



Be a Scientist!

Conduct an experiment related to peppered moth color morphs. Line the bottom of one large box with white construction paper and another large box with black construction paper. Next, cut out many small squares of the same black and white paper to represent the two color morphs of peppered moths.

Scatter an equal number of small squares of white and black paper into the *black* box. Have a partner time you. How many squares of white paper did you pick up compared to black paper in fifteen seconds? Now, scatter an equal number of the white and black squares in the *white* box and conduct the same test. How many squares of white paper did you pick up compared to black paper in fifteen seconds? Switch roles with your partner and run the tests again. Compare your results.



Beyond the Book

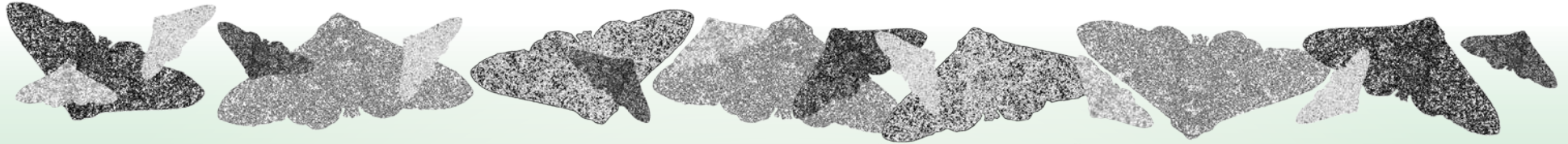
Use graphing software to construct a time line of peppered moth population changes. Include the start of the Industrial Revolution.

FOCUS Book

The Curious Case of the Peppered Moth



: Science A-Z 



Different Colors

The Curious Case of the Peppered Moth



FOCUS Question

What caused the peppered moth population to change color twice?

Cause and Effect

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The Curious Case of the Peppered Moth
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Written by Joe Levit

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When you think of certain animals, a specific color may come to mind. Red for a cardinal. Orange for a tiger. However, some species have more than one color that can appear in their population.

Most black bears, for example, have an all-black coat of fur. But did you know that not all black bears are black? They can also be brown, cinnamon, or even blond.

Other animals also show this kind of *variation*. A jaguar can have a typical spotted yellow coat or be almost entirely black. Even monarch butterflies, normally orange, are sometimes white instead. These different color types are called *morphs*.

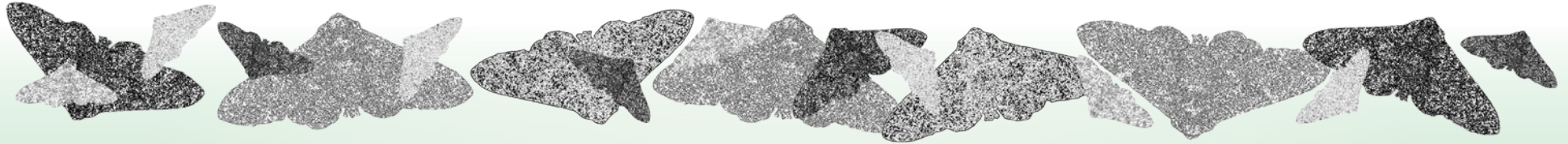


blond



black

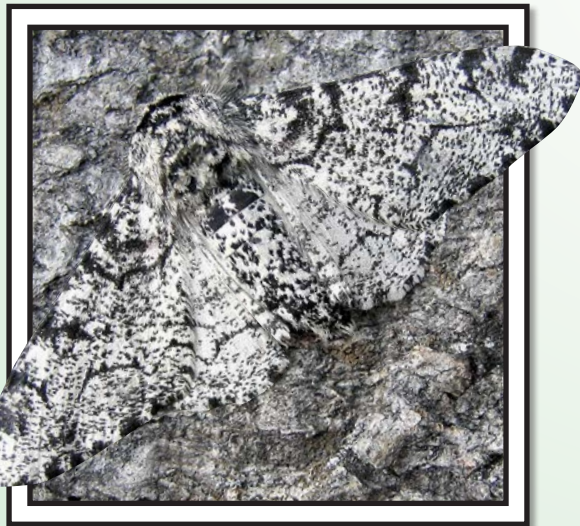
Two color morphs of the American black bear



The Peppered Moth

Some species of moths have morphs. One famous example is the peppered moth. This night-flying moth is found in Europe, North America, and many parts of Asia, including Russia and China.

The peppered moth comes in two morphs—white and black. The white morph is the typical one, making up about 99 percent of the population. That is why it is called *typica*. Typical peppered moths look as if someone sprinkled pepper over their white wings and backs. This pattern *camouflages* the white moths on the trees where they rest during the daytime. They blend in with the light-colored lichen that grows on the trees.



