- Learn that vascular plants have specialized tissues (xylem and phloem tubes) for the transport of water, minerals, and sugar to cells.
- Discover that leaves play an important role in the transport of water to cells in vascular plants.
- Learn that green plant cells make sugar from carbon dioxide and water in the presence of sunlight, and release oxygen.
- Learn that plant and animal cells obtain energy by breaking down sugar into carbon dioxide and water (cellular respiration).
- Classify leaves based on venation pattern.
- Design, conduct, and analyze the results of experiments.
- Write scientific reports.
- Use metric tools and make and record quantitative observations in a scientific investigation.

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FOSS AND NATIONAL STANDARDS

The **Living Systems Module** encourages students to develop the skills of investigation and experimentation to build explanations based on knowledge and evidence. This module supports the following National Science Education Standards.*

SCIENCE AS INQUIRY

Develop students' abilities to do scientific inquiry.

- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Think critically and logically to make the relationships between evidence and explanations.
- Communicate scientific procedures and explanations.
- Use mathematics in all aspects of scientific inquiry.

CONTENT: LIFE SCIENCE

Develop students' understanding of structure and function in living systems.

- Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems.
- All organisms are composed of cells—the fundamental unit of life. Most organisms are single cells; other organisms, including humans, are multicellular.

*“Middle-school students can develop the understanding that the body has organs that function together to maintain life. Teachers should introduce the general idea of structure-function in the context of human organ systems working together.”***

*National Science Education Standards (Washington, DC: National Academy Press, 1996).

**National Science Education Standards (Washington, DC: National Academy Press, 1996), page 156.

- Cells carry on the many functions needed to sustain life. They take in nutrients, which they use to provide energy for the work that cells do and to make the materials that a cell or an organism needs.
- The human organism has systems for digestion, respiration, circulation, and excretion. These systems interact with one another.

Develop students' understanding of populations and ecosystems.

- For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis.

SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

Develop students' understanding about personal health.

- Food provides energy and nutrients for growth and development. Nutrition requirements vary with body weight, age, activity, and body functioning.

*“The instructional activities of a scientific inquiry should involve students in establishing and refining the methods, materials, and data they will collect. As students conduct investigations and make observations, they should consider questions such as ‘What data will answer the question?’ and ‘What are the best observations or measurements to make?’ Students should be encouraged to repeat data-collection procedures and to share data among groups.”***

**National Science Education Standards (Washington, DC: National Academy Press, 1996), page 144.

LIVING SYSTEMS MODULE MATRIX

SYNOPSIS

SCIENCE CONTENT

THINKING PROCESSES

1. LIVING CELLS

Students study four related human-body transport systems that provide all the cells water, food, gas exchange, and waste disposal. The structures and functions of the circulatory, respiratory, digestive, and excretory systems are explored through a variety of multimedia activities. Students observe and analyze an investigation on gastric juice in the stomach.

- Cells require water, food, gases, and waste removal to live.
- In humans, oxygen is transported to the blood and carbon dioxide is transported from the blood in the respiratory system.
- In the human circulatory system, blood transports resources to the cells and wastes from the cells.
- The digestive system breaks down complex substances into simple ones.
- Kidneys filter wastes from blood and convert them into urine for excretion.
- The respiratory, circulatory, digestive, and excretory systems work together to ensure that cells receive the resources they need.

- Use print and video resources to gather information about multiple human organ systems.
- Describe structure and function relationships in a variety of organs in a system.
- Describe the sequence of events in complex relationships in human organ systems.
- Observe and communicate the results of an experiment on digestion.
- Identify the dependent and controlled variables in an experiment.

2. VASCULAR PLANTS

Students investigate the transport system in vascular plants and learn about the specialized structures, xylem and phloem tubes. Students design and conduct a scientific investigation and discover that leaves play an important role in the transport of water to cells in vascular plants. They use multimedia resources to gather information about plants. They collect and classify plant leaves, based on appropriate criteria.

- Life happens in cells.
- Vascular plants have two transport systems, one to transport water and minerals from roots to leaves, and one to transport sugar from leaves to cells that need it.
- In vascular plants, water and minerals are transported to cells in xylem tubes; sugar is transported to cells in phloem tubes.
- Vascular bundles are arranged in predictable patterns of veins in the leaves of vascular plants.
- Scientists classify objects and information by organizing them into groups with similar attributes.

- Classify objects (e.g., rocks, plants, leaves) in accordance with appropriate criteria.
- Plan and conduct an investigation to find out how water gets to the cells in a vascular plant.
- Use appropriate tools to measure mass and volume in an experiment.
- Use mathematics to analyze investigation results.
- Organize and communicate findings.

3. SUGAR AND CELLS

Students analyze an experiment to determine the conditions under which plants produce food (photosynthesis). They design an investigation to determine what conditions are needed to activate an organism (yeast) and are introduced to the process by which plant and animal cells obtain energy from food (cellular respiration). They design and conduct an experiment to determine the sugar content of common foods.

- Chlorophyll absorbs sunlight.
- Photosynthesis requires carbon dioxide, water, and light.
- Photosynthesis produces sugar and oxygen gas.
- Plant and animal cells break down sugar and oxygen into carbon dioxide and water to obtain energy (cellular respiration).
- Animals obtain six classes of nutrients from food: protein, carbohydrate, fat, minerals, vitamins, and water.
- The volume of gas produced by yeast is proportional to the amount of sugar present.

- Observe and describe evidence of yeast's cellular respiration.
- Plan and conduct an investigation to find out how much sugar is in different breakfast cereals.
- Use appropriate tools to measure mass, volume, and temperature in an experiment.
- Use mathematics to analyze investigation results.
- Organize and communicate results of an experiment using years as an indicator of sugar.
- Identify the dependent and controlled variables in an experiment.

READING AND WRITING

- *Living Cells*
- *Circulatory System*
- *The Disassembly Line*
- *Summary: Living Cells*
- Science Notebook: Students respond to written questions and explain their understanding of transport systems in humans.

- *Vascular Plants*
- *Classification*
- *Summary: Vascular Plants*
- Science Notebook: Students develop an experimental question, write a plan, organize data, and write findings and conclusions.

- *Making Food*
- *Photosynthesis*
- *Cellular Respiration*
- *Living with Diabetes*
- *Summary: Sugar and Cells*
- Science Notebook: Students develop an experimental question, write a plan, organize data, and write findings and conclusions.

EXTENSIONS

Math Extension

- Problem of the week.

Science Extensions

- Read about the man with a hole in his stomach.
- Research other organs involved in digestion.
- Research dialysis.
- Research asthma.
- Find out about the hearts of other animals.
- Diagram an organ system.

Math Extension

- Problem of the week.

Science Extensions

- Study a cross section of wood.
- Investigate flowers.

Language Extension

- Research maple syrup.

Math Extension

- Problem of the week.

Science Extensions

- Test various sugars or liquids.
- Test sugar substitutes.
- Calculate percentage of sugar.
- Develop your own food pyramid.

Language Extension

- Find sugars in products.

Social Studies Extension

- Research world breakfasts.

ASSESSMENT

Survey

Embedded Assessment

- Science Notebook

Benchmark Assessment

- I-Check 1

Embedded Assessment

- Science Notebook
- Response Sheet

Benchmark Assessment

- I-Check 2

Embedded Assessment

- Science Notebook
- Response Sheet

Benchmark Assessment

- I-Check 3

Posttest