# 5.7 Evolution

The process of evolution and the evidence pointing towards it

## The evidence for evolution

The most common evidence for evolution is **fossils**. Darwin in particular had an interest in fossilised organisms and studied them in detail. These fossils appeared in rocks formed over long periods of time. Darwin observed that of the fossils he looked at, the organisms changed slightly over time.

Since Darwin, many more fossils have been located which point towards evolution. These more recent fossils have identified the development of the *Homo* genus (in particular the human), and famously the evolution of the modern horse (genus *Equus*) has been well documented in the **fossil record**. Also, the fossil record can be used to identify linking organisms between major groups, such as the ***Archaeopteryx*** which appears to be one of the earliest birds, but shows many typical features of reptiles.

More recent evidence, other than fossils, comes from biological molecules and DNA. Biological molecules are important in that **cytochrome C**, a protein which is used in respiration, and therefore *all* living organisms (except the prokaryotes) must have it, and other protein molecules show certain patterns such as when two closely-linked organisms are observed as having identical or similar biological molecules. DNA coding also presents evidence, such as with humans and their closeness to other primates. We share 98.8% of our coding sequences to chimpanzees, 98.4% to gorillas and 93.4% to baboons.

Your course requires that you appreciate that *variation*, *adaptation* and *natural selection* are all major components of **evolution**. Evolution is a long, but fairly simple, process:

1. Variation must occur before evolution can take place
2. Once variety exists, then the environment can "select" – it will select those variations giving an advantage
3. Individuals with an advantage will survive and reproduce
4. Therefore they pass on their advantageous characteristics (inheritance)
5. The next generation will be better adapted to their environment (adaptation)

Note that it is **genetic variation** that is important here, variation due to environment is not passed on through inheritance.

### *The link between evolution and biodiversity*

There is a clear link between the process of evolution and the level of **biodiversity** (see 5.9 Biodiversity). It is possible for a new species to evolve from a part of an already-existent species (this process is called *speciation* – see 5.6 Speciation), which essentially means two species have resulted from one. This will of course *increase* diversity.

### *Evolution today*

Evolution is happening all the time, even now. At any time, a species (or group of organisms) can be placed under a new selection pressure, so different variations will be selected, and evolution will occur. This is most obvious in the organisms with a shorter life cycle, rather than those where generations take place over decades.

**Insects** provide a good example. They are pests, and we have devised very clever ways of killing them, but no matter how hard we try some always survive. Pesticides are chemicals designed to kill pests, specifically insecticides for insects. An insecticide is a very strong selective pressure, and susceptible insects will die. If it has some resistance, it will survive, allowing it to reproduce and pass on its resistance. Resistance will therefore quickly spread through the whole population. This is an example of evolution.

The same happens with microorganisms. Using antibiotics on **bacteria** will kill most usually, but sometimes some are resistant. They are never completely resistant, the antibiotic usually has some effect on a bacterium, but some bacteria are more resistant than others. This resistance can be passed on as bacteria multiply: again a form of evolution.