

Investigation 7.5.1 CONTROLLED EXPERIMENT

SKILLS MENU

Modelling Natural Selection

Some prey species are extremely well camouflaged. Darwin believed that the evolution of this trait was influenced by natural selection. If this is true, better-camouflaged individuals should be favoured over less well camouflaged individuals and become more common in the population over time. In this investigation, you will design and conduct a controlled experiment to test Darwin's theory in a simulated predator–prey relationship over a number of “generations.”

Testable Question

Can an environment favour the success of better-camouflaged individuals in a predator–prey relationship?

Hypothesis

Formulate a hypothesis based on the testable question, after considering options for your experimental design.

Variables


As you design your experiment, carefully choose your independent and dependent variables and decide which variables will need to be controlled.

Experimental Design

Your experiment must simulate a predator–prey relationship in which prey exhibit varying degrees of camouflage. There are many ways of designing and conducting such an experiment. Consider the following suggestions in your experimental design process:

- Use simple objects with different colours or patterns as your prey items (such as pieces of paper or coloured candies).
- Use different coloured or patterned backgrounds for your environment (such as paper backgrounds or natural ground covers).
- Use a student as the predator and give him or her a limited time interval in which to hunt prey.
- Use the ratio of camouflaged versus non-camouflaged individuals that survive predation to determine the ratios of the following generation. For example, if 6 camouflaged and 4 non-camouflaged individuals survive from an initial population of 20 individuals of each, then the next generation should begin with a ratio of 6:4 camouflaged to non-camouflaged individuals.

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|-----------------|-------------------------|-----------------|
| • Questioning | • Planning | • Observing |
| • Researching | • Controlling Variables | • Analyzing |
| • Hypothesizing | • Performing | • Evaluating |
| • Predicting | | • Communicating |

- Use the Internet and other sources to find more ideas on how to design your experiment. 
- Be sure to carefully consider how you will collect and record your data. How will you design your data tables?

Equipment and Materials

- Obtain materials as required for your design.








DO NOT consume any food items used in your experiment.







Procedure

1. Research and plan your controlled experiment.
2. Obtain teacher approval for your design and gather the equipment and materials you need.
3. Conduct your experiment.
4. Record your observations in an appropriate format. Consider graphing your results.

Analyze and Evaluate

- (a) Identify the major variables that you measured and/or controlled in this investigation. Which variables were manipulated (independent) and which were responding (dependent)? 
- (b) Prepare a formal lab report on this investigation.  
- (c) Share your findings with other students in the class. How do your results compare with theirs?  

Apply and Extend

- (d) Real-world experiments of natural selection involving predator–prey relationships have been conducted on small islands in the Bahamas. Research and summarize the findings of these large-scale controlled experiments.   
- (e) Use the Internet and other sources to search for extremely well camouflaged species. Share your findings with the class.   
- (f) Try one or more online computer simulations of natural selection and/or artificial selection. Explain how natural selection differs from artificial selection.



A Walk through Time

In this activity you will gain perspective on important events in both human history and the history of life on Earth. You will examine two timelines—one that represents major events in the history of human civilization, and one that represents major events in Earth's history. The data used in this investigation are based on historical references and the fossil record.

Purpose

To investigate the timing of major events on Earth and in human history using a physical time-scale model

Equipment and Materials

- 50 m measuring tape (one per class)
- Human Civilization Event Cards (handout)
- Life on Earth Event Cards (handout)

Procedure

1. Copy **Table 1** into your notebook. You will use it to record all observations (ya = years ago and mya = millions of years ago).

Table 1 Data Table

Human civilization events	Time (ya)	Life on Earth events	Time (mya)
Earliest human civilization		Earth forms	
Domestication of rice and wheat		First evidence of life on Earth	


2. When instructed to do so, all student groups will place their Human Civilization Event Card(s) at the appropriate positions along the same side of the tape measure, according to the values indicated on the backs of the cards. Scale: 1 m = 250 years
3. After all the cards have been placed on this scale, the entire class will “take a walk *back* through time,” beginning at 0 m, which represents the present. Read and record the information from the Event Cards in Table 1.
4. Next, place your Life on Earth Event Card(s) at the appropriate positions along the opposite side of the tape measure. Scale: 1 m = 100 million years
5. After all the cards have been placed on this scale, the class will “take a walk *forward* through time,” beginning at the end of the tape (50 m). Read and record the information from the Event Cards in Table 1.

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| • Predicting | | • Communicating |

Analyze and Evaluate

- (a) Did the historic timing of any of the Human Civilization events surprise you? Explain. T/I
- (b) Did any events demonstrate that civilization made rapid progress from 1400 to 1900? Explain. T/I
- (c) Did any events suggest civilization made very slow progress between 1400 and 1900? Explain. T/I
- (d) Did the historic timing of any of the major Life on Earth events surprise you? Explain. T/I A
- (e) For approximately how long did prokaryotes inhabit Earth before any eukaryotes were present? T/I
- (f) Approximately how long did life exist on Earth before multicellular life arose? T/I
- (g) Based on these models, would you consider the following events to be ancient or recent? T/I
 - (i) first evidence of photosynthesis
 - (ii) presence of life on land
 - (iii) appearance of dinosaurs
 - (iv) extinction of dinosaurs
 - (v) appearance of apes
 - (vi) first humans
- (h) Do any of the events demonstrate or suggest that major change in life on Earth is slow? Explain your thinking. T/I
- (i) Do any of the events demonstrate or suggest that such change is fast? Explain your thinking. T/I

Apply and Extend

- (j) In this investigation you used a linear model to represent time. Research and report on other ways of depicting the timing of events in Earth's history. T/I A C 



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