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Natural Selection and the Peppered Moth

In the early 1900s coal-burning was common in London, the air was thick with pollution. Coal smoke blackened the trees until their bark was dark brown. The peppered moth was a speckled brown moth that blended into the dark English tree bark perfectly. Then in 1956, London passed a clean air act and coal was banned in the city. Smokestacks were made taller to get pollutants further out into the atmosphere. Within ten years the trees, once brown from coal smoke, began to take on their natural light-colored bark. As the trees got lighter, the brown peppered moths stood out against the bark and were easy targets for hungry birds. Lighter moths, however, blended in and survived to lay eggs. Over many generations, which for insects can be just a couple of years, all the peppered moths were lighter in color.

This is how **natural selection** works, though in mammals and other vertebrates it takes much longer for traits to spread throughout a populations. This physical change is also called ***adaptation*** or structure and function.

Peppered moths on a coal smoke blackened tree.

The lighter moth stands out as easy prey.

Peppered moths on a natural colored tree.

The darker moth now stands out as easy prey.

Peppered Moth Simulation

Objective: Simulate changes in moth population due to pollution and predation, and observe how species can change over time.

Organisms have characteristics, traits and behaviours that enable them to survive in their environment. These are called adaptations. Adaptations increase an organism's fitness within its environment. A "fit" organisms is able to successfully survive and reproduce in its environment. Darwin observed this process in nature and called it Natural Selection.

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Procedure:

1. Set up: You will be working with a partner in this activity. One partner will be the scorekeeper, one partner will be the predator.
2. Obtain 1 dark environment and 1 light environment.
3. Obtain 1 small sheet of of light paper, and 1 small sheet of dark paper.
4. Cut out 30 small squares of each type of paper.
5. Have one partner (scorekeeper) choose a background and place 10 squares down randomly and spread out (5 of each colour) . The "predator" cannot watch the scorekeeper placing the squares.
6. Once complete, the scorekeeper will time for 5 seconds and see how many squares the predator was able to pick up. They must be picked up one and a time and **cannot** be slid off the paper.
7. Record the type of background used and how many light and dark squares were picked up. (Refer to data table)
8. After each "hunt" the remaining prey that lived will reproduce another generaation. Therefore, for each "prey" that was not caughts, add another square of the same colour (an "offspring") to the group.
   a. Example: If 4 dark squares survived and 2 light squares, add 4 more dark and 2 more light.
9. Repeat the hunt 3 times and record results. If at any time any of the population completely dies out, you must start again with more squares at the beginning (ie start with 10 instead of 5 each)
10. Repeat steps 1-7 with the other background, switching roles.

Table 3: Number of Dots Caught on Dark Background

Hunt Number	# of dark dots caught	# of light dots caught	# of dark survivors	# of light survivors
1)				
2)				
3)				

Table 4: Number of Dots Caught on Light Background

Hunt Number	# of dark dots caught	# of light dots caught	# of dark survivors	# of light survivors
1)				
2)				
3)				

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Discussion

1. Choose one set of data to graph. Create a line graph to illustrate the population of “prey” over the 3 generations of BOTH colours (ie two lines on one graph) Include a legend. Title your graph according to which background you have chosen.

2. What patterns emerged from the data you collected?

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3. Explain your results using Darwin's Theory of Natural Selection. Include terms like fitness, variation, natural selection and adaptations.

4. Would you expect to see a higher frequency of the light or dark allele in an area that is covered in snow for most of the year? Explain?