

# London's Peppered Moths

By Laura Klappenbach

In the early 1950's, H.B.D. Kettlewell, an English physician with an interest in butterfly and moth collecting, decided to study the unexplained color variations of the peppered moth.

Kettlewell wanted to understand a trend that had been noted by scientists and naturalists since the early nineteenth century. This trend, observed in the industrialized areas of Britain, revealed a peppered moth population—once primarily made up of light gray-colored individuals—that now consisted primarily of dark gray individuals. Kettlewell was intrigued. Why had this color variation taken place in the moth population? Why were dark gray moths more common only in industrial areas while light gray moths were still predominant in rural areas? What do these observations mean?

## **Why Had This Color Variation Taken Place?**

To answer this first question, Kettlewell set about the task of designing several experiments. He hypothesized that something in industrial regions had caused the dark gray moths to be more successful than the light gray individuals. Through his investigations, Kettlewell established that dark gray moths lived better in the industrial areas than light gray moths. He was able to attribute this increased fitness to the dark gray moths' ability to better blend into their habitat and avoid predation by birds.

## **Why Were Dark Gray Moths More Common in Industrial Areas While Light Gray Moths Were Still Predominant in Rural Areas?**

Once Kettlewell had completed his experiments, the question remained: what had changed the moth's habitat in industrial regions enabling darker colored individuals to blend in to their surroundings better? To answer this question, we can look back into Britain's history. In the early 1700's, the city of London—with its well-developed property rights, patent laws, and stable government—became the birthplace of the Industrial Revolution.

Advancements in iron production, steam engine manufacturing, and textile production catalyzed many social and economic changes that echoed beyond the city and altered the future of what had been, until then, a primarily agricultural workforce. Great Britain's plentiful coal supplies provided the energy resources needed to fuel the fast-growing metalworking, glass, ceramics, and brewing industries. Because coal is not a clean energy source, its burning released vast quantities of soot into London's air which settled as a black film over the city.

In the midst of London's newly industrialized environment, the peppered moth found itself in a difficult struggle to survive. Soot coated and blackened the trunks of trees throughout the city, killing lichen (a moss-like fungus) that grew on the trees and turning the bark from a light gray-flecked pattern to a dull, black film. The light gray, pepper-patterned moths, that once blended into the lichen-covered bark, instead stood out as easy targets for birds and other hungry predators.

## **About Natural Selection**

The theory of natural selection suggests a mechanism for adaptation and gives us a way to explain the variations we see in living organisms and the changes evident in the fossil record. Selection processes can act on a population to either reduce genetic diversity or to increase genetic diversity. The types of natural selection (also known as selection strategies) that reduce genetic diversity include: stabilizing selection and directional selection.

The selection strategies that increase genetic diversity include diversifying selection, frequency-dependent selection, and balancing selection. The peppered moth case study described above is an example of directional selection: the frequency of color varieties changes dramatically in one direction or another (lighter or darker) in response to the predominating habitat conditions.

Name \_\_\_\_\_ Date \_\_\_\_\_

## Peppered Moth Worksheet

**Directions:** Read the article and then answer each question in complete sentences.

1. What does variation mean?

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2. What variation in peppered moths does this article describe?

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3. Why were dark-colored peppered moths successful during the Industrial Revolution in England?

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4. What do you think would have happened to the peppered moth population during the Industrial Revolution if a dark variety of the species had not existed?

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5. Why are dark-colored peppered moths rare today?

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6. How is the peppered moth story an example of natural selection?

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