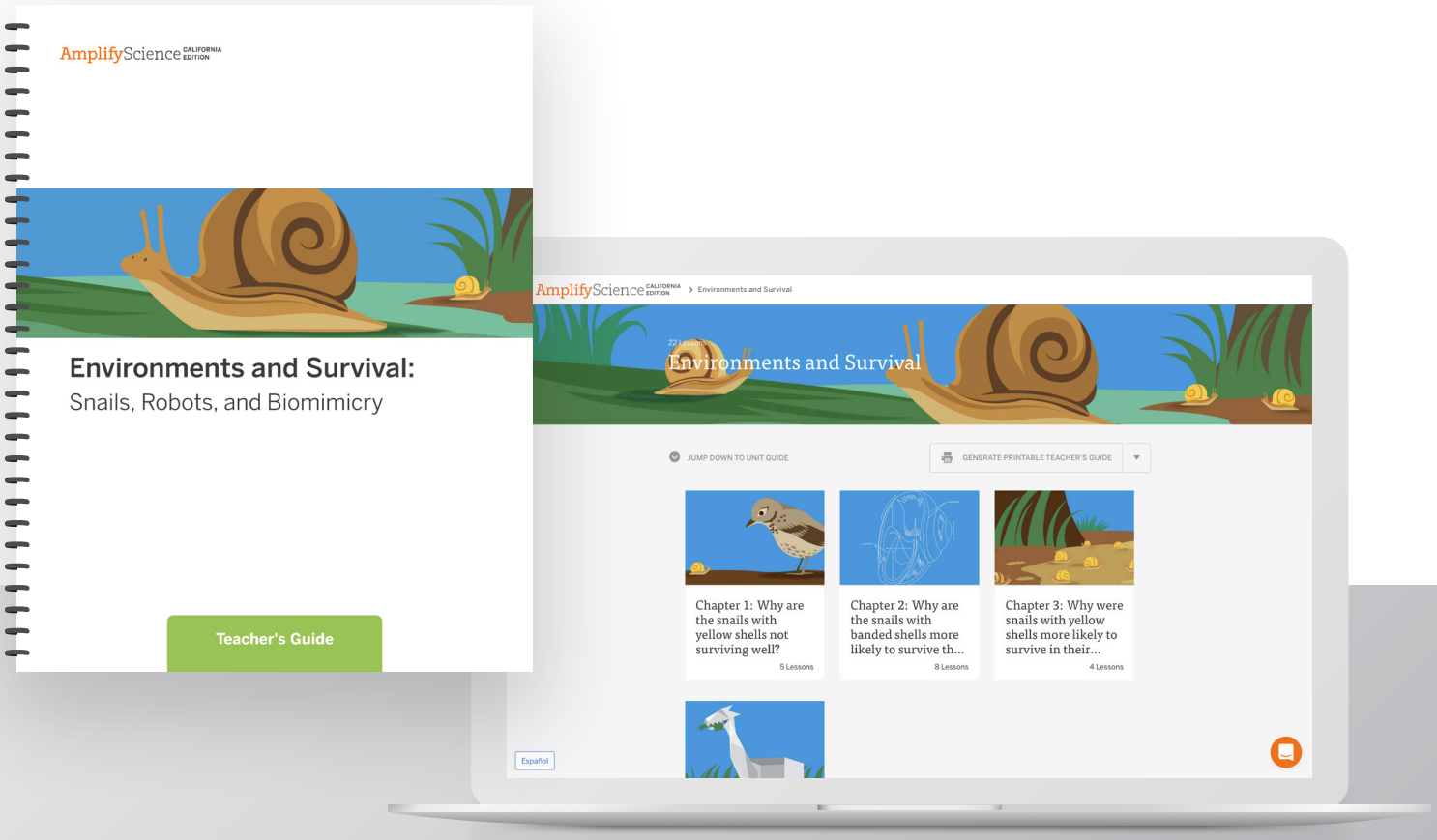
Amplify Science
CALIFORNIA

Grade 3

UNIT GUIDE

Environments and Survival



Amplify.

