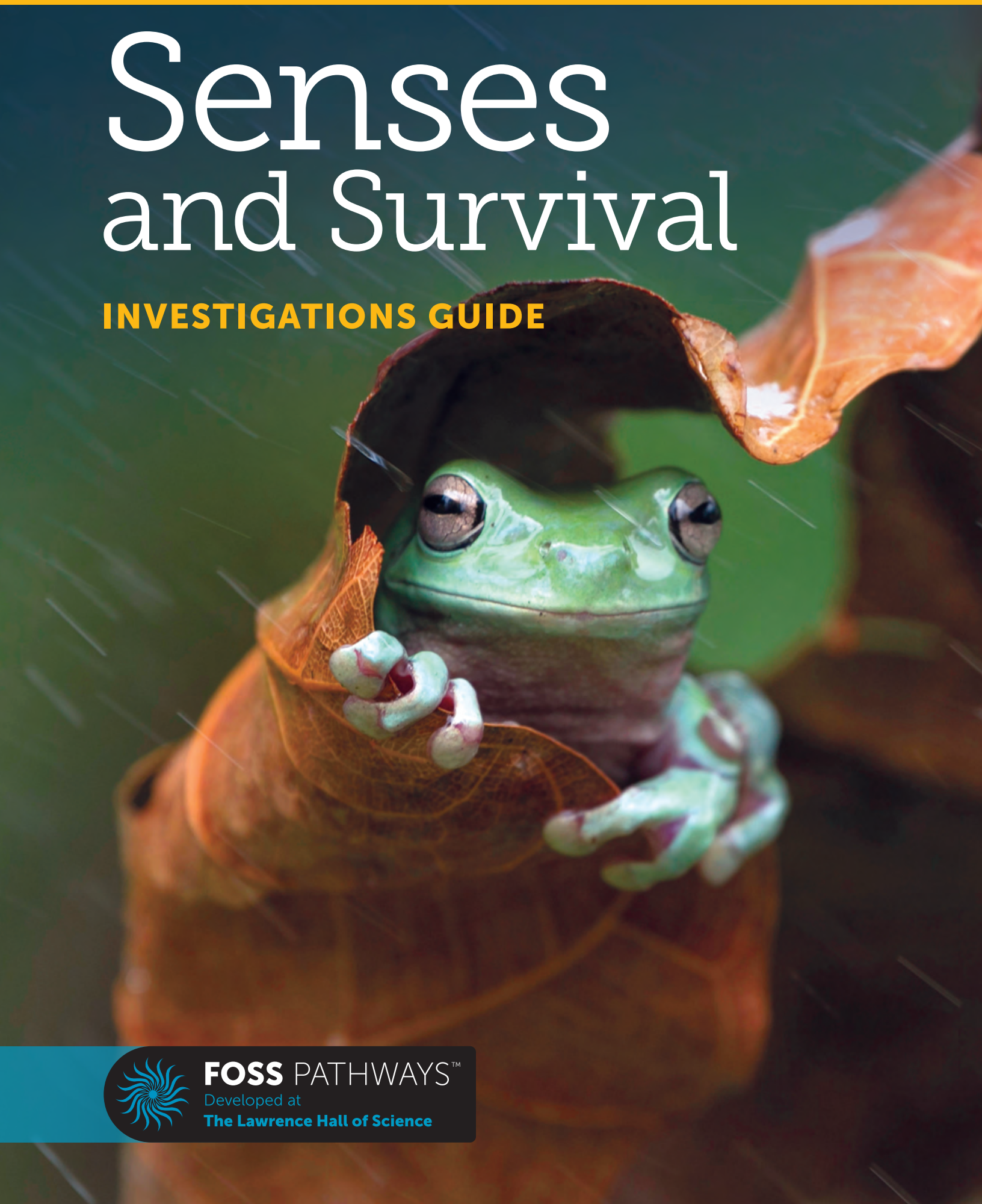
SAMPLER

Senses and Survival

INVESTIGATIONS GUIDE



FOSS PATHWAYS™
Developed at
The Lawrence Hall of Science

PreK–5 science that meets the challenge of our time

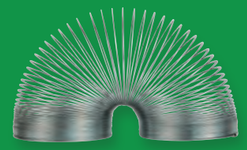
Welcome to new FOSS® Pathways™. Now as never before, the world needs scientific thinkers—to view the world thoughtfully, approach challenges analytically, and embrace opportunities enthusiastically. For educators to help unlock this potential in their students, they need powerful tools that work for the needs of today. A program that engages students of all backgrounds and experiences. Fully leverages modern digital technology. And does it all in the hours available.

