**Peppered Moth Simulation**

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

**Introduction:**

Charles Darwin accumulated a tremendous collection of facts to support the theory of evolution by natural selection. One of his difficulties in demonstrating the theory, however, was the lack of an example of evolution over a short period of time, which could be observed as it was taking place in nature. Although Darwin was unaware of it, remarkable examples of evolution, which might have helped to persuade people of his theory, were in the countryside of his native England. One such example is the evolution of the Peppered Moth *Biston betularia*.

The economic changes known as the industrial revolution began in the middle of the eighteenth century. Since then, tons of soot have been deposited on the country side around industrial areas. The soot discoloured and generally darkened the surfaces of trees and rocks. In 1848, a dark-coloured moth was first recorded. Today, in some areas, 90% or more of the-peppered moths are dark in colour. More than 70 species of moth in England have undergone a change from light to dark. Similar observations have been made in other industrial nations, including the United States.

**Instructions:**

Click the link below to read more information on Kettlewell's study of moths. At the end, you will run two simulations, during this time you will play the part of a bluejay that eats moths.

After each simulation record the % of dark moths and light moths - you will need this information later.

Peppered Moth Simulation at [**peppermoths.weebly.com**](http://peppermoths.weebly.com/)

**Data and Analysis**

Read the background information and answer the questions as you go.

**Life Cycle of the Peppered Moth**

1. Why are these moths called "peppered moths?"

2. What animals eat the peppered moth?

3. Moths that have dark, almost black, bodies are called:

**Impact of Pollution**

4. When was the first black form of the moth found?

5. What was the Industrial Revolution?

6. What was causing the different colors in the moths?

**Kettlewell's Experiments**

*(Skip this section and move on to “Birdseye View” and the “Final Analysis” questions. If you have time, you can come back and do this section for bonus points.)*

a. How do scientists test theories?

b. Write down ONE of Kettlewell's predictions.

c. Dark moths were found in what parts of the country?

d. How did Kettlewell directly study the moths?

e. Why did dark moths have a survival advantage?

f. When Kettlewell recaptured the marked moths, what did he find?

g. Where did Kettlewell publish his findings?

**Birdseye View**

7-8. Open the simulation and play the role of the bird in both the dark and the light forest. Try to behave as a bird would behave, choosing the moths that are the most obvious. At the end of each simulation, record the percent of moths that are now living in the table below.

**Final Analysis**

9. Explain how the color of the moths increases or decreases their chances of survival.

10. How does this simulation show "natural selection" happening? In your explanation use data from your table (percent light or dark moths in each forest) to give evidence for natural selection occurring.

11. What would happen if there were no predators in the forest? Would the colors of the moths change over time? Defend your answer?