

NATURAL SELECTION EXPLAINED

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(1) Sometimes people mistakenly credit Charles Darwin for coming up with the concept of evolution, but he did not. Evolution, the idea that characteristics or traits within a population of a species can change over long periods of time (many generations), was around before Darwin was even born. What Darwin should be credited for is coming up with a theory that explains the main mechanism (the cause) that drives evolution. He called this mechanism “natural selection”.

(2) The term natural selection can be broken down into two parts. “Natural” refers to the natural environment that surrounds a population. This environment includes the habitat, climate, food resources, predators, parasites, competitors and many more factors that affect a population. “Selection” refers to the fact that individuals in a population will possess different traits (ones determined by genes) and some of these traits will be selected **for** and passed on to the next generation whereas some traits are not as likely to be chosen so they will be selected **against** and not be passed to the next generation. If certain traits/genes in a population are being selected **for** or **against**, who or what is doing the selecting? Natural selection, proposes that it is the conditions of the environment itself that selects **for** or **against** traits/genes.

(3) For example, the environment will select **for** genes for large body size in a population when this is a beneficial trait for survival and reproduction in the environment. The environment will also select **against** the genes for small body size if this is not as beneficial. This results in larger individuals surviving to reproduce and pass on their genes for larger body size to the next generation. Over many generations, the population will have a larger body size. If, however, the environmental conditions change and a smaller body size becomes more beneficial in the new environment, then genes for smaller body size will begin to be selected **for** and genes for larger body size will be selected **against**.

(4) This is what has happened to the evolution of insects and arthropods. Giant 9 foot millipedes, 3 foot long scorpions and dragonflies with 2.5 foot wingspans thrived in



Dark and light colored peppered moths.

prehistoric times, yet their modern day ancestors are much smaller in comparison. This means that nature began selecting **for** smaller body sizes due to changing environmental conditions. In the Carboniferous and early Permian Period (350–250 million years ago) giant forests pumped out a lot of oxygen into the air. The ancient atmosphere contained 30%-35% oxygen as compared to the 21% oxygen that our air currently contains today. Insects and arthropods do not have lungs so they depend on a network of tiny tubes, called tracheae, to transport oxygen throughout their bodies. Without lungs, insects and arthropods cannot forcibly move air into their bodies. Oxygen-rich air allows for insects to have larger bodies, but when oxygen is reduced, trying to supply enough oxygen to a large body becomes a challenge and a disadvantage. With less atmospheric oxygen, it became more beneficial to have a smaller body that was easier to supply with oxygen. Thanks to decreased oxygen levels and natural selection, we don't have to worry about foot long cockroaches!

(5) Another famous example of evolution by natural selection involves the change in color of the peppered moth from light colored to dark colored in England in the 19th century. Earlier in that century, almost all the moths were light colored. As England began its industrial revolution, more factories were built and burned coal which covered the landscape in dark soot (the powdery remains of burned coal). Before industrialization, the light bark of the trees in England matched the light color of the moths which provided the moths with good camouflage against predatory birds. The moths' light colored trait was selected **for** by its clean preindustrial environment. As the industrial revolution progressed and the trees became more covered in soot, the lighter

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colored moths began to stand out against the dirty dark tree bark which made them easier to spot by predatory birds. Only the darker moths were camouflaged enough to avoid being eaten. The industrial environment full of soot covered trees selected **for** the dark colored moth genes and **against** the light ones. In less than 100 years, almost the entire peppered moth population in cities were transformed from light to dark.

(6) As opposed to natural selection, artificial selection involves humans, instead of nature, as the agents of selection. In artificial selection, humans choose the traits they prefer the most to breed into plants and animals. When humans find plants or animals with traits

they prefer, these individuals are chosen for breeding because we want the offspring they produce to exhibit the traits we have selected. We have selected **for** traits like increased milk production in cows, increased sweetness and size in fruits, and certain physical features in purebred pets. Unlike natural selection, this type of selection does not usually make an organism better suited to surviving in the wild, it only makes them more attractive for human uses. For example, though bigger heads are desired in British bulldog purebreds, they have been bred to have such large heads that 80% have to be delivered by Caesarean section. The bulldog pups' heads are so large that they are easily trapped inside the birth canal which leads to the death of the mom and pups.

Article Questions

- 1) What is Charles Darwin famous for proposing?

- 2) What is natural selection?

- 3) There is a certain type of fish in a lake. Fisherman can catch the largest of these fish using nets. They don't like the little fish and most of the smaller ones can get through the holes in the nets. After a few decades of this type of fishing, how do you think this fish population may change? Use the ideas explored in this article to give an explanation for your answer.

- 4) You are a sheep farmer that sells the wool of the sheep for profit. Your farm can only support a certain number of sheep at any given time. What can you do to make sure that you will have the largest profit? Use ideas explored in this article to guide your answer.

- 5) Pick one trait in humans you think might be selected **for** in our modern day environment? Support your answer with evidence.