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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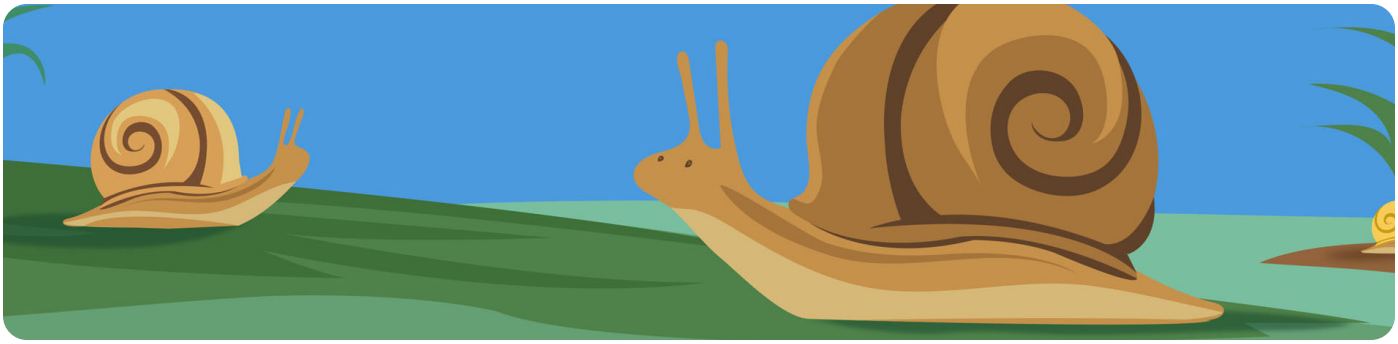

Welcome to Environments and Survival

Young people have many misconceptions and gaps in their understanding about the factors that affect the survival of organisms in their environment. The concept that organisms have needs that must be met in order to survive is likely familiar to students. However, the idea that an organisms' environment and specific traits also influence its ability to survive is likely less familiar. Amplify Science California brings clarity and depth to students' understanding of these important concepts by providing opportunities to fully investigate the many factors that make organisms more likely or less likely to survive.

> Unlike a typical curriculum, Amplify Science California anchors learning by inviting students to take on the role of scientists and engineers.

In this unit, students take on the role of biomimicry engineers. Their job is to help the lead engineer at a fictional engineering firm study a population of grove snails with the goal of understanding how the snails' traits influence their survival in a changing environment. Working together, they figure out why the snails with yellow shells aren't surviving as well as the snails with banded shells. By the end of the unit, students help the engineering firm design a robot that aims to mitigate the effect of an environmental change.

Unit Type: Engineering Design

Student Role: Biomimicry Engineers

Phenomenon: Over the last 10 years, a population of grove snails has changed: The number of grove snails with yellow shells has decreased, while the number of snails with banded shells has increased.

Core Concept: Understanding that the environment and specific traits of organisms influence an organisms' survival

Target Performance Expectations:

- 3-LS2-1: Animals' Social Interactions
- 3-LS4-1: Fossils and Evidence of Environment
- 3-LS4-2: Adaptive and Non-Adaptive Traits
- 3-LS4-3: Survival Impact of Different Environments
- 3-LS4-4: Solutions to Environmental Changes
- 3-5-ETS1-1: Defining the Problem
- 3-5-ETS1-2: Developing Possible Solutions
- 3-5-ETS1-3: Improving Designs

Students figure out the unit phenomenon through the use of a variety of resources.

Student Books

Hands-On Kit

Videos

Practice Tools

About technology in this unit:
Amplify Science California gives you the flexibility to use technology in the way that meets your needs best. In 3–5, teachers have the option of using:

- **Student digital licenses** that allow for online completion of work, teacher feedback and grading, and digital class management.
- **Traditional consumable resources** that allow for a more familiar paper and pencil experience.

Whether students use the student digital experience or print workbooks, there are some technology-based activities all students will experience from time to time.

In grade 3, technology-based activities include Practice Tools and some digital Simulations. In this particular unit, only 6 of the 22 lessons incorporate the use of devices with only 7% of the unit's activities involving the use of a digital tool.

When the use of a digital tool is called for in a lesson, teachers have several implementation options:

- **If limited student devices are available,** students can do activities in pairs or small groups.
- **If no student devices are available,** teachers can project the digital tool to the class and create a whole class experience.

Chapter 1: The storyline begins

What students investigate:

Why are the snails with yellow shells not surviving well?

What they figure out:

In a specific snail population, the snails with yellow shells are less likely to survive because it is harder for them to avoid song thrush birds in their environment. Organisms are more likely to survive if they can meet their needs in their environment, and avoiding predators is one of those needs. The snails with yellow shells are less able to avoid being eaten by the birds, so they are less likely to survive.