A major advancement from a proven leader

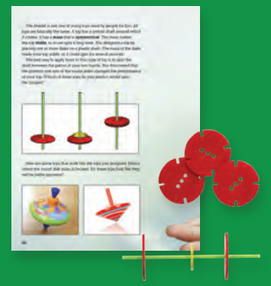
The Full Option Science System™ (FOSS) was conceived to enlist students not as passive recipients of information, but as active investigators of phenomena. That principle has proven its worth for 150,000 teachers and 4 million students across all 50 states, building a legacy of student engagement and test-score improvement. Now FOSS takes science education another significant step forward, with FOSS Pathways. This new PreK–5 core curriculum:

Aligns with today's national science standards and is adaptable to meet state and local requirements

Incorporates the digital tools for a flexible multimedia experience



Lends flexibility to teach in the class time allotted for science



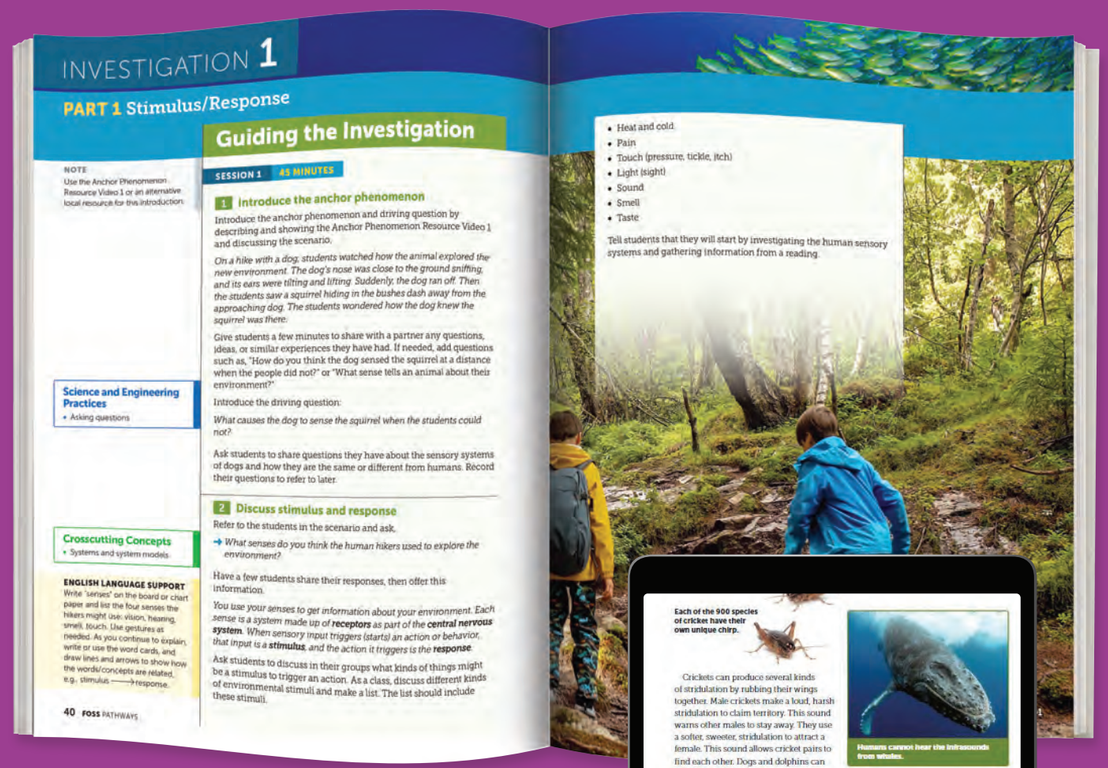
Teaches through a multimodal approach to resonate with every student

Engages students through coherent phenomenon storylines that are local and relevant

Provides unmatched educative support to teach phenomena-based science

How Pathways develops the scientific thinkers of tomorrow

New FOSS Pathways supports today's demand to develop scientifically literate thinkers and problem solvers in a multitude of ways.



