Around 1.8 million species on earth have been identified and named but many more are undiscovered, the total number of species on the planet can r**ange from 5 million to 100 million**. Almost every one of the 7.3 billion people alive in 2014 are **similar enough to be recognised as humans and yet different enough to be distinguished from one another.**

Genetic Diversity:

DNA determines the variety of proteins that make up each organism. Genetic similarities and differences between organisms may be described in terms of variation in DNA.

Genetic diversity is described as: **the total number of different alleles in a population. A population is a group of individuals of the same species that live in the same place and can interbreed.**

A species consists of one or more populations. The greater the number of different alleles that all members of a species possess, the greater the genetic diversity of that species. Genetic diversity is reduced when a species has fewer different alleles. The greater the genetic diversity, the more likely that some individuals in a population will survive an environmental change.

This is because of a wider range of alleles and therefore a wider range of characteristics. This gives a greater probability that some individual will possess a characteristic that suits it to the new environmental conditions**. Genetic diversity is a factor that enables natural selection to occur.**

Natural selection in the evolution of populations:

Not all alleles of a population are equally likely to be passed to the next generation. This is because only certain individuals are reproductively successful and so pass on their alleles.

Reproductive success and allele frequency:

Differences between the reproductive success of individuals affects allele frequency in populations. The process:

1. within any population of a species there will be **a gene pool containing a wide variety of alleles.**
2. **Random mutation of alleles within this gene pool may result in a new allele of a gene which in most cases will be harmful.**
3. However, in certain environments, **the new allele of a gene might give its possessor an advantage over other individuals in the population.**
4. These **individuals are more likely to obtain the available resources and so grow more rapidly and live longer. As a result, they will have a better chance of breeding successfully and producing more offspring.**
5. Only those individuals that **reproduce successfully will pass on their alleles to the next generation.**
6. As **these new individuals also have the new 'advantageous' allele, they in turn are more likely to survive = reproduce successfully.**
7. Over **many generations the number of individuals with the new 'advantageous' allele will increase at the expense of the individuals with the 'less advantageous' alleles.**
8. **Over time, the frequency of the new 'advantageous' allele in the population increases while the 'non-advantageous' decreases.**

Genetic diversity and adaptation

The 'advantageous' allele depends on the environmental conditions at any one time.

Natural selection in action:

The peppered moth normally has a light colour that camouflages it against the light background of the lichen covered trees on which it rests. In 1848 a dark form of the peppered moth appeared in Manchester. At this time, most buildings, walls and trees in the city were blackened by the soot from 50 years of industrial development.

Genetic Diversity between plant, mountain goat and butterfly.