How they figure it out:

- Imagining that they are different organisms and considering whether they will be able to survive in different environments
- Learning about how earthworms meet their needs for survival in an underground environment as they read the student book *Earthworms Underground*
- Collecting data in a board game to understand why organisms are more likely or less likely to survive in different environments
- Analyzing data about the snails' environment

KEY


HANDS-ON


MODELING


READING


SIM


STUDENT-TO-STUDENT DISCUSSION


TEACHER


TEACHER-LED DISCUSSION


WRITING

DAY 1 | LESSON 1.1

Pre-Unit Assessment

- Becoming Biomimicry Engineers (20 min)
- Introducing the Grove Snail Population (15 min)
- Writing Initial Explanations (25 min)

Pre-Unit Assessment

DAY 2 | LESSON 1.2

Investigating Needs for Survival

- Introducing Needs for Survival (10 min)
- Investigating Needs for Survival (30 min)
- Making Inferences About Survival (20 min)

On-the-Fly Assessment

Optional Flextension: *Underwater Environments*

DAY 3 | LESSON 1.3

Earthworms Underground

- Introducing *Earthworms Underground* (10 min)
- Partner Reading (25 min)
- Connecting Traits to Survival in an Environment (10 min)
- Introducing Concept Mapping (15 min)

On-the-Fly Assessment

DAY 4 | LESSON 1.4

The Survival Model

- Introducing the Survival Model (10 min)
- Engaging with the Survival Model (20 min)
- Analyzing Survival Model Data (15 min)
- Think-Write-Pair-Share (15 min)

Critical Juncture Assessment

DAY 5 | LESSON 1.5

Writing an Explanation of Snails' Survival

- Making Inferences from Data (25 min)
- Introducing Scientific Explanations (10 min)
- Shared Writing of a Scientific Explanation (20 min)
- Reflecting on Biomimicry (5 min)

Self-Assessment

Chapter 2: The storyline builds

What students investigate:

Why are the snails with banded shells more likely to survive than the snails with yellow shells?

What they figure out:

Snails with banded shells are more likely to survive because their shells blend in with the environment. The snails live in an environment with brown grass, so it's harder for birds to see snails with banded shells. Another reason snails with banded shells are more likely to survive is that banded shells are stronger than yellow shells. Since birds need to crack the shell in order to eat the snail, snails with the stronger banded shells are more likely to survive.

How they figure it out:

- Exploring variation in traits within a species
- Using a physical model to collect data about how different traits affect whether organisms can meet their needs for survival in their environment
- Learning about the concept of structure and function by observing the traits of various animal mouths as they read the student book *Mystery Mouths*
- Investigating fossil structures so they can make inferences about the function of these structures
- Analyzing new data from the snails' environment and write an explanation about why banded-shell snails are more likely to survive
- Planning a design inspired by their knowledge of grove snails' adaptive traits

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WRITING

DAY 6 | LESSON 2.1

The Hummingbird Model

- Reviewing Snail Data (5 min)
- Observing Variation in Populations (10 min)
- The Hummingbird Model (30 min)
- Analyzing Data from the Hummingbird Model (15 min)
- Reading About Structure and Function (25 min)

DAY 7 | LESSON 2.2

Mystery Mouths

- Introducing *Mystery Mouths* (15 min)
- Partner Reading (30 min)
- Discussing Structure and Function (15 min)

On-the-Fly Assessment

DAY 8 | LESSON 2.3

Investigating Traits and Survival

- Observing Fossils (25 min)
- Grove Snail Card Sort (25 min)
- Reflecting on Snail Traits (10 min)

On-the-Fly Assessment

DAY 9 | LESSON 2.4

The Survival Model: Traits

- Introducing Pocket Mice (10 min)
- Returning to the Survival Model (25 min)
- Reading About Adaptive and Non-Adaptive Traits (20 min)
- Reflecting on Biomimicry (5 min)

DAY 10 | LESSON 2.5

Making Sense of Traits and Survival

- Modeling Ideas About Traits and Survival (30 min)
- Concept Mapping (25 min)
- Reflecting on Traits and Survival (5 min)

On-the-Fly Assessment

DAY 11 | LESSON 2.6

Writing About Snail Traits and Survival

- Making Inferences from Data (25 min)
- Discussing Scientific Explanations (10 min)
- Writing Explanations (25 min)

Critical Juncture Assessment

DAY 12 | LESSON 2.7

Using Snail Traits to Inspire a Design

- Reading About Biomimicry (20 min)
- Brainstorming Ideas for Designs (15 min)
- Planning a Design (25 min)

On-the-Fly Assessment

DAY 13 | LESSON 2.8

Sharing and Revising Designs

- Sharing Designs (20 min)
- Revising Designs (30 min)
- Reflection (10 min)

Self-Assessment

Chapter 3:
The storyline goes deeper

What students investigate:

Why were snails with yellow shells more likely to survive in their environment 10 years ago?