A logical progression

Students develop core ideas in a relevant and coherent learning progression that allows them to construct an explanation of the phenomena they have experienced.

Support for students

Comprehensive support and multimodal instructional experiences engage learners of all languages and cultures, taking advantage of prior experiences so all students can reason scientifically.

Evidence of learning

Research-based and field-tested assessments accurately measure student learning and progress. A variety of formative assessment tools provide evidence of students' use of the three dimensions and their knowledge of phenomena.

Support for teachers

Phenomena-based instruction is facilitated by appropriate educative support. This includes explicit background information needed for teachers to engage students in making the connection between the anchor phenomenon being investigated and the core ideas being exposed.

Rich digital resources

Digital resources for students and teachers are provided through FOSSweb on ThinkLink™. These multimedia materials are purposefully designed to enhance the learning experience and lend the flexibility to keep active science teaching viable if classroom circumstances change.

How FOSS Pathways aligns with today's standards

In this Sampler, pages 9-21 and 23-49 are provided from the teacher *Investigations Guide*. As you review, you will begin to witness the numerous ways that FOSS Pathways supports the development of tomorrow's scientists, engineers, and informed citizens. You'll see examples for:

Investigations driven by local, relevant phenomena and real-world problems

Instruction led by multimodal experiences that cognitively engage students to figure out phenomena

Identification of performances to meet targeted learning goals and elicit evidence of students' use of all three dimensions

Instructional support for teachers that provides an explicit connection between the phenomenon, three-dimensional learning, and multimodal learning experiences

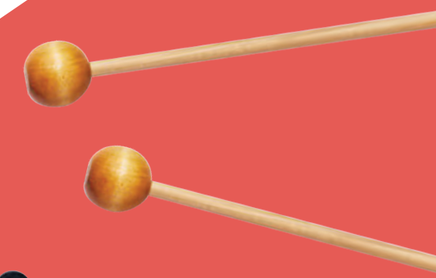
Clear integration of ELA/ELD skills and practices, with ties to standards and resources for engaging multilingual students

Cross-curricular activities that give students a choice and voice to differentiate instruction

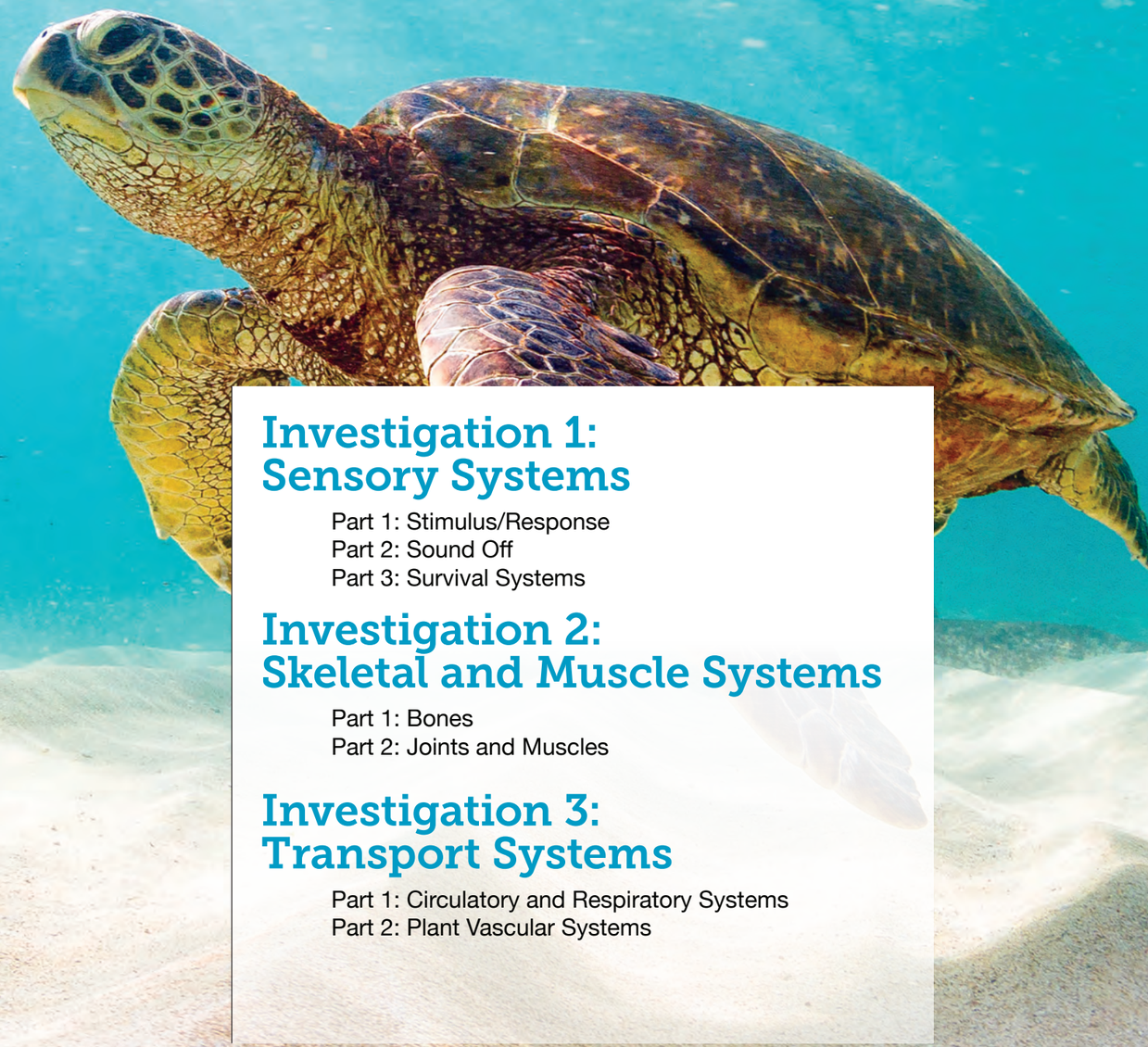
▶ Images on this page include actual components, resources and/or materials provided in FOSS kits.

