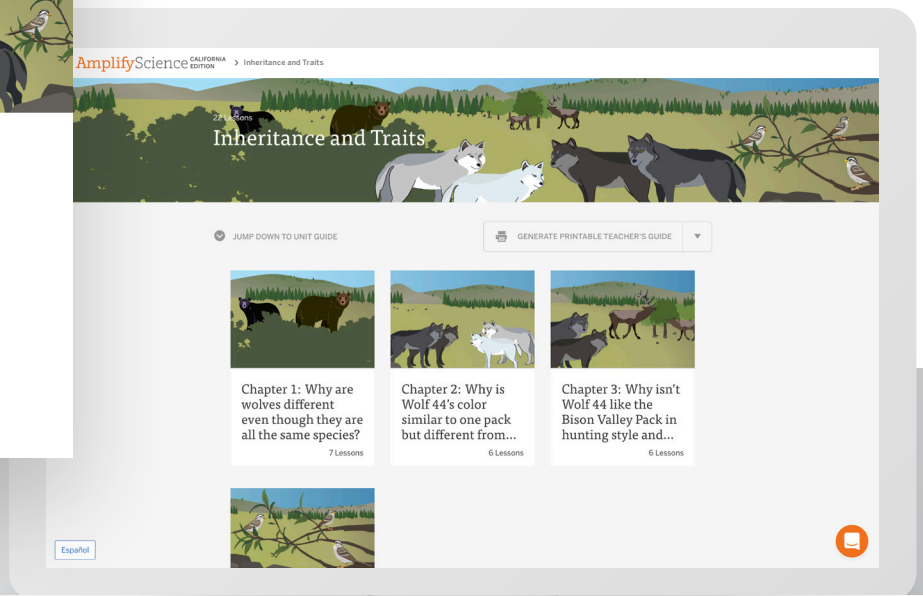
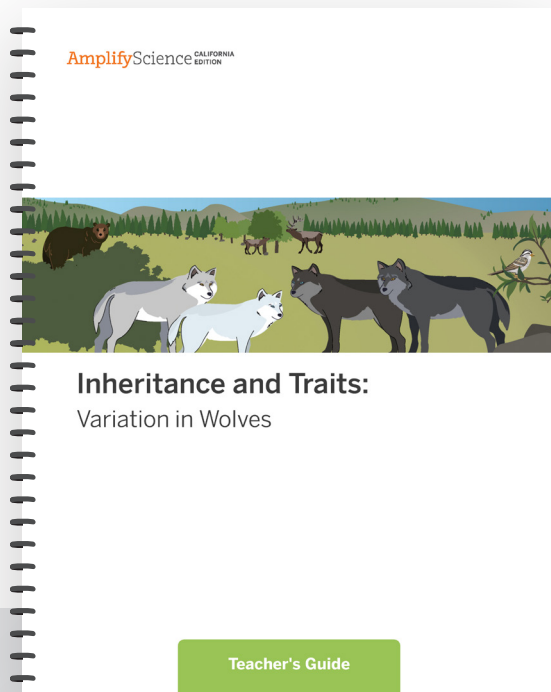


UNIT GUIDE

Inheritance and Traits





Amplify.

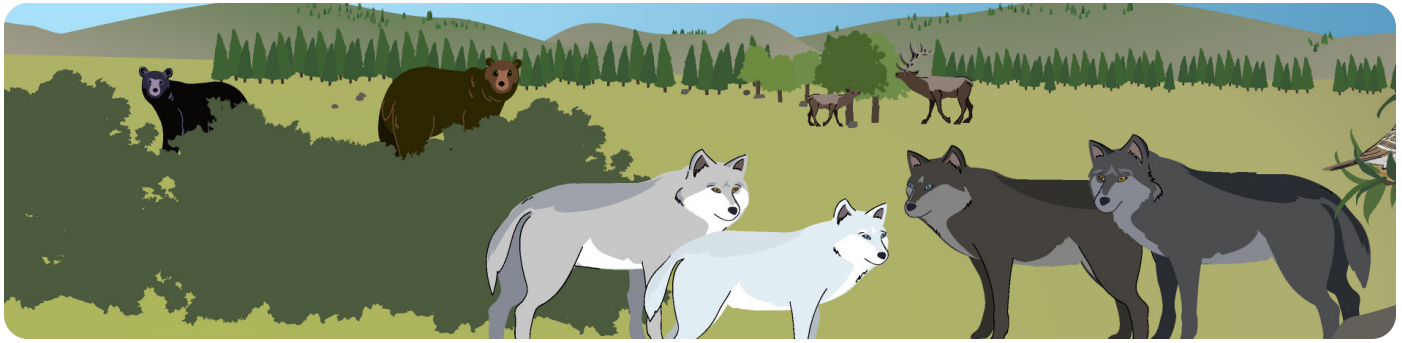


THE LAWRENCE
HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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Welcome to Inheritance and Traits

The Next Generation Science Standards (NGSS) set a higher bar for students' understanding of inheritance and variation of traits than past standards. While in the past, elementary students were expected to simply know that plants and animals inherit traits from their parents, the NGSS expect that students should be able to provide evidence to support this idea. Similarly, students were previously expected to simply know that traits can be influenced by the environment, but are now expected to say *how* they know by gathering evidence. Amplify Science California prepares students to meet these expectations through robust and engaging lesson content that doesn't stop at the *what*, but pushes students to understand the *why*.

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 wildlife biologists. Their job is to help a class of students near the fictional Graystone National Park to solve the mystery of Wolf 44—a wolf they have observed to be different from the rest of its pack. Working together, they observe variations between and within different species, investigate inherited traits and those that result from the environment, and figure out the origin of several of Wolf 44's traits. By the end of the unit, students apply what they've learned about traits to predict what the offspring of the white-crowned sparrow will look like.

Unit Type: Investigation

Student Role: Wildlife Biologists

Phenomenon: An adopted wolf in Graystone National Park ("Wolf 44") has some traits that appear similar to one wolf pack in the park and other traits that appear to be similar to a different wolf pack.

Core Concept: Understanding the role that inherited information and environmental factors play in determining variation in the traits of organisms

Target Performance Expectations:

- 3-LS1-1: Life Cycles and Life Stages
- 3-LS2-1: Animals' Social Interactions
- 3-LS3-1: Traits are Inherited and Vary
- 3-LS3-2: Traits can be Influenced by Environment

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

Student Books



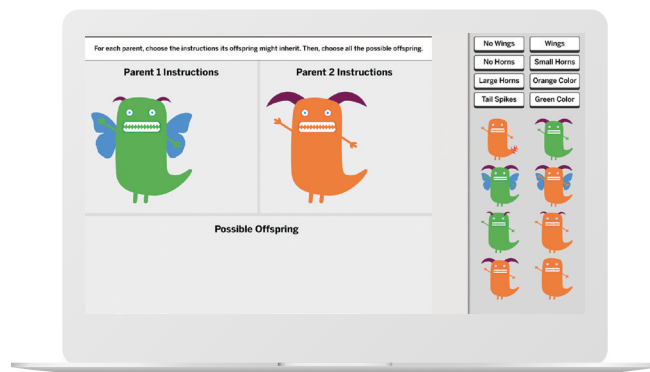
Hands-On Kit



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 6% 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 wolves different from each other even though they are all the same species?

What they figure out:

Even though all wolves are the same species, some wolves are different from others due to variation of traits within a species. This means that even though wolves can have similarities in their traits, there can also be variations in each trait. For example, wolves have different colors of fur: Some wolves have a trait for gray fur, others have a trait for black fur.

How they figure it out:

- Investigating similarities and differences between a broad array of organisms as they read the student book *Blue Whales and Buttercups*
- Exploring patterns of similarities and differences of traits between animals, both across species and within the same species
- Observing traits and their variations as they read the student book *Handbook of Traits*
- Constructing an explanation about why wolves are different even though they are all the same species

KEY



HANDS-ON



MODELING



READING



STUDENT-TO-STUDENT
DISCUSSION



TEACHER







TEACHER-LED
DISCUSSION



WRITING

DAY 1 | LESSON 1.1




Pre-Unit Assessment

-  Introducing the Unit (5 min)
-  Writing Initial Explanations (30 min)
-  Introducing the Investigation Notebook (10 min)
-  Previewing the Reference Book (15 min)

Pre-Unit Assessment
Optional Flexextension:
Comparing Life Cycles

DAY 2 | LESSON 1.2




Blue Whales and Buttercups

-  Introducing Asking Questions (15 min)
-  Partner Reading (30 min)
-  Reflecting on Relatedness (15 min)

