5.1.1 Evolution and Totality of fossils

Evolution: Change in the heritable characteristics of a species

Direct Fossil: Bones, teeth, shells, leaves etc

Indirect Fossil: footprints, tooth marks, tracks, burrows etc.

The fossil record reveals that changes occur over time in the features of organisms on the planet.

The law of fossil succession - organisms are not found randomly but in rocks of particular ages in a particular order, suggesting that modern organisms evolved from ancestral species (speciation).

Transitional fossils - intermediary forms over the evolutionary pathway from a single genus, provides evidence for evolution - eg. birds from prehistoric reptiles

The fossil record demonstrates that prokaryotes precede eukaryotes, and that invertebrates precede vertebrates.

The fossil record is incomplete - fossilization requires specific circumstances to occur, and only the hard parts of an organism is preserved.

Radioisotope dating & carbon dating can help determine the age of fossils

Gradualism: Gradual change from common ancestors over time, eg. Galapagos finches

Punctuated Equilibrium / Catastrophism: (Cambrian explosion): a long period of no change, and a catastrophic event that causes a short and sudden period of big change , eg. volcanic eruptions

5.1.1 Selective Breeding

Artificial selection by man to produce desirable traits in an animal's offspring

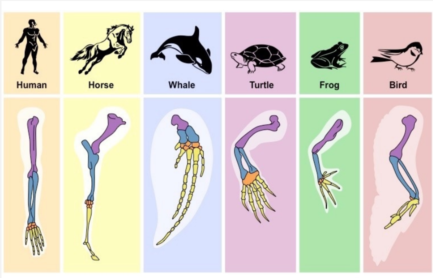
As a result, domesticated breeds of animals can vary compared to the wild counterpart.

Examples: Racing horses (speed), draft horses (endurance), sheepdogs (herding), cattle (increased milk or meat), greyhounds (racing)

5.1.2 Homologous / Analogous Structures

Homologous Structures	Analogous Structures
inherited from a common ancestral origin, does not necessarily have the same function	inherited from different ancestral origins, may have similar function but different bone structure and origin
appearance and function diverge over time to make use of environmental niches (**Adaptive radiation / divergent evolution**). The more similar the structures, the more likely they are closely related	selective pressure / similar habitats and diets causes the structures to become similar in function or appearance (**Convergent evolution**)
the feature is adapted to suit various environmental needs	different species evolve the trait independently
example: pentadactyl limb (humans, horse, cats, whales bats)	example: human eyes and octopus eyes, wings of insects and birds, tail fin of orca and shark
the pentadactyl limb evolved to suit environmental niches for locomotion, eg., galloping, flying, swimming, using tools in humans	the eyes of the human and the octopus evolved independently out of a need to see. wings in insects and birds evolved independently out of a need to fly
homologous genes, DNA, embryo structure and other biological molecules are used to determine homologous structures and evolutionary relationships	

5.1.2 Pentadactyl Limbs



Pentadactyl Limb

Limb Structures

Single proximal bone (front / top bone) - humerus, femur

Two distal bones (back / bottom bone) - radius & ulna, tibia & fibula

Group of wrist / ankle bones - carpals, tarsals

Series of bones, 5 digits - metacarpals & phalanges, metatarsals & phalanges

Evolutionary differences can be seen in the varying length and thickness of the bone. Some metacarpals and phalanges (finger bones) were lost in the penguin's forelimb.

5.1.2 Speciation

Where populations of a species gradually diverge into separate species (ie, they cannot interbreed to produce fertile offspring)

Biological separation: species cannot interbreed due to biological obstacles such as size or number of chromosomes

Geographical separation: species cannot interbreed due to geographic obstacles - often occurs after a species extends its range by migrating to an island & is why Australia has many endemic species (only found in a certain geographical area)

Continuous variation across a geographical range of related populations match the concept of gradual divergence - as speciation occurs gradually, it can be difficult to group for species and variation

Continuous variation between populations provide evidence for evolution of species and the origin of new species by evolution

5.1.2 Industrial Melanism

An example of how changes to an environment can cause an evolutionary adaptation

Biston betularia - roosts during the day and active at night, are prey to birds

In the countryside / unpolluted areas, peppered moths are dominant as they can camouflage on the lichen to hide from predators

In industrial areas where sulphur dioxide kills lichen and soot darkens trees, melanic moths are dominant as their darker colour can help camouflage against the darker trees and protect against predators.

The dark allele is dominant over the light allele & codes for the moth to make more melanin

In industrial areas, melanic moths were more likely to survive and thus pass on the melanic allele to their offspring