

Lesson 9: Tools to Predict Traits

Introduction

In the last lesson, you considered how individuals from the same parent can look different from one another. But what about other family members? In this lesson you will consider the different explanations for variation in a population. You will apply these ideas to a real population of jaguars to explain the variation within a family.

Process and Procedure

Lesson Focus Question

1. Write the focus question for this lesson in the box below. Underneath the box, write bullet points to show your current ideas about whether it is possible for a family of black jaguars to have a spotted jaguar.

Jaguar Pedigrees

2. Read the following information about scientists studying a jaguar family. As you read, annotate the text.

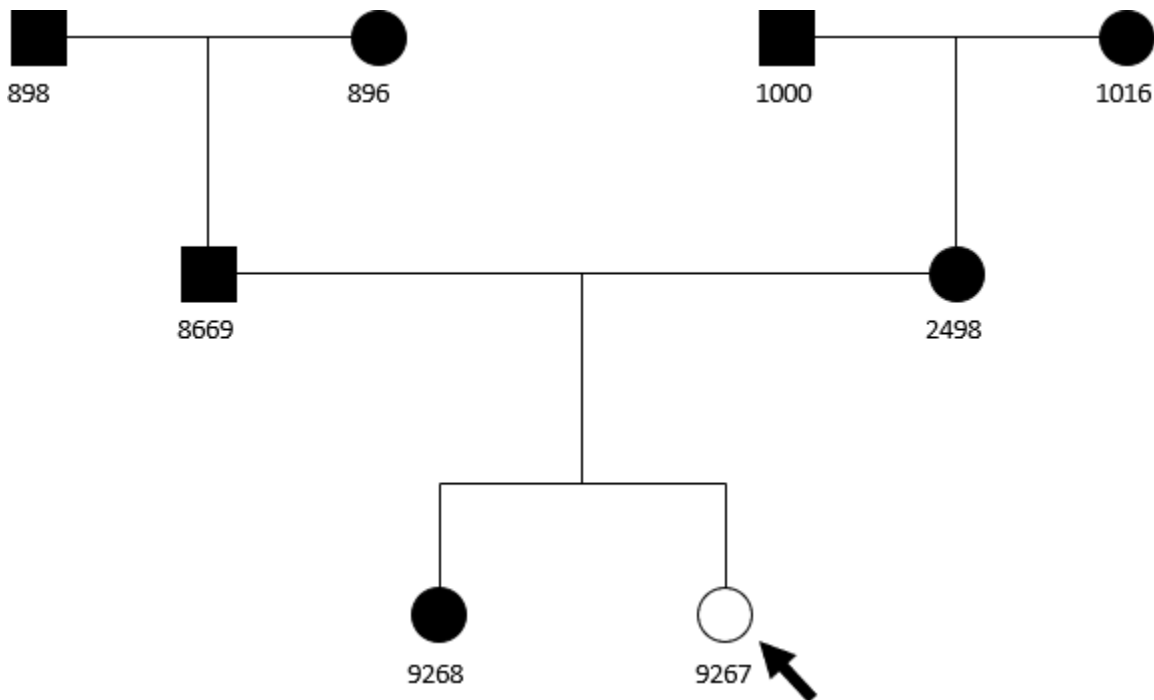
Jaguar Research

In 2003, a group of scientists published a paper that provided information about several generations of jaguars. They included information on 116 jaguars to learn more about the fur color trait in families. For each jaguar, the data included not only the fur color but also the fur color of the mother and father if they were known.

Later, another scientist who was studying the data noticed something interesting. She saw that jaguar number 9267 was spotted, but that most of the jaguar's family members were black. The scientist began creating a pedigree with some of the closest relatives to 9267. Her pedigree looked like the following. There is an arrow pointing to 9267. The scientist knew that the jaguar was spotted, a female, and that her parents were 8669 and 2498.

A pedigree is a tool that scientists use to chart an individual's ancestors. It is similar to a family tree, but focuses on a particular trait. A pedigree usually shows only the phenotype of an individual. However, a pedigree can be used to predict the genotype of an individual.

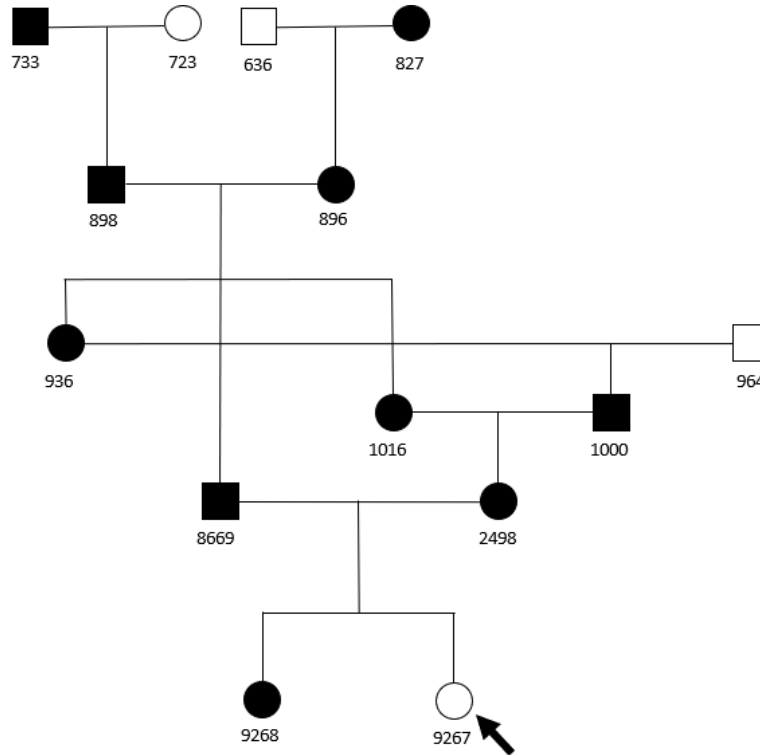
Using this information, study the pedigree. What else can you learn about how pedigrees represent different animals and relationships? Draw arrows and write short statements to show what you see or infer in the pedigree. If you have questions, write them down as well.



3. Using the pedigree as a tool to help you analyze the jaguar family, answer the following.
 - a. How many family members are shown?
 - b. How many of the family members have black fur?
 - c. How many of the family members are female?
 - d. What are the numbers of jaguar 2498's mother and father?
 - e. How are jaguars 9267 and 9268 related to each other?

4. Jaguar 9267 is a spotted jaguar, but all her family members are black. Consider the three possible explanations: genes, parents, and mutations. Which of the explanations best fit the data about jaguar 9267 and her family? You may choose as few or as many explanations as reasonably fit. Explain your ideas about the explanations you think best fit the data.

5. The scientist who created the pedigree decided it would be valuable to look at some additional family members. She examined additional family members and developed the following pedigree.



With your team, describe the additional family members that are part of the new pedigree.

How does this information help you understand how jaguar 9267 can have spotted fur when her parents and grandparents all have black fur? Use the following words in your description:

- Υ Heterozygous
- Υ Homozygous
- Υ Dominant
- Υ Recessive
- Υ Gene
- Υ Allele

6. Read and annotate the article, *Scientific Argumentation*.

Scientific Argumentation

Scientific argumentation is a process for reaching agreements and justifying the best explanation for a natural phenomenon. Scientists use argumentation to listen to, compare, and evaluate competing explanations. They and their peers attempt to identify strengths, weaknesses, and limitations in claims, evidence, and reasoning, with the ultimate goal of refining and improving the explanation. An important component of a scientific argument is a rebuttal. A rebuttal refutes alternative claims, evidence, and/or explanations.

Scientific argumentation is used to compare and evaluate competing explanations in light of currently accepted explanations and new evidence. Scientists may determine that one explanation has stronger evidence and reasoning to support it, while another explanation has weaker evidence and may be refuted. Alternatively, scientists may find that the evidence for several explanations may be combined to create an even stronger argument.

7. Throughout this lesson series, we have considered three explanations for the variation that exists between individuals of the same population. Your teacher will assign you one of the three explanations.

With your group, consider the evidence from today's lesson and the other activities in this unit. Use the first part of the Argument Tool on the next page to record the evidence that best supports your claim.

Then critique the quality and strength of the evidence that supports the claim.

Argument Tool

Question

What is the question that you are investigating?

What's the best explanation for the similarities and differences we see in individuals within a species—not only for one species, but for every species of plant and animal?

<p style="text-align: center;">Claim A</p> <p>What is a claim you could argue? Parents is the best explanation for the similarities and differences we see in individuals within a species.</p>	<p style="text-align: center;">Claim B</p> <p>What is a claim you could argue? Genes is the best explanation for the similarities and differences we see in individuals within a species.</p>	<p style="text-align: center;">Claim C</p> <p>What is a claim you could argue? Mutation is the best explanation for the similarities and differences we see in individuals within a species.</p>
<p>The evidence that supports this claim is...</p>	<p>The evidence that supports this claim is...</p>	<p>The evidence that supports this claim is...</p>

Scientific Reasoning: Evaluating the Evidence and Claim

<p>Use science ideas to critique the quality and strength of the evidence that supports the claim.</p>	<p>Use science ideas to critique the quality and strength of the evidence that supports the claim.</p>	<p>Use science ideas to critique the quality and strength of the evidence that supports the claim.</p>
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Adapted from the Regents of the University of California

Synthesize and Summarize Key Science Ideas

8. **The unit central question is:** What's the best explanation for the similarities and differences we see in individuals within a species—not only for one species, but for every species of plant and animal?

Use the three explanations and evidence from all the lessons to write a scientific argument that answers the focus question. Use the Argument Tool on the next page to help organize your ideas.

Argument Tool continued

Constructing a Scientific Argument

Write a scientific argument that includes:

- The scientific question
- Your claim (use ideas from all three claims that are best supported by evidence, science ideas, and reasoning)
- Relevant evidence that supports your claim
- Relevant science ideas
- Scientific reasoning that critiques the evidence and evaluates your claim

Scientific Argument

Rebuttal

Write a rebuttal that explains why each of the three claims alone is insufficient to answer the question.