On-the-Fly Assessment





DAY 3 | LESSON 1.3

Observing Similarities and Differences

-  Observing Similarities and Differences in Animals (20 min)
-  Observing Bird Traits (25 min)
-  Thought Swap (15 min)

DAY 4 | LESSON 1.4




Introducing Species

-  Observing Bird Sounds (10 min)
-  Identifying Songbirds (20 min)
-  Sorting Bear Species (20 min)
-  Introducing the Problem Students Will Investigate (10 min)

On-the-Fly Assessment
Optional Flexextension: Isopod Traits

DAY 5 | LESSON 1.5




Variation in a Species

-  Looking for Patterns in the Wolf Pack (20 min)
-  Asking Questions About Wolves (15 min)
-  Class Traits Poster Walk (25 min)

On-the-Fly Assessment




DAY 6 | LESSON 1.6

Making Sense of Variation

-  Reading *Handbook of Traits* (20 min)
-  Word Relationships (20 min)
-  Modeling Trait Variation (20 min)

DAY 7 | LESSON 1.7

Explaining Variation

-  Gathering Data (20 min)
-  Introducing Scientific Explanations (10 min)
-  Shared Writing of a Scientific Explanation (25 min)

Critical Juncture Assessment
Self-Assessment

Chapter 2:

The storyline builds

What students investigate:

Why is Wolf 44's color similar to one pack but different from the other?

What they figure out:

Wolf 44's color is similar to the wolves in the Bison Valley Pack because its parents are in the Bison Valley Pack. Offspring inherit instructions for each trait from both parents. This means that the trait of fur color comes from Wolf 44's parents. This is why Wolf 44 has light-colored fur, similar to its parents.

How they figure it out:

- Searching for patterns in traits of parents and their offspring in wolf packs and fruit flies
- Exploring why offspring have similar traits to their parents, but not always to their siblings, as they read the student book *The Code*
- Participating in a lively classroom activity that helps students apply the idea that parents pass instructions for traits
- Analyzing more details about the two wolf packs and using this information to begin making their claim about Wolf 44's fur color

KEY



HANDS-ON



MODELING



READING



STUDENT-TO-STUDENT
DISCUSSION



TEACHER







TEACHER-LED
DISCUSSION



WRITING

DAY 8 | LESSON 2.1




Asking Questions About Data

-  Reviewing New Wolf Data (20 min)
-  Examining Fruit Fly Families (15 min)
-  Asking Investigable Questions (15 min)
-  Making Observations Between Families (10 min)

On-the-Fly Assessment

DAY 9 | LESSON 2.2




Exploring Patterns

-  Discussing Patterns (15 min)
-  Reading *Parents and Offspring* (25 min)
-  Modeling Patterns in *Parents and Offspring* (20 min)

On-the-Fly Assessment

DAY 10 | LESSON 2.3





The Code

-  Setting Purpose for Reading (15 min)
-  Partner Reading (35 min)
-  Discussing Genes (10 min)

On-the-Fly Assessment





DAY 11 | LESSON 2.4

Exploring Inheritance

-  Preparing to Make a Creature (15 min)
-  Making Creatures (20 min)
-  Observing Similarities and Variations (20 min)
-  Discussing Fruit Fly Offspring (5 min)

DAY 12 | LESSON 2.5




Making Sense of Inheritance

-  Modeling Trait Inheritance (20 min)
-  Word Relationships (20 min)
-  Asking Questions About Wolf Data (10 min)
-  Examining the Data About Wolves (10 min)

On-the-Fly Assessment

DAY 13 | LESSON 2.6

Explaining Inheritance

-  Thought Swap (15 min)
-  Gathering Data About Traits (15 min)
-  Writing Scientific Explanations (30 min)

Critical Juncture Assessment
Self-Assessment

Chapter 3:

The storyline goes deeper

What students investigate:

Why isn't Wolf 44 like the Bison Valley Pack in hunting style and size?

What they figure out:

Wolf 44 doesn't hunt like the Bison Valley Pack because it learned to hunt from the wolves in the Elk Mountain Pack. Learning to hunt is a trait that is determined by a wolf's environment. Wolf 44 is medium sized because of inherited instructions and the environment it lives in. Its parents passed on instructions for being smaller in size, but Wolf 44 lives with the Elk Mountain Pack, which has access to a rich diet. This means that Wolf 44 can grow bigger than its parents, but it can't grow as big as the wolves in the Elk Mountain Pack.