Alignment to NGSS Performance Expectations

Grade 4 NGSS Performance Expectations	Senses and Survival	
	Investigation(s)	Benchmark Assessment
4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	**Investigation 1** **Investigation 2** **Investigation 3**	• Investigations 1 I-Check • Survey/Posttest
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.	**Investigation 1**	• Investigation 2 I-Check • Survey/Posttest
3–5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost	**Investigation 3**	• Survey/Posttest



Senses and Survival Investigations



Investigation 1: Sensory Systems

Part 1: Stimulus/Response
Part 2: Sound Off
Part 3: Survival Systems

Investigation 2: Skeletal and Muscle Systems

Part 1: Bones
Part 2: Joints and Muscles

Investigation 3: Transport Systems

Part 1: Circulatory and Respiratory Systems
Part 2: Plant Vascular Systems

Senses and Survival

▶ **Start here to begin your review of the Grade 4 Senses and Survival Investigations Guide**

Introduction

The **Senses and Survival Module** provides students with firsthand and media experiences with three kinds of general biological systems in animals and plants—sensory systems, skeletal and muscle systems, and transport systems. These systems allow animals to sense and respond to danger in their environment; to obtain food and water; to find mates; and to avoid predators. In addition, they let both plants and animals grow and develop.

Students' engagement with these ideas is driven by three anchor phenomenon that drive them to investigate each system, first by focusing on the systems in humans and then comparing the structures in other organisms that perform similar functions. Students investigate these phenomenon:

- Anchor phenomenon 1—Animals using their senses
- Anchor phenomenon 2—A broken arm
- Anchor phenomenon 3—A scraped knee bleeds
- Anchor phenomenon 4—A wilted plant survives

Students plan and carry out investigations with stimulus and response to gather data to develop models and construct explanations. Students design physical models to understand how structures in a system function together to provide information and resources to organisms to support survival. Students gain experiences that will contribute to the understanding of these crosscutting concepts: cause and effect; systems and system models; and structure and function.

