NGSS Transition Support Guide

FOSS	**Environments**
	Grade 4 – Structure, Function, and Information Processing

IMPORTANT INFORMATION ABOUT CHANGES TO YOUR KIT!

You will notice an addition at the beginning of the Environments Teacher's Guide – Investigation 0, Part 1-3; Sensory Systems. These three activities have been pulled from the 5th grade Living Systems kit and moved to 4th grade as they are best aligned to the 4th grade Structure, Function, and Information Processing standards. Additional resources for these activities, including articles and videos, can be accessed through FOSSweb using access code LYSP127245.

After students have had some experience exploring how animals receive different types of information through their senses and use that information to guide their actions, you will want to refer to this learning in Investigation 2: Bugs and Beetles. Prompt students to identify how the beetles and isopods are using their senses to respond to their environment.

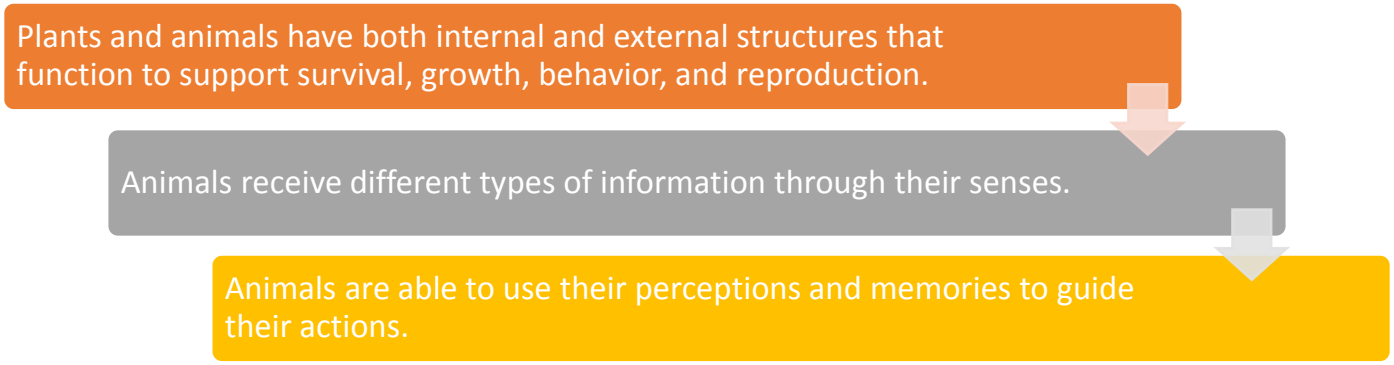
Investigation 5: Brine Shrimp may be skipped in the interest of time. If you would like to order brine shrimp eggs, please email Serena Decator in the STEM Materials Center – serena.decator@esd112.org.

Directions for Using this Guide

Before teaching this unit, please review the *Science and Engineering Practices* and *Crosscutting Concepts* for each investigation. This guide highlights what the teacher and student does in each investigation to support the *Science and Engineering Practices* and *Crosscutting Concepts* that are already implicit in the instructional materials. If you need support on using *Science and Engineering Practices* refer to

Appendix F. *Crosscutting Concepts* are referred to in Appendix G in the *Next Generation Science Standards.* For example, in Investigation 1 - the *Science and Engineering Practice* is Developing and Using Models. Therefore, the teacher should guide students to developing their own model based on prerequisite knowledge of systems.

Learning Progression for this Kit



Common Student preconceptions to be aware of include:

- Adaptation is an intention by the organisms to satisfy a desire or need for survival (adaptation is introduced at the end of Investigation 0, Part 3.
- Individual organisms can adapt to their environment.

For More Information

If you have questions about this guide or its content, please direct your inquiry to your science materials center, or Regional Science Coordinator.

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Publisher	Kit Title	Grade Level
FOSS	Environments	4th

Investigation 0	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Sensory Systems		**Planning and Carrying Out Investigations** Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.	**Structure and Function** Organisms have structures and functions to respond to environmental stimuli.	**Core Idea Question** How do the structures of organisms enable life's functions? (LS1.A)
0.1 Stimulus/Response	What the student does	0.1 Students use a falling cup device to investigate the time that elapses between a visual stimuli and a response. Students collect data to compare foot-response time to hand-response time.	0.1 Students identify the components of the central nervous system and the function of each component.	0.1 The article "Structure of the Brain" and video "The Brain and the Nervous System" can be accessed through FOSSweb using access code LYSP127245.
0.2 Attention	What the student does	0.2 Students make observations about how organisms respond to visual stimuli.	0.2 Students identify features of organisms that attract attention.	0.2 The articles "Sensory Systems" and "Animal Communication" can be accessed through FOSSweb using access code LYSP127245.
0.3 Sound Off	What the student does	0.3 Students make observations about how organisms respond to auditory stimuli.	0.3 Students explain how animals use their sense of hearing to respond to stimuli.	

