

# 4

## Variation and Heredity

### Objectives

You will be able to

- Determine whether variations of living organisms are due to genetics or the environment.
- Construct a scientific explanation about how environmental and genetic factors influence the growth of organisms.
- Share observations with your group.
- Communicate your ideas and listen actively.



*How do the environment and genetics affect who we are and how we are similar or different?*

### Evaluation and Feedback

To evaluate your work, you will

- Use the “Constructing Explanations and Designing Solutions” row of the Science and Engineering Practices Rubric.
- Use other criteria determined by your teacher.

## Task 4: Variation in Elephants

As a group:

- Observe and explain variation in elephants.
- Analyze a graph of average heights of different species of elephants.
- Explain why the different species of elephants have different heights.
- Analyze a graph of two orphaned baby Asian elephants who are fed different diets.
- Explain why the orphaned baby Asian elephants have different weights after 44 weeks.

### Vocabulary

- environmental differences
- genetics
- inheritance
- species
- variation

### Connect to the Culminating Project

Plan and organize your children’s book in your Individual Project Organizer:

- Write and illustrate a storyboard for your book.

## Introduction

In the previous task, you modeled how sexual reproduction passes on a combination of genes from parents to offspring, resulting in variation in traits. You have also looked at how the environment influences traits of organisms. So which is it—genetics or environment?

- In 1979, researchers at the University of Minnesota had the same question and conducted a study looking at identical twins (genetically the same) who were raised apart (in different environments). Make a prediction: Do you think these identical twins still had identical traits after 20 years apart? Why or why not?

## Part I • Variation in Elephants

1. Consider the elephant photo below. Make four observations about what might explain the variation in elephant size.



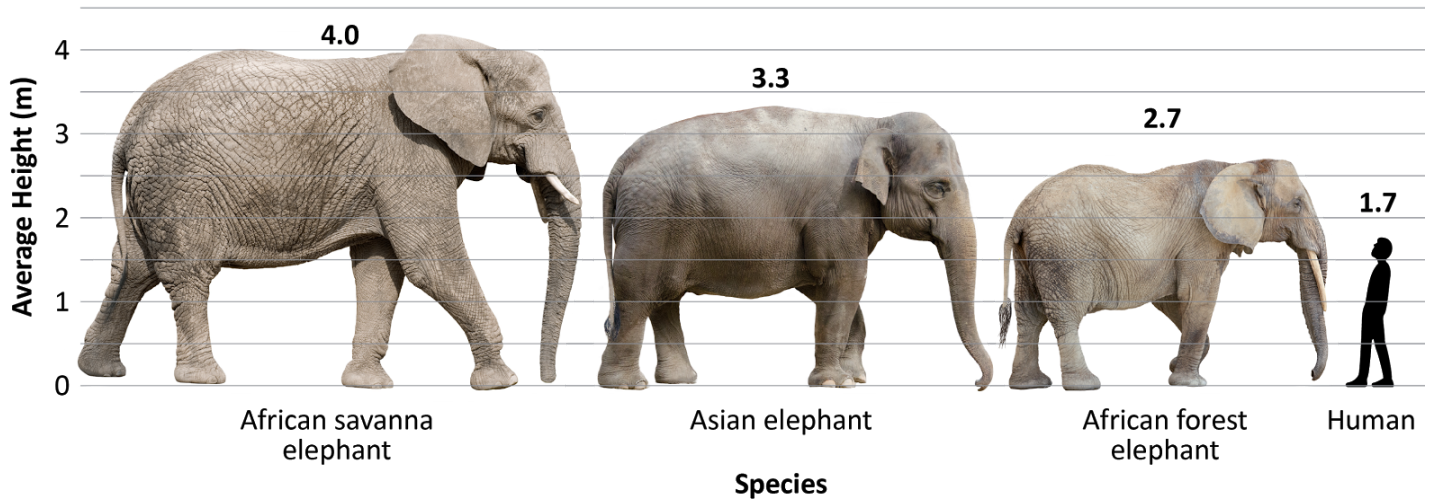
Observation 1

Observation 2

Observation 3

Observation 4

2. The elephants in the above picture belong to the same **species**.
  - What does *species* mean to you?
  - In the space below, write a sentence that has the words **cats** and **species** in it.