CONTENTS

The NGSS Performance Expectations bundled in this module include:

Life Sciences
4-LS1-1
4-LS1-2

Engineering, Technology, and Applications of Science
3–5-ETS1-1

NOTE

The three modules for grade 4 in FOSS Pathways are:

- Energy
- Soils, Rocks, and Landforms
- Senses and Survival

Module Matrix
At a Glance

Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
INV. 1 Sensory Systems **Phenomenon 1—Animals using their senses:** On a hike with a dog, students watched how the animal explored the new environment. The dog's nose was close to the ground sniffing, and its ears were tilting and lifting. Suddenly, the dog ran off. Then the students saw a squirrel hiding in the bushes dash away from the approaching dog. The students wondered how the dog knew the squirrel was there. **Storyline:** Students start with their own sensory systems to experience and explain how the human sensory receptors provide information from the environment, and send it to the brain, where it is interpreted to produce a return message for muscles to take action. Stimuli to human receptors (heat and cold, pain, touch, light (sight), sound, smell, taste) result in a response. Students consider that other animals respond to sensory stimuli that humans can't perceive. Students develop a general model for sensory systems in mammals, birds, reptiles, and fish and what might cause problems for the successful functioning of those systems.	***What causes the dog to sense the squirrel when the students could not?*** **FOCUS QUESTIONS:** **How do humans respond to their environment?** **How do animals use their sense of hearing?** **How do animals sense and respond differently when their environment is changed by humans?**	**LS1.A:** Structure and function **LS1.D:** Information processing • Organisms have sensory systems to gather information about their environment and act on it. • A stimulus is something that triggers (starts) a response. A stimulus is often information received through the senses. The stimulus might signal danger. • A response is a living thing's reaction to a stimulus. Response time is the length of time it takes to respond to a stimulus. Sensory systems are involved in stimulus and response. • Animals detect, interpret, and act on sounds they hear. • Animals communicate to warn others of danger, scare predators away, or locate others of their kind, including family members. • Human activities can interfere with animals' ability to sense their environment or act on the information. • Scientists use knowledge of animals' sensory systems to solve environmental problems.	**Science and Engineering Practices** Asking questions Developing and using models Planning and carrying out investigations Analyzing and interpreting data Using mathematics and computational thinking Constructing explanations Obtaining, evaluating, and communicating information **Crosscutting Concepts** Cause and effect Systems and system models Structure and function	**4-LS1-1:** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. **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.
INV. 2 Skeletal and Muscle Systems **Phenomenon 2—A broken arm:** A child is riding a scooter across the playground and stumbles and falls onto the asphalt. The child's left arm is injured in the fall, and at the hospital, the X-ray reveals a broken arm. The child is unable to move the arm until it heals. **Storyline:** Students start by figuring out what bones are in their skeletal system, what their shapes and orientation are, and how they interact to provide support, protection, and movement. They compare the human skeleton to other animals (a cat and a bird) to look for similarities and differences. Students investigate what holds the skeletal system together and provides for articulation (the joints composed of ligaments and tendons, and muscles that contract to cause movement). Students build models to emulate a functioning arm to understand how the systems work together to provide movement. Students find that a broken arm means that one or more of the three bones in the arm are broken. It might also involve damage to the tissues surrounding the joints and the functioning of muscles. A broken bone affects the movement and survival of an animal.	***How does breaking an arm affect movement?*** **FOCUS QUESTIONS:** **What are the functions of the skeletal system?** **How do our bones and muscles work together so we can move in so many ways?**	**LS1.A:** Structure and function • A skeleton is a system of interacting bones. • There are about 206 bones in the human skeleton. Each bone in the human body has an identifiable shape, position, orientation, and function. • Bones have several functions: support, protection, and movement that are important for survival. • The skeletons of humans and other vertebrates have many similarities. • Bones have different shapes depending on where they are and what their purpose is. • Some animals (invertebrates) have exoskeletons (stiff outer coverings) rather than internal skeletal systems. • The place where two bones meet is called a joint. The human skeleton has different types of joints. • Muscles attach across joints to move bones. Muscles contract when they work. • Movement of humans and other animals is important for survival. • The skeletal, muscular, and sensory systems interact to enable motion.	**Science and Engineering Practices** Developing and using models Planning and carrying out investigations Analyzing and interpreting data Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information **Crosscutting Concepts** Systems and system models Structure and function	**4-LS1-1:** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Module Matrix
At a Glance CONTINUED