Throughout the investigation:	What the teacher does	• Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate interpretive thinking. • Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results.	• Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of structure and function as it relates to animal systems.	

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Investigation 1	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Terrestrial Environments		**Developing and Using Models** Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.	**Systems and System Models** A system can be described in terms of its components and their interactions.	**Core Idea Question** What happens to an ecosystem when the environment changes? (LS2.C)
1.1 Set Up	What the student does	1.1 Students construct a visual and physical model of a terrestrial ecosystem.	1.1 Students identify the subsystems of an ecosystem, and discuss the function of each subsystem.	1.1 Have students generate a list of the components (both living and non-living) of an ecosystem. Develop a visual model (sketch) of an ecosystem showing these subsystems. Pose the questions: Can we create a smaller physical model of a terrestrial ecosystem in the classroom? What elements would we need? As a class, guide students to design a model ecosystem (terrarium). Ask probing questions to help them discover elements that are needed and that will work in the classroom. Have students draw and label a model of the class design. Label elements as living or non-living. Discuss and label the function of each subsystem (producer,

				consumer, decomposer, etc.) on the conceptual model. Use the conceptual model as a guide as they build their terrariums.
1.2 Recording	What the student does	1.2 Students use their model to describe the interactions between the living and non-living subsystems in the terrarium.	1.2 Students observe and record the interactions between the living and non-living subsystems in the terrarium.	1.2
Throughout the investigation:	What the teacher does	• Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate interpretive thinking. • Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results.	• Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of ecosystems and their subsystems. • Teacher uses the specific language of systems, i.e. system, subsystem, interactions.	

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Investigation 2	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Bugs and Beetles		**Planning and Carrying Out Investigations** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**Cause and Effect** Events that occur together with regularity might or might not be a cause and effect relationship.	**Core Idea – From NRC Framework** How do organisms live, grow and respond to their environment? (LS1.A) Pre-investigation activity: Before conducting investigations with the beetles and isopods, spend some time observing each of the two organisms. For example, have students draw a visual model comparing the subsystems of the two creatures. Students can use their observations to predict behavior and make claims about possible environmental preferences. Encourage students to use systems language.
2.1 Making Animal Runways	What the student does	2.1 Students plan an investigation to test how much water isopods and beetles like in their environment.	2.1 Students discuss if events that occur together with regularity are a cause and effect relationship.	2.1 After building the runways, ask student groups to design a plan to answer the investigative question on p. 14. Start by discussing the concept of a fair test in which only one variable

				is changed, and every other variable must be kept the same. Students will work in groups to create a plan that includes steps to follow for the investigation and a labeled diagram. Each group should present their idea to the class. Facilitate a conversation to help the class come to consensus about a shared plan. Introduce the term "procedure" and explain that a procedure is a set of steps that a scientist follows to test an investigative question. As a class, write a common procedure for the investigation.
2.2 Responding to Moisture	What the student does	2.2 Students conduct an investigation to test how much water isopods and beetles like in their environment.	2.2 Students observe the effect of different amount of moisture in soil on critter behavior and reason about the causes.	2.2 Use the common procedure developed in 2.1 rather than following step 3 on pg. 18. As a class, write a Claim, Evidence, Reasoning (conclusion) statement: 1) Students make a claim about the answer to the investigative question 2) Students use evidence from the investigation to support their claim 3) Students use scientific reasoning to explain how their evidence supports their claim

2.3 Responding to Light	What the student does	2.3 Students plan and conduct an investigation to test the effect of light on critter behavior.	2.3 Students observe the effect of different amount of light on critter behavior and reason about the causes.	2.3 Student groups can write their own procedures using the procedure from 2.1 as a model. As student groups, write a Claim, Evidence, Reasoning (conclusion) statement: 1) Students make a claim about the answer to the investigative question 2) Students use evidence from the investigation to support their claim 3) Students use scientific reasoning to explain how their evidence supports their claim
2.4 Designing an Animal Investigation	What the student does	2.4 Students select, plan and conduct an investigation of their own choice involving the critters.	2.4 Students observe the effect of their changed variable on critter behavior and reason about the causes.	2.4 Independently, students write a Claim, Evidence, Reasoning (conclusion) statement: 1) Students make a claim about the answer to the investigative question 2) Students use evidence from the investigation to support their claim 3) Students use scientific reasoning to explain how their evidence supports their claim
Throughout the investigation:	What the teacher does	• Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate interpretive thinking.	• Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class	

		• Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results. • Teacher models designing scientific investigations (fair test) and writing a science explanation (Claim, Evidence, Reasoning).	discourse to deeply explore the topic of cause and effect.	

