

## Genetic Secrets of the Peppered Moth

Peppered moths are found in gardens all over Britain, but they're famous all over the world because of their colourful history. Now scientists have solved the mystery of one of the best examples of evolution in action.

### The Story of the Peppered Moth

Once upon a time, at the start of the 1800s, there lived in Britain a population of moths. They were white with speckles, which allowed them to blend in perfectly with the lichen-covered tree trunks where they spent their days. They were so well camouflaged that hungry birds couldn't see them.

This colour scheme had always worked well for them. But by the middle of the century, all that had changed.

Britain was in the midst of the 'industrial revolution' – a time when lots of factories were being built, spewing out clouds of black coal smoke, and more and more people were moving to big cities, burning coal fires and travelling in coal-powered trains. The trees near the cities became black with soot. The moths were no longer camouflaged, but stood out against the black tree trunks.

One day, a moth was born that looked different to its parents. This moth was black. While all the white speckled moths were being eaten by birds, the black moth was well camouflaged against the sooty black trees. It survived and had babies – these were black too, and they also escaped the hungry birds. Over time, more and more of the white moths were eaten until almost all the remaining moths were black. The moth population had adapted to its changing environment – it had evolved.

Years later, laws were made to reduce air pollution. The tree trunks became cleaner, lichen grew on them again, and suddenly the black moths stood out against the light, speckled bark. I bet you can guess what happened next...

That's right. The black moths were eaten by birds, and the few remaining white moths survived to have white moth babies until almost all the moths were white. The population had evolved once again.

### The missing piece of the puzzle

The black moths were first spotted in England in 1848, 10 years before Charles Darwin announced his theory of evolution to the science world. Fast forward 168 years to the present day, and scientists have finally worked out how this adaptation happened.

Dr Ilik Saccheri and his team at the University of Liverpool used genetic techniques to home in on the change in the moths' DNA that made them black.

### What is a gene?

DNA is a long thin molecule found inside almost every cell in your body. It's the chemical instruction manual for how each cell should behave. DNA is divided up into genes, which are like individual instructions, each with a different job.

### Jumping genes

The scientists were surprised to discover that the change was caused by a 'jumping gene' – a rogue piece of DNA that had inserted itself into one of the moth's genes.

Adding an extra bit of DNA into the middle of a gene would normally stop it from working, but for one lucky moth and its descendants who inherited the disrupted gene, this chance event was the key to survival.

Dr Ilik Saccheri from the University of Liverpool



"What makes this study so powerful is that we have been able to link a single change at the DNA level to a visible change in the moth population over time, and that we also know the environmental conditions that brought this about."

### Copycat butterflies

Interestingly, this same gene also controls the colour and wing patterns in tropical butterflies, and allows them to copy each other's appearance.

Dr Nicola Nadeau from the University of Sheffield



"The butterflies are using the same gene as the moths, but not to hide from birds, they actually want to be seen!"

Dr Nadeau, who studies butterfly genetics, explained how poisonous butterflies use bright colours to warn birds not to eat them. The birds will learn to avoid these butterflies, so the brightly coloured butterflies become more common, in the same way that the moth population changed. Different kinds of butterflies also copy each other's patterns to avoid being eaten – this is called mimicry.

You can pretend to be a hungry bird and watch butterfly evolution in action in this online game: <http://www.evolutionarygenetics.group.cam.ac.uk/evolving-butterflies/>