The white, or *typica*, peppered moth morph blends in well with this kind of lichen.



A black, or *carbonaria*, peppered moth morph stands out against a light background.

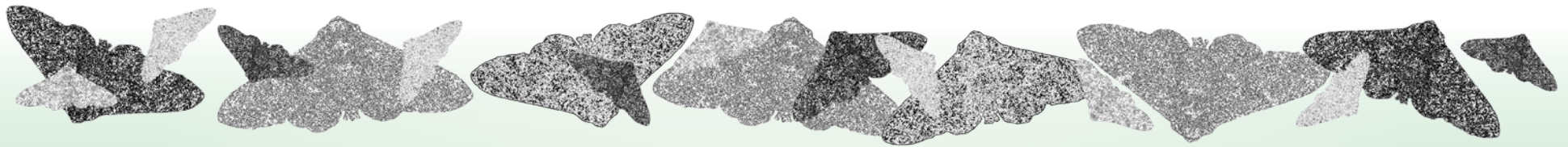
Word Wise

The root word in *carbonaria*—*carbon*—comes from the Latin word *carbo*, which means “charcoal” or “coal.”

The Moth's Morph

Blending in is a good thing for peppered moths since moths are an important food source for birds. But birds have a hard time finding the white moths because they are camouflaged. The black morph is easier to see against the lighter trees.

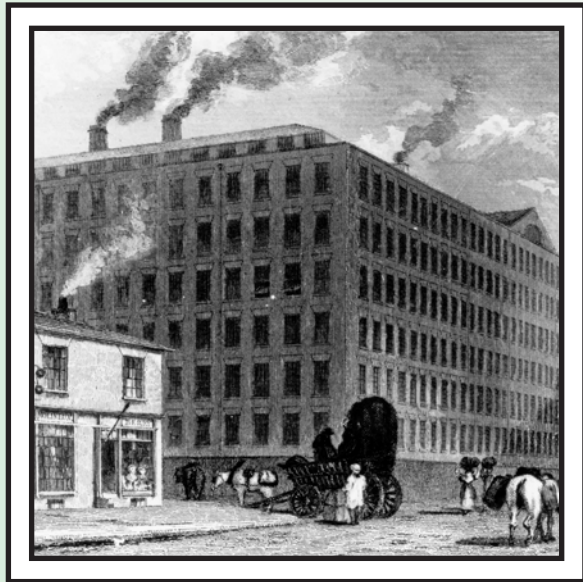
Many of the black peppered moths are eaten before they can reproduce. That is why there are fewer of them. Only 1 percent of the individuals in the species are black morphs. The black morph remained rare in the population for thousands of years. But in the late 1700s, something changed. That's when the case of the peppered moth became curious.



Pollution

From 1780 to 1830, the urban areas of Great Britain went through a large transformation. Factories and homes in big cities like London and Manchester stopped using wood as their main form of fuel. Instead, they used coal to power steam engines, furnaces, and fireplaces. This time in history became known as the Industrial Revolution. Coal was a plentiful and cheaper source of fuel. But burning it came at a cost.

Chimneys belched black fumes—produced by burning coal—into the air. Wind carried the smoke away from cities. The countryside was soon covered in a blanket of black soot.



A thread factory in Manchester, England, in 1829. Burning coal allowed factories to increase production of cotton cloth for a growing population of people.

Suddenly Seen

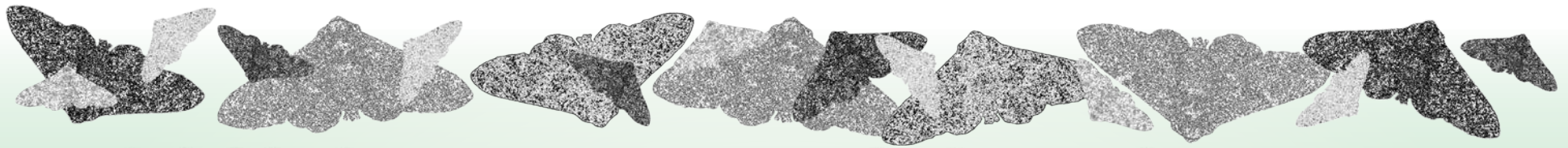
The black soot covered forests and stuck to tree trunks and branches. A toxic gas in the soot, called *sulphur dioxide*, killed off the light-colored lichens growing on the trees. As a result, the trees turned very dark. The darkened trees were not an ideal place for white peppered moths. Before the pollution, those moths had blended in with the light color of lichens (see page 3). But now they stuck out noticeably against the darkened bark.