What they figure out:

Snails with yellow shells were more likely to survive in the past because their yellow color was an adaptive trait in their former environment. That area used to be sandy, so the snails with yellow shells blended in against the yellow sand. When the environment changed from sandy to brown grass, the yellow color became a non-adaptive trait; it is easier for birds to see the yellow snails against the brown grass.

How they figure it out:

- Analyzing new data about changes in the snails' environment
- Exploring how the survival of organisms with different traits is affected by changes in the organisms' environment by participating in a classroom model
- Researching three examples of how a change in environment can cause traits that were once adaptive to become non-adaptive, or vice versa, as they read the student book *Environment News*
- Create models that address the misconception that organisms can decide to change their traits

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TEACHER-LED DISCUSSION


WRITING

DAY 14 | LESSON 3.1

The Survival Model: Changing Environment

- New Evidence About the Snail Population (10 min)
- Returning to the Survival Model (30 min)
- Discussing How Environments Can Change (20 min)

DAY 15 | LESSON 3.2

Environment News

- Introducing *Environment News* (10 min)
- Partner Reading (30 min)
- Reflecting on Environmental Changes (20 min)

On-the-Fly Assessment

DAY 16 | LESSON 3.3

Environmental Change and Adaptive Traits

- It's All About the Environment (20 min)
- Modeling Environmental Change (25 min)
- Concept Mapping (15 min)

On-the-Fly Assessment
Critical Juncture Assessment

DAY 17 | LESSON 3.4

End-of-Unit Assessment Part 1

- Reflecting on Key Concepts (10 min)
- Making Inferences from Data (20 min)
- Writing Scientific Explanations (30 min)

End-of-Unit Assessment Part 1
Self-Assessment

Chapter 4:
Application to a new context

What students investigate:

How can engineers use what they learn from organisms' traits to design solutions?

What they figure out:

Through the practice of biomimicry, engineers observe different organisms to understand the functions of their traits and get ideas that can help them design solutions to problems. They make a design, test it to see how well it meets the design criteria, and revise the design to make it better.

How they figure it out:

- Responding to a design challenge where they apply their understanding of how structures allow organisms to carry out different functions
- Learning about engineers who use biomimicry to design a robot that is inspired by cockroach traits as they read the student book *Cockroach Robots*
- Designing a robot for removing invasive plants that is inspired by giraffe traits
- Planning and building design prototypes, testing them with a physical model and a digital app, and revising their designs
- Presenting evidence-based arguments about how well their designs meet the criteria

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WRITING

DAY 18 | LESSON 4.1

Cockroach Robots

- Introducing the Design Task (5 min)
- Reading *Cockroach Robots* (30 min)
- Reflecting on the Design Cycle (25 min)

DAY 19 | LESSON 4.2

Planning Designs

- Introducing the Design Challenge (10 min)
- Partner Reading (15 min)
- Exploring the Materials (10 min)
- Planning Designs (25 min)

DAY 20 | LESSON 4.3

Making and Testing Designs

- Making Test Versions of Robot Necks (15 min)
- Testing Students' Test Versions (20 min)
- Sharing Results of the Neck Test (10 min)
- Revising Neck Designs (15 min)

On-the-Fly Assessment

DAY 21 | LESSON 4.4

End-of-Unit Assessment Part 2

- Reading About Tooth Structure (10 min)
- Exploring the RoboGrazer Simulation (10 min)
- Planning Robot Teeth (15 min)
- Designing Robot Teeth (25 min)

End-of-Unit Assessment Part 2 Self-Assessment

DAY 22 | LESSON 4.5

Presenting Design Arguments

- Preparing a Design Argument (25 min)
- Biomimicry Engineering Conference (25 min)
- Reflecting on the Unit (10 min)

All students. All standards.

Rather than treating the standards simply as a list of topics to cover, we designed Amplify Science California to allow for truly in-depth and integrated coverage of the disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs). Unlike other programs, however, ours makes the NGSS' vision of "all students, all standards" a reality by creating a unit-specific learning progression for every unit called a Progress Build.