How they figure it out:

- Gathering new evidence as they investigate traits that result from interactions with the environment as they read the student book *How the Sparrow Learned Its Song*
- Considering Wolf 44's traits and whether they were inherited from its parents or acquired from the environment

KEY



HANDS-ON



MODELING



READING



STUDENT-TO-STUDENT
DISCUSSION



TEACHER






TEACHER-LED
DISCUSSION



WRITING

DAY 14 | LESSON 3.1




Introducing Traits That Aren't Inherited

-  Revisiting New Data About the Wolves (15 min)
-  Observing Traits in Flamingos (30 min)
-  Reflecting on Observations (15 min)

On-the-Fly Assessment

DAY 15 | LESSON 3.2




How the Sparrow Learned Its Song

-  Asking Questions About How Organisms Get Traits (10 min)
-  Partner Reading (30 min)
-  Discussing the Role of the Environment (20 min)

On-the-Fly Assessment




DAY 16 | LESSON 3.3

Investigating What Determines Traits

-  Writing a Scientific Explanation (20 min)
-  Revisiting Class Traits (20 min)
-  Setting Up a Fair Test (40 min)

DAY 17 | LESSON 3.4



The Role of the Environment

-  Completing the Celery Investigation (20 min)
-  Reading *Handbook of Traits* (20 min)
-  Discussing Evidence (20 min)

On-the-Fly Assessment

DAY 18 | LESSON 3.5




Making Sense of Traits

-  Modeling How the Environment Affects Traits (30 min)
-  Reviewing Wolf Data (30 min)

Critical Juncture Assessment

DAY 19 | LESSON 3.6

End-of-Unit Assessment Part 1

-  Returning to the Data About Wolf Size (10 min)
-  Word Relationships (20 min)
-  Writing Final Explanations (30 min)

End-of-Unit Assessment Part 1

Chapter 4:

Application to a new context

What students investigate:

How can scientists investigate questions about traits?

What they figure out:

Scientists can investigate questions by looking for patterns in data. For example, data about sparrows shows that two parent sparrows have black stripes, so the offspring will probably have black stripes. The environment also affects which traits the offspring will have. The sparrow's song will be the same as other birds around it because the song is a learned trait. The sparrow offspring may also be bigger than its parents because the environment has more food.

How they figure it out:

- Learning about arachnologist Lauren Esposito, who discovered an unknown scorpion and identified it as a new species as they read the student book *Scorpion Scientist*
- Generating their own questions as they review evidence about environmental conditions, the traits of sparrow parents, and patterns and variations within a population
- Analyzing data from the sparrow families
- Sharing their claims and discussing what they predict the offspring will look like

KEY



HANDS-ON



MODELING



READING



STUDENT-TO-STUDENT
DISCUSSION



TEACHER






TEACHER-LED
DISCUSSION



WRITING

DAY 20 | LESSON 4.1




Scorpion Scientist

-  A New Message from Graystone Elementary School (10 min)
-  Partner Reading (40 min)
-  Discussing Patterns in *Scorpion Scientist* (10 min)

On-the-Fly Assessment

DAY 21 | LESSON 4.2




End-of-Unit Assessment Part 2

-  Reviewing Data About Sparrows (25 min)
-  Asking Investigable Questions (25 min)
-  Answering Questions with Data (10 min)

End-of-Unit Assessment Part 2

DAY 22 | LESSON 4.3

Investigating Sparrow Offspring

-  Determining Offspring (30 min)
-  Thought Swap (15 min)
-  Concluding the Unit (15 min)

Self-Assessment

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.

Inheritance and Traits 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 why Wolf 44 has some traits that are more similar to the Bison Valley Pack (its birth pack) and some traits that are more similar to the Elk Mountain Pack (its adopted pack).

Progress Build Level 1:

Traits vary within a species.

Progress Build Level 2:

Organisms get instructions for traits from their parents.

Progress Build Level 3:

Traits can be determined by inheritance, the environment, or both.

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:

Multiple meaning words (Example from Lesson 1.2)

Words with multiple meanings may present an obstacle for English learners. To help avoid confusion, before reading, explain that some words have more than one meaning. Discuss some examples likely to be familiar such as *fly* or *play*. Then, have partners work together to complete the optional activity on page 6, Multiple Meaning Words: *Blue Whales and Buttercups*, in the Investigation Notebook.

For students needing more support:

Sentence frames (Example from Lesson 3.1)

When students are reflecting on their observations of flamingo families, you can suggest sentence frames as a support for students who are less comfortable speaking in class. Write the following sentence frames on the board (or jot them down in individual student's notebook pages for them to refer to) and encourage students to use them as needed.

- I observed _____
- I noticed _____
- I think this means that _____

For students ready for a challenge:

Further investigation (Example from Lesson 1.4)

If students have had their interest piqued by listening to the bird sounds, they may want to further explore bird sounds. There are many free websites and apps that show common birds and play recordings of their sounds. Students can be encouraged to listen for bird sounds around the school and in their community. A good time to hear birds may be in the schoolyard before school begins, as many birds are active in the morning. Students can then try to identify the bird sounds online by using one of the recording resources for bird sounds. An online search for “identify bird sounds” should bring up some useful and kid-friendly resources.

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.

Inheritance and Traits 3-D Coverage

SEPs

Science and Engineering Practices

DCIs

Disciplinary Core Ideas

CCCs

Cross-Cutting Concepts

Unit Level

Students **investigate** the variation between similar organisms (patterns) and **how** traits that depict parents and offspring are determined (cause and effect).

Chapter Level

Chapter 1: Why are wolves different even though they are all the same species?

Students **analyze and interpret data** from a wide variety of organisms to figure out **the degree of relatedness and variation that exists among them** (patterns) and to figure out that **even when organisms share many traits, there can be variation within each trait** (patterns).

Chapter 2: Why is Wolf 44's color similar to one pack but different from the other?

Students **analyze and interpret data** from **parents and offspring as they look for patterns of traits** (patterns). Students apply ideas about **how traits are inherited** (cause and effect) in order **to explain** why Wolf 44's color looks similar to **wolves in one pack but different from wolves in another pack** (patterns, cause and effect).

Chapter 3: Why isn't Wolf 44 like the Bison Valley Pack in hunting style and size?

Students **ask questions and analyze and interpret data** to figure out **how some traits result from the environment** (cause and effect). Students then **explain** Wolf 44's behavioral and physical characteristics (patterns).

Chapter 4: How can scientists investigate questions about traits?

Students **obtain information** about how scientists investigate questions. They then **ask and investigate their own questions** about **what determines the traits of White-Crowned Sparrows** (cause and effect).

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

The image displays three overlapping pages from a lesson brief for the unit 'Inheritance and Traits'. The top page (page 507) is the 'Teacher References' section, featuring a '3-D Statements' icon and a 'Key' section with links for 'Practices', 'Disciplinary Core Ideas', and 'Crosscutting Concepts'. It lists '3-D Statements' for Unit Level, Chapter Level (Chapter 1: Why are wolves different even though they are all the same species?, Chapter 2: Why is Wolf 44's color similar to one pack but different from the other?, Chapter 3: Why isn't Wolf 44 like the Bison Valley Pack in hunting style and size?, Chapter 4: How can scientists investigate questions about traits?), and Lesson Level (Lesson 1.1: Pre-Unit Assessment, Lesson 1.2: Blue Whales and Buttercups, Lesson 1.3: Observing Similarities and Differences). The middle page (page 508) shows Lesson 1.4: Introducing Species, Lesson 1.5: Variation in a Species, Lesson 1.6: Making Sense of Variation, Lesson 1.7: Explaining Variation, Lesson 2.1: Asking Questions About Science, Lesson 2.2: Exploring Patterns, Lesson 2.3: The Code, Lesson 2.4: Exploring Inheritance, Lesson 2.5: Making Sense of Inheritance, and Lesson 2.6: Explaining Inheritance. The bottom page (page 509) shows Lesson 3.1: Introducing Traits, Lesson 3.2: How the Sparrow Lived, Lesson 3.3: Investigating What Happened, Lesson 3.4: The Role of the Environment, Lesson 3.5: Making Sense of Traits, Lesson 3.6: End-of-Unit Assessment, Lesson 4.1: Scorpion Scientist, Lesson 4.2: End-of-Unit Assessment, and Lesson 4.3: Investigating Sparrows.

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