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Investigation 3	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Water Tolerance		**Planning and Carrying Out Investigations** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**Cause and Effect** Cause and effect relationships are routinely identified, tested, and used to explain change.	**Core Idea – From NRC Framework** What happens to an ecosystem when the environment changes? (LS2.C)
3.1 Setting Up the Experiment	What the student does	3.1 Students plan and conduct an investigation to test the effect of different amounts of water on the height a plant will grow.	3.1 Students make predictions about how the different amounts of water will affect plant growth.	3.1 Have students generate a list of questions that we could investigate about the plants in the terrarium. Select the variable "amount of water" as the changed variable. Have students plan an investigation to answer the question: "How do different amounts of water affect the height that a plant grows?" Guide groups to select only one plant to investigate in order to have only one changed variable (different groups may study different plants).

3.2 Observing Plants at 5 and 8 Days	What the student does	3.2 Students record their observations of the plant growth at 5 and 8 days.	3.2 Students discuss potential causes for their observations and predict how they may change during the investigation.	3.2 Have students create their own data table to record their observations and data, rather than using the Student Sheet No. 10. Explore the selected plant (barley, corn, wheat and/or pea) as a system. What are its subsystems and their function? What are the inputs and outputs of this living system?
3.3 Observing Plants at 11 or More Days	What the student does	3.3 Students record their observations of the plant growth at 11 or more days.	3.3 Students observe the effect of different amounts of water on the height the plants grew and reason about the causes.	3.3 Independently, students write a Claim, Evidence, Reasoning (conclusion) statement to answer the question "How do different amounts of water affect the height that a plant grows?" 1) Students make a claim about the answer to the investigative question 2) Students use evidence from the investigation to support their claim 3) Students use scientific reasoning to explain how their evidence supports their claim
Throughout the investigation:	What the teacher does	• Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate interpretive thinking. • Teacher facilitates class discourse to analyze	• Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of cause and effect.	

		observations/data and develop conceptual understanding of results. • Teacher models designing scientific investigations (fair test) and writing a science explanation (Claim, Evidence, Reasoning).		

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Investigation 4	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Aquatic Environments		**Developing and Using Models** Use a model to test cause and effect relationships or interactions concerning the functioning of a natural or designed system.	**Systems and System Models** A system can be described in terms of its components and their interactions.	**Core Idea – From NRC Framework** How do organisms live, grow and respond to their environment? (LS1.A)
4.1 Goldfish Aquariums	What the student does	4.1 Students construct a model of an aquatic ecosystem.	4.1 Students identify the subsystems of an ecosystem, and discuss the function of each subsystem.	4.1 Revisit the list of the elements of an ecosystem. Pose the questions: Can we create a smaller physical model of an aquatic ecosystem in the classroom? What elements would we need? As a class, guide them to design a model ecosystem (aquarium). Ask probing questions to help them discover elements that are needed and that will work in the classroom. Explore the goldfish as a system. What are its subsystems and their function? What are the inputs and outputs of this living system?

4.2 **Acid in Water**	What the student does	4.2 Students use bromothymol blue indicator to compare the acidity of the water in the goldfish aquarium to a class aquarium containing only plants. Students relate the acid in the water to carbon dioxide produced by the fish. (**Asking Questions)**	4.2 Students explore the inputs and outputs of living systems by investigating how the presence of goldfish and elodea affect the acidity of the water.	4.2
4.3 **New Organisms**	What the student does	4.3 Students continue to add to the components of the aquatic ecosystem. Students discuss how their model is similar and different to a natural freshwater environment.	4.3 Students identify the subsystems of an ecosystem, and discuss the function of each subsystem.	4.3 Explore the Elodea, Lemna, pond snails and/or Gammarus as systems. What are its subsystems and their function? What are the inputs and outputs of this living system?
Throughout the investigation:	What the teacher does	• Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate interpretive thinking. • Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results.	• Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of ecosystems and their subsystems. • Teacher uses the specific language of systems, i.e. system, subsystem, input, output, and interactions.	Facilitate discourse that helps students see the connections between subsystems of a system and the way in which each subsystem connects to and supports other subsystems. Which are critical subsystems and why?