Phenomenon and Storyline	Driving Question and Focus Questions	Content and Disciplinary Core Ideas	Practices and Crosscutting Concepts	NGSS PEs
INV. 3 Transport Systems **Phenomenon 3—A scraped knee bleeds:** A child fell down outside while playing ball and scraped a knee on the ground. The scraped knee was bleeding as it was cleaned and bandaged. **Storyline:** Students identify blood as a major component of a system in multicellular organisms (including humans) for moving resources and water to and from cells. Students develop a physical model of the heart, the component of the system that pumps blood through a network of tubes (arteries, veins, capillaries) and find out how the circulatory system works with the respiratory system to provide oxygen to each cell. **Phenomenon 4—A wilted plant survives:** When students returned from spring vacation, their classroom plant was wilted with the stems and leaves hanging down. The soil in the pot was very dry. Students placed the plant pot in a basin of water. In a few hours, the plant stems were holding the leaves upright. **Storyline:** Students find out about the interacting parts of the vascular system in plants (xylem and phloem) for the transport of water and minerals from the roots up to the stem and leaves, and sugar from the leaves to the stems and roots. Students develop an argument that the circulatory system of humans and the vascular system of plants is necessary for survival of the organisms.	***What causes the knee to bleed and why do we need blood to live?*** **FOCUS QUESTION:** **How do humans transport resources to all their cells?** ***What causes the leaves to change on the plant?*** **FOCUS QUESTION:** **How are resources transported to cells in a plant?**	**LS1.A:** Structure and function • All cells have basic needs: water, food, gas exchange, and waste disposal. Multicellular organisms have systems for transporting resources and waste. • In the human circulatory system, blood transports resources to the cells and carries waste from the cells. • In humans, the respiratory system transports oxygen to the blood and carbon dioxide from the blood. • Vascular plants have specialized tissues for the transport of water, minerals, and sugar to cells. The xylem tubes carry water and minerals from the plant's roots to all the cells in a one-way flow; phloem tubes carry sugar from the leaves to all the cells that need it.	**Science and Engineering Practices** Developing and using models Analyzing and interpreting data Constructing explanations Engaging in argument from evidence Obtaining, evaluating, and communicating information **Crosscutting Concepts** Systems and system models Structure and function	**4-LS1-1:** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. **3–5-ETS1-1:** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

FOSS Pathways includes:

Investigations Guide

The Investigations Guide is a spiral-bound guide containing everything you need to teach the module. FOSS active investigation lesson plans include:

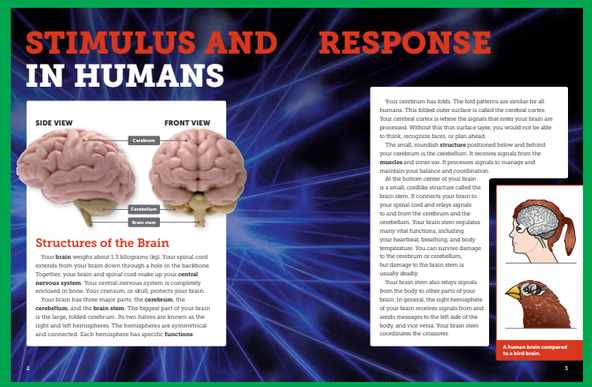
- Three-dimensional learning objectives
- Relevant and local phenomena storylines with driving questions
- Sense-making discussions
- Embedded assessment and “What to Look For” guidance
- Vocabulary reviews
- English language support strategies
- ELA strategies and connections

Science Resources Student Book

The *FOSS Science Resources* student book contains readings developed to reinforce, extend, or apply core ideas covered during FOSS active investigations. Readings give students opportunities to:

- Use text to obtain, evaluate, and communicate information
- Use evidence to support their ideas during sense-making discussions and focus question responses
- Integrate information from multiple sources
- Interpret graphs, diagrams, and photographs to build understanding

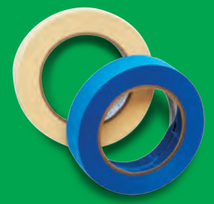
Available in print and as an interactive eBook in English and Spanish.



▶ Images on this page include actual components, resources and/or materials provided in FOSS kits.