Each Progress Build defines several levels of understanding of the unit's anchoring phenomenon, with each level integrating and building upon the knowledge and skills from lower levels. In this way, each Progress Build provides a clear roadmap for how students' understanding of the phenomenon is expected to deepen and develop with each successive chapter and lesson.

What's more, the program's system of assessments is also tied to these Progress Builds. This carefully crafted integration provides teachers with credible, actionable, and timely diagnostic information about student progress toward the unit's learning goals and grade-level performance expectations. Armed with this powerful data, teachers have the ultimate flexibility to decide when to move on and when to slow down and dive deeper.

Environments and Survival Progress Build

The Progress Build in this unit consists of three levels of understanding. At each level, students add new ideas and integrate them into a progressively deeper understanding of how environments and specific traits of organisms influence an organisms' survival.

Progress Build Level 1:

When it is easier for organisms to meet their needs in an environment, they are more likely to survive.

Progress Build Level 2:

There can be adaptive and non-adaptive traits in a population.

Progress Build Level 3:

What is adaptive can change when the environment changes.

Examples of differentiation in this unit

In addition to providing unit-specific Progress Builds that break learning goals into smaller, more achievable levels of understanding, Amplify Science California makes learning accessible for all students through a variety of scaffolds, supports, and differentiation strategies for every lesson. **For a complete list of strategies, see the Differentiation section of every Lesson Brief**.

Below are a few examples of strategies embedded in this unit.

For English learners:

Build background knowledge (Example from Lesson 1.3)
Building students' background knowledge helps support them in understanding text. You may wish to bring in earthworms for students to observe before they read *Earthworms Underground*. You can prompt students to observe the earthworms' body parts and how earthworms move. Then, students can connect their observations to what they read about these organisms in the book. Be sure to carefully handle the earthworms you collect and provide them with enough moisture and dirt so they do not dry out. Also, take care to return the worms to the location where you found them.

For students needing more support:

Anticipation Guide (Example from Lesson 2.2)
For each book, we provide an optional Anticipation Guide in the Investigation Notebook. Anticipation Guides can help support students by activating prior knowledge before reading, promoting engaged reading, and encouraging students to monitor their comprehension. If you choose to use this optional activity, have students turn to page 19, Getting Ready to Read: *Mystery Mouths*, in the Investigation Notebook. To use this activity, explain that students should work with a partner to decide if they agree or disagree with each statement. After reading, ask partners to revisit the statements and discuss whether they want to change any responses based on their reading. Encourage students to refer to the text as they discuss.

For students ready for a challenge:

New design challenge (Example from Lesson 4.4)
Some students will benefit from an additional challenge using the RoboGrazer Simulation. Ask students if they can figure out what settings for neck length, neck test score, and teeth give the best output scores and ratings. Ask them which factors influence the amount of plant material that is consumed.

3-D Statements

In order to help teachers recognize the three-dimensional structure of every unit, chapter, and lesson, each unit contains a 3-D Statement document that makes the integration clear.

Making the 3-D statement document all the more effective, the three dimensions are color-coded for easy recognition.

Environments and Survival 3-D Coverage

SEPs
Science and Engineering Practices

DCIs
Disciplinary Core Ideas

CCCs
Cross-Cutting Concepts

Unit Level

Students use physical models, read informational texts, analyze data, and engage in student-to-student discussions to figure out why some snails are more likely to survive than others (structure and function, systems and system models). Students write scientific explanations about their findings and use their newfound understanding of how the traits of organisms affect the organisms' survival (structure and function) in order to help an engineering firm design a robot that aims to mitigate the effect of an environmental change (systems and system models).

Chapter Level

Chapter 1: Why are the snails with yellow shells not surviving well?

Students use models and obtain information from text to figure out that organisms' likelihood of survival depends on how easy or hard it is for them to meet their needs in a given environment (structure and function, systems and system models).

Chapter 2: Why are the snails with banded shells more likely to survive than the snails with yellow shells?

Students use models, analyze and interpret data, engage in discourse, and construct explanations about why the snails with banded shells are more likely to survive than the snails with yellow shells (structure and function, systems and system models).