Think About It

Predict how the darkened trees affected the peppered moth population. Then read on to discover the answer.



This white peppered moth is easy to notice against the darkened tree.



Survival of the Fittest

Among the dark, sooty trees, birds began to notice the *white* peppered moths more often. They gobbled them up in greater numbers. As a result, fewer white moths reproduced. At the same time, the few *black* peppered moths that had always been around were now hidden against the black soot. They were able to reproduce more often and make more black moths.

Over several decades, the black morph moths became more common than the white morph moths. In some places, the change was dramatic. By 1895, about 98 percent of the peppered moths in Manchester were black!



Birds like this one feed on peppered moths. They will eat black or white morphs, whichever they can find.

Cleaning Up Coal

Air pollution around cities remained a problem for many years. It wasn't just affecting peppered moths. When the smoke combined with fog to form *smog*, the pollution made many people very sick. In December of 1952, smog hovered over London for five days. Four thousand people died in what came to be called the Great London Smog.

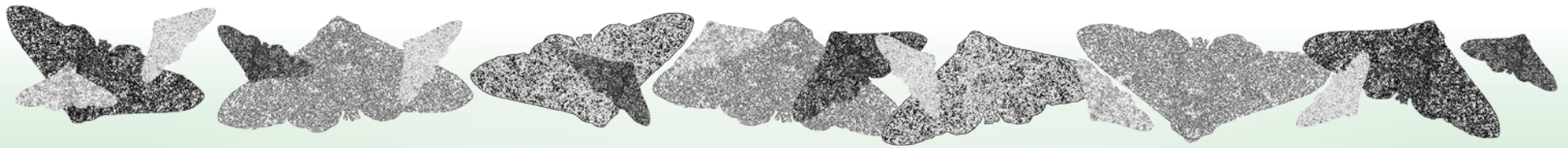
That human tragedy caused people to change the way they used coal. They used less coal or switched to other, cleaner-burning fuels such as gas. This change reduced the amount of pollution going into the air and changed things again for the peppered moths.

Think About It

Make a new prediction. How did the reduction in pollution affect the peppered moth population?



The Great London Smog of 1952

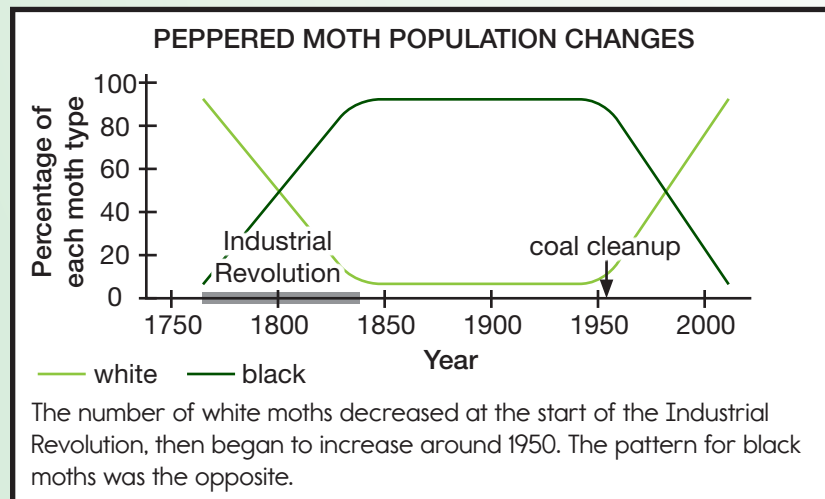


Back to the Beginning

White peppered moths began making a comeback. The light-colored lichens grew back on Great Britain's trees. Once again, the white morph moths could hide from predators. They reproduced at a higher rate. The black moths were eaten more often. They reproduced less.

The number of black peppered moths went down. Even today, the black morph is becoming rarer. Scientists expect that, eventually, only 1 percent of the peppered moth population in Great Britain will be the black morph.

A changing environment caused changes in the peppered moth population. The curious case of the peppered moth is an example of evolution at work on a fast-paced, local level.



Read-Think-Write

Write your answers on separate paper. Use details from the text as evidence.

- 1 What are different color types within one species of animal called?
- 2 Why did cities in Great Britain become polluted with soot between 1780 and 1830?
- 3 Why did the number of white peppered moths decline during the Industrial Revolution?
- 4 Look at the diagram on page 9. Which moth color had a higher population in 1950?
- 5 On the basis of what you learned in this book, describe why an arctic hare in a cold place like northern Canada has white fur.

FOCUS Question

What caused the peppered moth population to change color twice? Explain what happened to peppered moths in Great Britain before, during, and after the Industrial Revolution.

