

Lesson 2: The Same and Different

Introduction

You have been learning about jaguars, mosquitos, and geese to help you understand why individuals may have different versions of a trait than others of the same species. You considered three possible explanations for variation. In this lesson, you will look more closely at two organisms of same species that have different versions of a trait.

Process and Procedure

Lesson Focus Question

1. Write the focus question for this lesson in the box below. Underneath the box, write your best ideas about the question under the box. Think about the example of the black and spotted jaguars and the differences you might expect to find between them. Leave space to revise your answer as you learn more.

Looking for Variation: Differences in Proteins

2. Consider the possible explanations for variation among jaguar coat color: parents, genes, or mutations. If scientists wanted to determine which of these might cause differences in fur color, they might consider different kinds of evidence. In the table below, write the name of the explanation (parents, genes, or mutations) next to the type of evidence scientists would examine to find differences between spotted and black jaguars.

Evidence scientists might examine to look for differences to explain the variation in jaguar fur color	Explanation(s) this evidence might support
Pedigrees (jaguar family trees)	
Cells	
Chemicals or substances in cells	
Chemicals or substances in the nucleus of cells	

Add notes from the class discussion in the space below:

3. One scientist decided to focus on chemicals found in cells. She chose to look at the different proteins found in jaguars with different fur colors. With your partner, examine the scientist’s data about different proteins found in 20 jaguars.
 - a. For each protein description, circle the type of protein.
 - b. Use the What I See/What It Means tool to identify similarities and differences in the patterns of proteins between black and spotted jaguars:
 - i. In the space to the right of the table, draw arrows to any places where you see patterns of differences between black and spotted jaguars.
 - ii. Next to each arrow, write “What I See” and a brief description of what you observe.
 - iii. For each “What I See” statement, write a “What it Means” statement to show why you think the observation is important to explain the difference in fur color.

Protein Name and Description	Black Jaguars	Spotted Jaguars
Hemoglobin: a transport protein in the cytoplasm of red blood cells that carries oxygen to other cells of the body.	High levels in red blood cells	High levels in red blood cells
Keratin: a structural protein in the cytoplasm of cells that supports and protects cells. Keratin is found in skin, fingernails, and claws.	High levels in skin and claws	High levels in skin and claws
Sodium Channel: a structural protein found in cell membranes that allows sodium to move into and out of cells.	High levels in nerve cells	High levels in nerve cells
Actin and Myosin: two structural proteins that work together to cause muscle contraction and movement	High levels in muscle cells	High levels in muscle cells
Eumelanin: a pigment protein found in hair, skin, and eyes.	High levels in fur	Low levels in fur
Antibodies: Immune proteins that circulate in the immune system to fight infections	High levels, particularly during infections	High levels, particularly during infections
Acetylcholinesterase: an enzyme protein that supports normal functioning of the nervous system. Insecticides prevent this enzyme from functioning properly.	High levels in nerve cells	High levels in nerve cells
Insulin: a hormone protein that helps to regulate blood sugar levels.	Low levels, except after meals	Low levels, except after meals
DNA Polymerase: an enzyme protein that makes copies of genetic information of DNA molecules in the nucleus of cells	High levels	High levels
MC1R: a regulatory protein that controls the type of pigment made in cells	High levels; part of protein deleted	High levels; protein complete
Ferritin: a storage protein found in the blood that stores and releases iron	High levels in blood	High levels in blood
Pepsin: an enzyme protein that breaks down food during digestion	High levels in stomach after eating	High levels in stomach after eating

4. Refer to the protein data on the previous page and the Variations in Organisms case studies about mosquitos andgeese from Lesson 1.
- a. What protein might show differences between mosquitos that are resistant to insecticides and those that are not? What do you predict are the differences in the protein between mosquitos?

Protein Name	Mosquitos that are resistant to insecticide	Mosquitos that are not resistant to insecticide

- b. What protein might show differences between geese that can fly at extremely high altitudes and those that cannot? What do you predict are the differences in the protein between geese?

Protein Name	Geese that can fly at extremely high altitudes	Geese that cannot fly at extremely high altitudes

Synthesize and Summarize Key Science Ideas

5. Reread your initial response to the lesson focus question. Revise your ideas using a different color. If you prefer to rewrite your answer, draw a line, then write your answer below the line in a different color. Be prepared to share why you made the changes you did.
6. In Lesson 1, you considered three possible explanations for variation: parents, genes, and mutations. Based on what you learned in this lesson, do you have any new evidence to support one or more of the possible explanations? If so, write the name of the explanation and the evidence below.

I have new evidence to support the explanation of _____.

The new evidence that supports this explanation is: