

Lesson 8: Inheritance of Traits

Introduction

You have learned that an offspring receives two copies of each gene, one from its mother and one from its father. A gene may have several different forms, or alleles. In jaguars, there are two alleles for the gene that codes for fur color.

You have also learned that an individual's genes determine its traits. Genes code for specific proteins and the structure of that protein determines its function. The traits of an organism are the result of its specific combination of proteins.

In this lesson, you will have an opportunity to use and apply your understanding of these processes to the mosquitos and geese you read about in Lesson 1.

Process and Procedure

Lesson Focus Question

1. Write the focus question for this lesson in the box below. Be prepared to share your ideas with the whole class.

Inheritance of Traits

- As a team, you will create an illustration of gene expression, the process by which the genes an organism inherits from its parents result in a trait. While individuals have two copies of each gene, for your illustration you will use a single gene in your illustration.

Your illustration should show the following criteria:

- The name of the gene and its location in the cell
- The DNA sequence for the portion of the gene given
- The location and a description of the mutation that occurs, labeled with the type of mutation
- The mRNA sequence that is transcribed and its location in the cell
- The important components of translation and their locations in the cell
- The amino acid sequence that is produced by translation of the mRNA
- A description of how the mutation affects the organism at both the protein and organism level

Note: Your teacher will provide you with copies of the sequences for your organism. You may attach them to your illustration if it is helpful.

Resistance to Insecticide in Mosquitoes

Review the mosquito case on the *Variations in Organisms* handout from Lesson 1.

The following sequences show a part of the DNA sequence in the typical AChE allele and the insecticide-resistant AChE allele. Note that this is only a small portion of the DNA sequence. The whole AChE gene is made up of several thousand DNA nucleotides, begins with a start codon, and ends with a stop codon.

Typical AChE:

CGG CGG CAG TAC GAC ACC TAG AAG CCC CCA CCG AAG ATG AGG CCC TGA CGG

Insecticide-resistant AChE:

CGG CGG CAG TAC GAC ACC TAG AAG CCC CCA TCG AAG ATG AGG CCC TGA CGC

Geese Living at High Altitude

Review the geese case on the *Variations in Organisms* handout from Lesson 1.

The following DNA sequence shows a portion of the alpha hemoglobin gene (HBA) in bar-headed geese that fly at high altitudes and in greylag geese, a type of goose that lives at lower altitude. Note that this is only a small portion of the DNA sequence. The whole hemoglobin gene is made up of several thousand DNA nucleotides, begins with a start codon, and ends with a stop codon.

Greylag goose HBA:

CAA CAC CGG TAT GTA GTA GGG AGC CGT AAC TGC GGT CTT CAG GTG CGA TCG

Bar-headed goose HBA:

CAA CAC CGG TAT GTA GTA GGG AGC CGT AAC TGC CGT CTT CAG GTG CGA TCG

Rubric for Gene Expression Illustration

Task	Good	Best
Create an illustration that includes the steps of gene expression.	I created an illustration, but it was missing some of the steps of the process of gene expression.	I created an illustration that includes all steps of the process of gene expression.
Include the name of the gene and its location in the cell.	I drew a representation of the gene, but was not clear about either its structure, location, or name.	I correctly drew a representation for the structure of the gene in the proper location in the cell and labeled it with its name.
Include the location and a description of the mutation that occurs and the name of the type of mutation.	I showed an incorrect mutation or was not clear about the location or type of mutation.	I clearly indicated the mutation and its location and named the type of mutation.
Include the mRNA sequence that is transcribed and its location in the cell.	I showed an mRNA sequence, but there were mistakes in the sequence, or I was not clear about its location in the cell.	I showed a correct mRNA sequence and indicated its location in the cell clearly.
Include the amino acid sequence that is produced by the translation of the mRNA sequence.	I included an amino acid sequence with mistakes in the sequence.	I included a correct amino acid sequence in the cell.
Include a description of how the mutation affects the organism at the protein level and organism level.	I described either the way the mutation affects the protein or the way it affects the organisms.	I described both how the mutation affects the protein and how it affects the organism.
Present the information clearly so that it is easy to understand the illustration.	Most parts of my illustration were clear, but some parts were confusing.	My illustration is clear and includes the correct information, labels, arrows, and brief descriptions where needed.

3. Following your teacher's directions, discuss the feedback your team received:

a) Which pieces of feedback are most helpful to your group? Why?

b) Are there pieces of feedback that you do not plan to use as you revise your model? Why will you not use them?

Revise your model using the feedback that your team agrees with.

Synthesize and Summarize Key Science Ideas

4. The focus question for this lesson was: *How can multiple offspring of the same parents have different versions of the same trait?* With your teammates, develop a scientific explanation for this question. Use the Explanation Tool to think about your claim, evidence, and reasoning. When you are ready, write your explanation on chart paper.

Question	
How can multiple offspring of the same parents have different versions of the same trait?	
Evidence from data and observations (e.g. patterns or trends specific to your investigation)	Reasons your evidence links to your claim. Include science concepts (i.e. patterns or trends that are generalizable across many situations, science vocabulary).
Claim (should answer the question)	
Scientific Explanation (Be sure to include the claim, evidence, and reasoning in your explanation. Reasoning includes science concepts and linking words used to connect your ideas in the paragraph.)	

5. How has your response to the lesson focus question changed over the course of this lesson? In the space below, write a reflection that summarizes the changes in your thinking and what caused your ideas to change. Be prepared to share your reflection with the whole class.

6. During the next class period, we will return to the unit central question, **“What is 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?”** You will think about this question in the next lesson as you make predictions about the traits of offspring in a family.

How confident are you that you can answer this unit central question completely?

Circle a number to show your confidence.

Not very confident 1 2 3 4 Very confident