**Part II • Genetic Variations Resulting in Different Elephant Sizes****Graph 1: Average Heights of Male Species (Types) of Elephants**

- Graph 1 above shows the average heights of three different species of elephants. Look over the graph and then discuss these questions with your group:
  - What does the axis that runs up and down on the left side of the graph (the y-axis) tell you?
  - What does the axis that runs across the bottom of the graph (the x-axis) tell you?
  - Write three statements that compare elephant data found in the graph.

**Sample Statement:** The male African savanna elephant is 0.7 m taller than the Asian elephant.

Statement 1

Statement 2

Statement 3

2. Construct an explanation.

**Claim:** After analyzing Graph 1, make a claim about elephant heights and elephant species.

**Evidence:** Use evidence from the graph to support your claim. Use numbers when stating your evidence.



**Reasoning:** Use a scientific concept to connect your evidence to your claim.

### Part III • Different Environmental Conditions Resulting in Variation in Elephant Sizes



1. Brainstorm with your group to describe five different **environmental differences** that might cause elephants of the **same** species to be different sizes. **Cause and effect:** Discuss **why** and **how** the different environments affect the elephants.

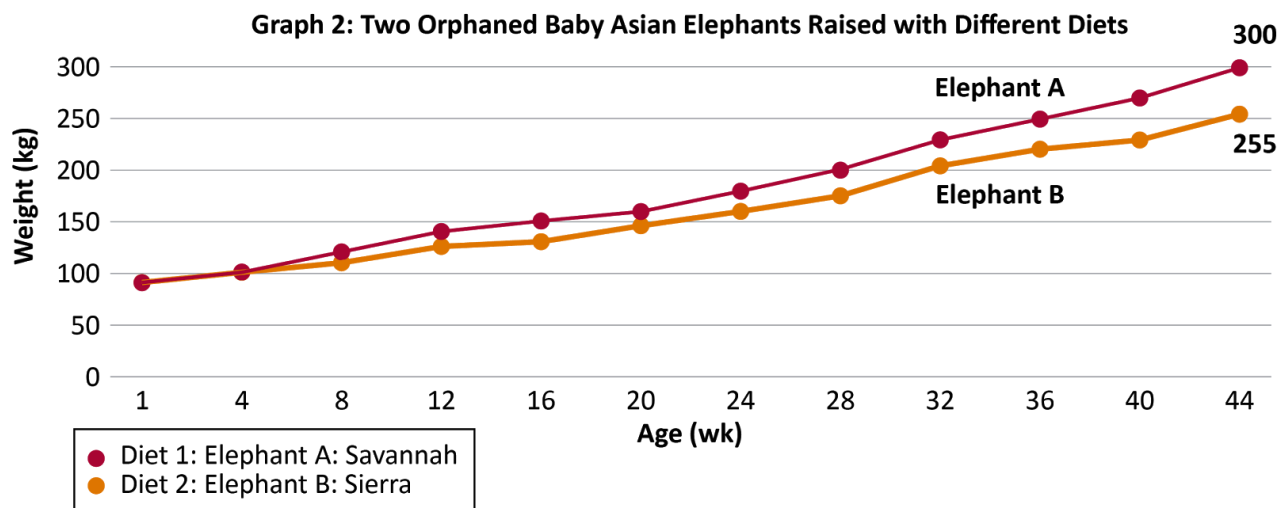
Difference 1

Difference 2

Difference 3

Difference 4

Difference 5



2. Graph 2 above shows the weekly weights of two orphaned elephants who were fed different diets. Look over the graph and then discuss the following questions with your group. Make notes and write your answers in your science notebook.



- What does the axis that runs up and down on the left side of the graph (the y-axis) tell you?
- What does the axis that runs across the bottom of the graph (the x-axis) tell you?
- Describe three possible differences between the two different diets.

3. In your science notebook, construct a claim, evidence, reasoning explanation following the guidelines in the table below.



**Claim:** After analyzing Graph 2, make a claim about the weight of the orphaned Asian elephants.

**Evidence:** Use evidence from the graph to support your claim. Use numbers when writing your evidence.

**Reasoning:** Use a scientific concept to connect your evidence to your claim.

4. **Cause and effect:** Based on what you have learned about why elephants have different heights and weights, explain why humans have different heights and weights.



#### REFLECT

At the beginning of this task, you were asked to think about a study of identical twins raised apart and predict whether these identical twins still had identical traits after 20 years. Look back at your response. After what you have learned about genetics and environment through this task, how would you add to or change your ideas? Is there any evidence from this task that you can add?

## Part IV • Connect to the Culminating Project and Assessment

Complete the Individual Project Organizer for this task.

