

# NATURAL SELECTION FACTSHEET

## WHAT IS NATURAL SELECTION?

Natural selection is the process where an environmental factor acts on a population, favouring the reproductive output of some organisms.

## WHERE DOES IT COME FROM?

In 1858, an English biologist called Charles Darwin proposed a process by which evolution occurs called 'Natural Selection'. He had no knowledge of genetics because it hadn't yet been discovered; however, since that time genetics has provided evidence to support natural selection as the most likely process by which evolution occurs.



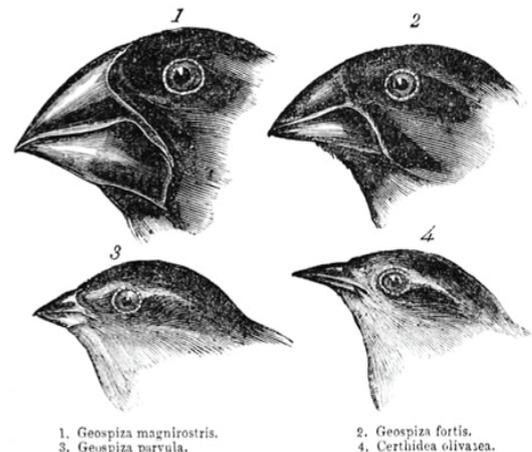
How did he come to this idea?

Darwin visited the Galapagos Islands in 1835. During his visit he observed that although the finches were similar on different islands, they showed distinct variation in beak size and structure. He realised that the beaks were different depending on local food source. From this, Darwin concluded that because the islands are so distant from the mainland, the finches that had arrived there in the past had changed over time to better suit their environment.

According to Charles Darwin animals with variations better suited to their environment would have a better chance of survival and ability to breed. They would then pass on the favourable characteristics to their offspring.

The **Selecting Agent** is the environmental factor acting on the population.

The **Selection Pressure** is the effect of Natural Selection acting on the population.



## NATURAL SELECTION OCCURS WITH:

**Variation** - Variation exists between individuals in a population.

**Selection Pressure** - The organisms that are better suited to their environment survive the pressure of selective agents. This is often referred to as 'Survival of the Fittest'.

**Reproduction** - Organisms that survive are able to reproduce and pass on their favourable genes to their offspring.

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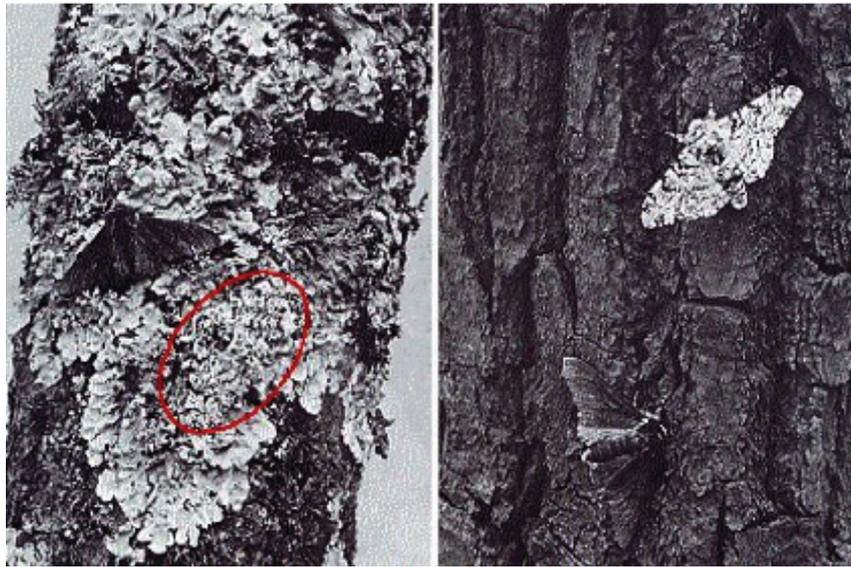
## EXAMPLES OF NATURAL SELECTION

### The peppered moth

One of the best known examples of natural selection in action is the peppered moth.

Early last century an English scientist called Henry Bernard Kettlewell began conducting studies with the intention of collecting evidence of natural selection. He focused on the peppered moth which came in two colours: the normal colour of white with black specks, and then the occasional mutant all-black moth.

Kettlewell found that in the cities, almost all the peppered moths were all black, while in rural areas they were almost all white. He concluded that this was due to a selective agent acting on the population. The selective agent he observed preying on the moths were birds.



Kettlewell explained the process as follows:

During the Industrial Revolution, many trees became covered in soot due to the 150 years of pollution. Lighter moths resting against the trees were easily spotted and plucked off by the birds. Black moths produce black offspring so eventually the population became mainly black.

Meanwhile in rural areas the air was cleaner and the tree trunks were a lighter colour. This made the lighter moths harder to see and the black moths easier to see and be eaten. The population in rural areas eventually became nearly all white.

Kettlewell confirmed his theory by carrying out his own experiments where he placed moths of both colours on tree trunks and observed birds eating the moths. The table below displays some of his results.

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Place and background colour	Number of moths observed	Percentage dark eaten	Percentage light eaten
Birmingham wood - dark tree trunks	58	26%	74%
Dorset - light tree trunks	190	86%	14%

Natural selection highlights how much the natural environment affects living organisms, causing the characteristics of a population to change over generations. More recent examples of natural selection include snakes, cane toads, bacteria and insects.

## Natural selection in insects

The rise of widespread agriculture has seen a rise in insects eating these crops, and a rise in efforts to eliminate these insects. One strategy to eliminate insects has been to develop chemical insecticides. These are sprayed on crops. However these insecticides are generally only useful for a few years as the insects develop a resistance to the crops. This is because the insecticide didn't succeed in killing all the insects and because some insects had a resistance to the spray. These resistant insects then reproduced and passed on their genes. Eventually, no insects died when sprayed.

Although triggered by humans, the development of resistance to insecticides is an example of natural selection.

## Natural selection in bacteria

Another example of human triggered natural selection can be seen in bacteria.

Bacteria are microscopic single-celled organisms. Some bacteria cause disease so antibiotics were developed to fight bacteria. After some time it was realized that some bacteria were naturally resistant to the chemical antibiotics. These resistant bacteria survived and reproduced. Through natural selection bacteria become resistant to different antibiotics.

## KEY POINTS

- Evolution is genetic change in a population from one generation to another.
- Natural selection is a mechanism for evolution through variation, selection pressures and reproduction.
- Continuous evolution over many generations can result in the development of new varieties and species.