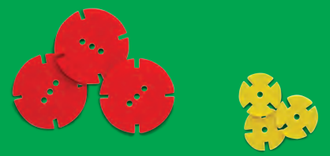
Equipment Kit

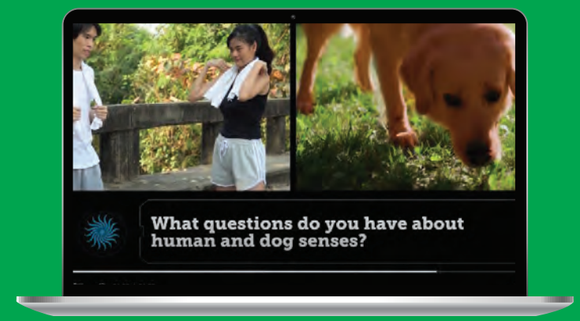
FOSS provides the equipment needed for all the investigations, including metric measuring tools. Our high-quality, classroom-tested materials are long-lasting and packaged by investigation to facilitate preparation and clean up. There is enough permanent equipment in each kit for 32 students. Consumable materials are supplied for three uses. Convenient grade-level and refill kits are available.



Technology

Online resources include duplication masters, eInvestigations Guide, teaching slides, FOSSmap online assessment, streaming videos, virtual investigations, and tutorials, as well as a library of teacher resources, including access and equity, three-dimensional teaching and learning, and environmental literacy.





SCAN HERE FOR A TOUR OF FOSSWEB!

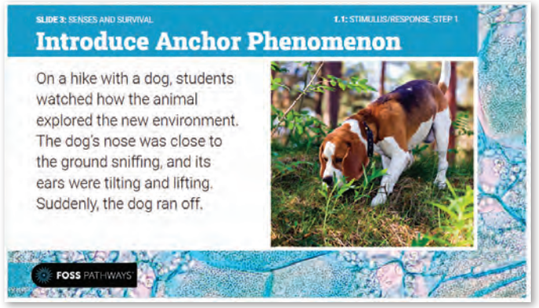
FOSSweb on ThinkLink

FOSSweb digital resources are delivered on School Specialty's curriculum platform called ThinkLink.

- Supports single sign-on and class management with Google classroom and learning management systems.
- Provides access to both teacher and student digital resources, including duplication masters, teaching slides, FOSSmap online assessment, streaming videos, and online activities.

Teaching Slides

Downloadable and editable slides from FOSSweb can be used to facilitate each part of each investigation. Teaching slides are available as Google slides in English and Spanish.

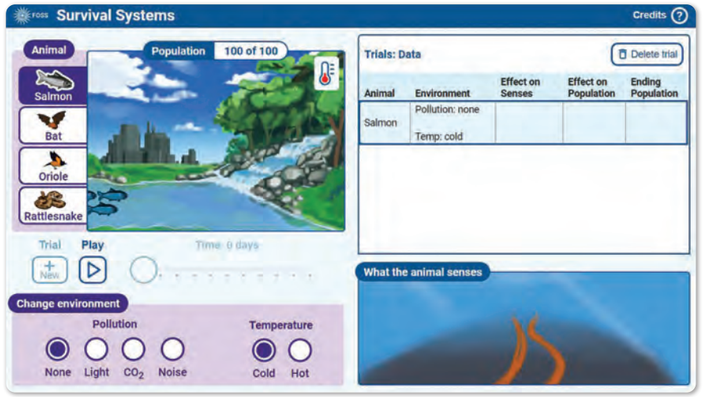


Streaming Videos

New engaging content videos in English and Spanish were developed to specifically support FOSS investigations.

Online Activities

New engaging simulations developed to address core ideas in FOSS, and interactive virtual investigations and tutorials offer additional content support for students.



Interactive eBooks

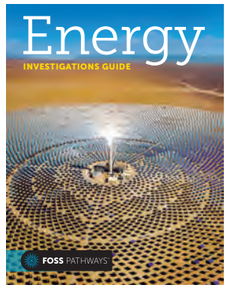
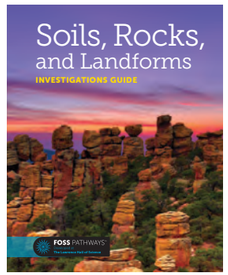
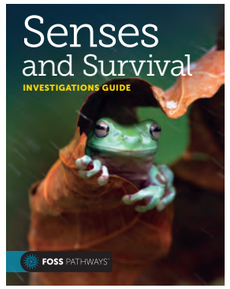
Keep your students engaged while teaching literacy skills with interactive *FOSS Science Resources* eBooks. The eBooks include integrated audio with text syncing and links to online activities and videos that bring the photos to life.

FOSSmap Online Assessment

Students in grades 3–5 can take summative assessments online with automatic coding of most responses. Student- and class-level reports help you identify the need for instructional next steps.