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Investigation 5	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Brine Shrimp Hatching	**This investigation can be skipped in the interest of time.** **If you wish to conduct this investigation, contact the SMC for materials.**	**Planning and Carrying Out Investigations** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**Cause and Effect** Cause and effect relationships are identified, tested and used to explain change.	**Core Idea – From NRC Framework** How do organisms live, grow and respond to their environment? (LS1.A)
5.1 Setting Up the Experiment	What the Student does	5.1 Students consider a scientific scenario, design an investigation collaboratively to test the effect of salinity on the hatching of brine shrimp eggs using controlled variables, and begin conducting the investigation.	5.1 Students identify and test the cause and effect relationship between salinity level and the viability of brine shrimp eggs.	5.1 Be sure to facilitate student discourse and consideration as to what methods and data-collection tools are appropriate for the question.
5.2 Determining Range of Tolerance	What the student does	5.2 Students make observations to produce data. They then use the data as the basis for evidence to explanation range of tolerance.	5.2 Students use collected data to make a cause/effect relationship claim.	5.2 Independently, students write a Claim, Evidence, Reasoning (conclusion) statement to answer the question "How do different levels of salinity affect the number of brine shrimp that will hatch?" 1) Students make a claim about the answer to the investigative question

				2) Students use evidence from the investigation to support their claim 3) Students use scientific reasoning to explain how their evidence supports their claim.
5.3 Determining Viability	What the student does	5.3 Students collaboratively design an approach to cause the dormant eggs to hatch.	5.3 Students apply understanding of tolerance range and optimal environmental conditions to design an approach that will cause the dormant eggs to hatch.	5.3 You may wish to have groups design and implement their own strategy/approach to cause hatching of dormant eggs. Afterward, teams can compare their approaches. Facilitate discourse around which approach or process better met the criterion for success. (Which designs successfully caused dormant eggs to hatch and why?).
Throughout the investigation:	What the teacher does	• Teacher models how to accurately obtain, and record data. • Teacher asks probing questions to facilitate interpretive thinking. • Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results. • Teacher uses the specific language of investigations, i.e. evidence, claim, variables, fair test, etc…	• Teacher provides a guiding question, asks probing questions of students throughout the investigation and inquiry, and facilitates class discourse to deeply explore the topic of cause and effect relationships.	Be sure to bring out discourse and develop understanding around what counts as data [numerical (quantitative) or observational (qualitative)], how to be systematic when designing investigations, and how to identify/control variables. Allow for opportunities for students to think, design, and draw conclusions both collaboratively and independently.

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Investigation 6	Classroom Instruction	Science and Engineering Practice	Crosscutting Concept	Helpful Modifications
Salt of the Earth		**Planning and Carrying Out Investigations** Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**Cause and Effect** Cause and effect relationships are routinely identified, tested, and used to explain change.	**Core Idea – From NRC Framework** What happens to an ecosystem when the environment changes? (LS2.C)
6.1 Setting Up the Experiment	What the student does	6.1 Students plan and conduct an investigation to test the effect of different amounts of salt in water on the height a plant will grow.	6.1 Students make predictions about how the different amounts of salt in water will affect plant growth.	6.1 As students plan an investigation to answer the question: "How does the amount of salt in water affect the height of plants?, guide groups to select only one plant to investigate in order to have only one changed variable (different groups may study different plants).
6.2 Observing Plants	What the student does	6.2 Students record their observations of the plant growth at 5 and 9 days.	6.2 Students observe the effect of different amounts of salt in water on the height the plants grew and reason about the causes.	6.2 Have students create a data table to record their data. Students may also collect observational data such as (number/size of leaves, color of plants, and apparent health of plants).

				Independently, students write a Claim, Evidence, Reasoning (conclusion) statement to answer the question "How do different amounts of salt in water affect the height that a plant grows?" 1) Students make a claim about the answer to the investigative question 2) Students use evidence from the investigation to support their claim 3) Students use scientific reasoning to explain how their evidence supports their claim
6.3 Choosing Your Own Investigation	What the student does	6.3 Students design an investigation to explore a question of their choice.	6.3 Students explore the effect of their chosen changed variable on their measured variable.	
Throughout the investigation:	What the teacher does	• Teacher models how to obtain, and record data. • Teacher asks probing questions to facilitate interpretive thinking. • Teacher facilitates class discourse to analyze observations/data and develop conceptual understanding of results.	• Teacher provides a guiding question, asks probing questions of students throughout investigation and inquiry, and facilitates class discourse to deeply explore the topic of cause and effect.	