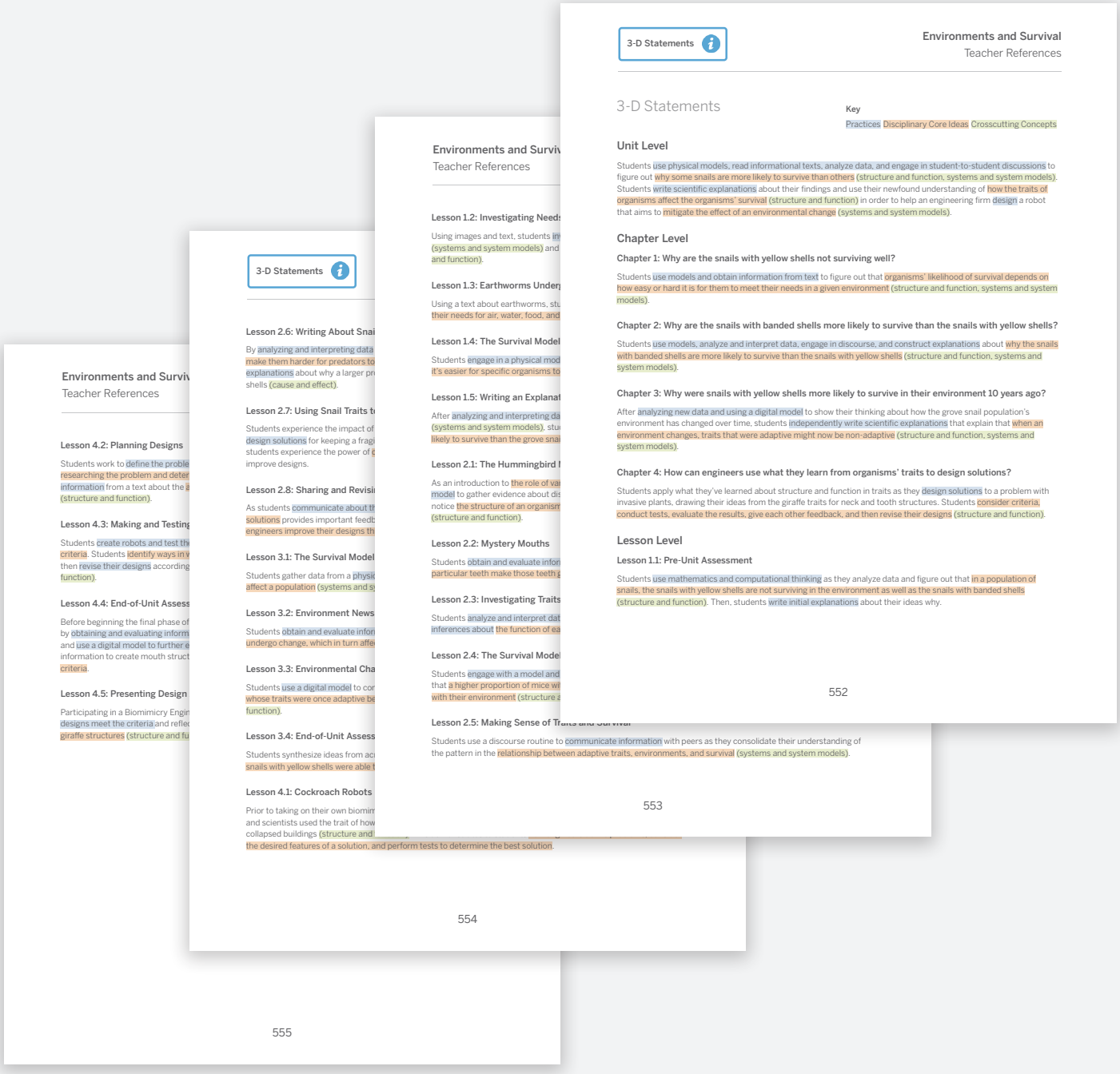
Chapter 3: Why were snails with yellow shells more likely to survive in their environment 10 years ago?

After analyzing new data and using a digital model to show their thinking about how the grove snail population's environment has changed over time, students independently write scientific explanations that explain that when an environment changes, traits that were adaptive might now be non-adaptive (structure and function, systems and system models).

Chapter 4: How can engineers use what they learn from organisms' traits to design solutions?

Students apply what they've learned about structure and function in traits as they design solutions to a problem with invasive plants, drawing their ideas from the giraffe traits for neck and tooth structures. Students consider criteria, conduct tests, evaluate the results, give each other feedback, and then revise their designs (structure and function).

To review the 3-D Statements at the lesson level, see the Lesson Brief section of every lesson.



Notes

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For more information on Amplify Science, visit **amplify.com/science/california**.

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