Grade Level Planning Guide

FOSS Pathways Modules Grade 4

FOSS Module	Module Overview/Bundled Performance Expectations	Disciplinary Core Ideas	Science and Engineering Practices	Crosscutting Concepts
 Physical Science	In the Energy Module, students investigate electricity and magnetism as related effects and engage in engineering design to convert energy from one form to another. They gather information about how energy is derived from natural resources and how that affects the environment and explore alternative sources of energy such as solar energy. Students interpret data to build explanations from evidence and make predictions of future events. They develop models to represent how energy moves from place to place in electric circuits and in waves. **NGSS PEs:** **Physical Sciences:** **4-PS3-1 4-PS4-1** **4-PS3-2 4-PS4-2** **4-PS3-3 4-PS4-3** **4-PS3-4** **Earth and Space Sciences:** **4-ESS3-1** **ETAS:** **3-5-ETS1-1** **3-5-ETS1-2** **3-5-ETS1-3**	**PS3.A:** Definitions of energy **PS3.B:** Conservation of energy and energy transfer **PS3.C:** Relationship between energy and forces **PS3.D:** Energy in chemical processes and everyday life **PS4.A:** Wave properties **PS4.B:** Electromagnetic radiation **PS4.C:** Information technologies and instrumentation **ESS3.A:** Natural resources **ETS1.A:** Defining and Delimiting Engineering Problems **ETS1.B:** Developing Possible Solutions **ETS1.C:** Optimizing The Design Solution	• Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	• Patterns • Cause and effect • Systems and system models • Energy and matter
 Earth Science	In the Soils, Rocks, and Landforms module, students plan and carry out investigations by incrementally changing specific environmental conditions to determine the impact of changing the variables of slope and amount of water in stream tables. Students analyze and interpret data from diagrams and visual representations to build explanations from evidence and make predictions of future events. They develop model mountains and represent the landforms from different perspectives to look for change. Students gain experiences that will contribute to understanding of the crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; and stability and change. **NGSS PEs:** **Earth and Space Sciences:** **4-ESS1-1** **4-ESS2-1** **4-ESS2-2** **4-ESS3-2** **ETAS:** **3-5-ETS1-2**	**ESS1.C:** History of planet Earth **E:SS2.A:** Earth materials and systems **ESS2.B:** Plate tectonics and large-scale system interactions **ESS2.E:** Biogeology **ESS3.B:** Natural hazards **ETS1.B:** Developing possible solutions	• Asking questions and defining problems • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations and designing solutions • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	• Patterns • Cause and effect • Scale, proportion, and quantity • Systems and system models • Stability and change • Energy and matter
 Life Science	In the Senses and Survival Module, students plan and carry out investigations with stimulus and response to gather data to develop models and construct explanations. Students design physical models to understand how structures in a system function together to provide information and resources to organisms to support survival. Students gain experiences that will contribute to the understanding of these crosscutting concepts: cause and effect; systems and system models; and structure and function. **NGSS PEs:** **Life Sciences:** **4-LS1-1** **4-LS1-2** **ETAS:** **3–5-ETS1-1**	**LS1.A:** Structure and function **LS1.D:** Information processing	• Asking questions • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	• Cause and effect • Systems and system models • Structure and function

FOSS® Pathways™ is an engaging PreK–5 science program developed at the Lawrence Hall of Science for the Next Generation Science Standards (NGSS). This sampler will introduce you to the major components of the program and show examples from FOSS Pathways Senses and Survival Investigations Guide.

Recommended Scope and Sequence

FOSS Pathways

GRADE	PHYSICAL SCIENCE	EARTH SCIENCE	LIFE SCIENCE
PK		Observing Nature	
K	Materials and Forces	Trees and Weather	Animals Two by Two
1	Sound and Light	Changes in the Sky	Plants and Animals
2	Solids and Liquids	Water and Landforms	Insects and Plants
3	Motion	Water and Climate	Structures of Life
4	Energy	Soils, Rocks, and Landforms	Senses and Survival
5	Mixtures and Solutions	Earth and Sun	Living Systems

Learn more at **FOSSPathways.com**

Scan the QR code and explore additional FOSS Pathways Samplers today.

Developed at:
The Lawrence Hall of Science
UNIVERSITY OF CALIFORNIA, BERKELEY

Published & distributed by:
Delta Education
School Specialty