

EVIDENCE FOR EVOLUTION



GEOLOGICAL EVIDENCE - FOSSILS

- Fossils are the remains or signs that a particular organism existed at least 10 000 years ago. They include dinosaur _____, mummified remains in deserts, frozen mammoths, insects in amber, _____ wood, moulds, casts, footprints and trails.
- Fossils are usually found in _____ rocks.
- Fossils are _____ events, and are often distorted or incomplete.
- The structures of fossils resemble many present-day organisms, so palaeontologists infer that they had the same _____ as that of present-day organisms.
- Since few fossils or living specimens of _____ forms (e.g. archaeopteryx, lungfish) exist, creationists argue that evolution has little foundation.
- **Dating of Fossils** is by 3 means:
 1. **Law of Superposition** states that layers of rocks deeper under the ground are than those close to the surface.
 2. **Index Fossils and Correlation** – If layers of the _____ type of rock containing the _____ type of distinctive fossils are found in the _____ location (e.g. on either side of the Grand Canyon), then they are of the _____ age.
 3. **Radioactive Dating** – Many elements have _____ (atoms with the same number of protons but with different numbers of neutrons) that are unstable and radioactive. Half of the original amount can break down over a certain calculated period of time (half- life), and are used to determine the age of rocks and carbon-containing fossils.

For example, when each half of the original mass of Uranium-238 in rocks breaks down to form Thorium-230, the process takes about 80000 years. Another example is when half an original mass of Carbon-14 in fossil remains breaks down, the process takes about _____ years.

BIOLOGICAL EVIDENCE – COMPARATIVE EMBRYOLOGY

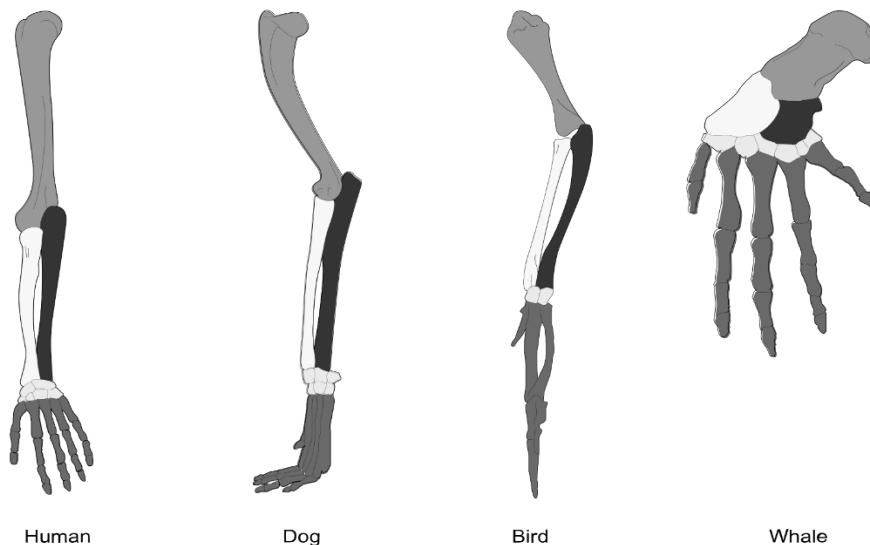
- Comparison of embryos of terrestrial species (e.g. humans, chickens, pigs) show pharyngeal _____ that resemble the gill slits of fish. Also these embryos show _____ in the early gestation period, slowly degenerating before the end of the gestation period.

BIOLOGICAL EVIDENCE – VESTIGIAL STRUCTURES

- Some species have structures that do not _____ at present, but may have functioned in an ancestor (e.g. appendix and wisdom teeth in humans).

BIOLOGICAL EVIDENCE – HOMOLOGOUS STRUCTURES

- **Analogous structures** are anatomical structures that are found in many unrelated organisms. For example, wings of birds and _____ serve the same function of flight. These similar structures do _____ show signs of an evolutionary relationship.
- **Homologous structures** are structures that are similar (e.g. the pentadactyl or five-fingered structure of a human _____ compared with the five-fingered structure of a _____) and also show signs of an evolutionary relationship.



BIOLOGICAL EVIDENCE – VARIATION DUE TO SEXUAL REPRODUCTION

- Asexual reproduction produces organisms or new cells identical to the parent organism or cell.
- Sexual reproduction occurs where a male sperm or a pollen grain combines with the female egg to produce similar but _____ identical offspring. In the event of a major _____ change, many sexually reproducing organisms will survive because of the _____ of characteristics they have.

BIOLOGICAL EVIDENCE – SYMBIOSIS

- Some organisms live amicably inside _____ organisms, sometimes to the benefit of both (e.g. alga and fungus in _____).
- It may be that eukaryotic cells were formed from a smaller _____ bacterium invading a larger cell. Evidence comes from mitochondria and chloroplasts that both contain _____

BIOLOGICAL EVIDENCE – SPECIALISATION IN ALGAL COLONIES

- Colonies of many algal types exist, where each individual algal cell is physically attached to other algal cells, but no interaction occurs between cells.
- However, *Volvox* is a 'ball' of algal cells which have one end responsible for movement, while another part of the 'ball' is responsible for reproduction. This may be evidence for the development of _____ organisms from unicellular organisms.

BIOLOGICAL EVIDENCE – PEPPERED MOTH

- This is observed example of Natural _____
- Before the Industrial Revolution in England, a forest-dwelling moth (*Biston betularia*) grew in 3 shades – light, peppered and dark. As the tree bark was lighter, the most common shade of moth was the peppered one. However, after the soot from the factories darkened the barks of trees in the moth habitat, the most common moth was the _____ one. The reason was probably because the light and peppered moths were no longer _____ and were being by predators. The dark moths then reproduced, changing the gene frequencies of the population.

BIOCHEMICAL EVIDENCE – BACTERIAL RESISTANCE TO ANTIBIOTICS

- This is an observed example of Natural Selection.
- Bacteria do _____ become resistant to antibiotics. Either they carry the genetic trait for resistance or they _____
- Before World War II, there were different kinds of bacteria – some which were resistant to _____ and some which were not. After the widespread use of antibiotics during and after World War II that killed most of the non-resistant bacteria, the resistant bacteria continued to _____ even more due to lack of competition. Their genetic resistance was passed on to subsequent generations. Many of the bacteria that we encounter today are _____ to our present antibiotics.

BIOCHEMICAL EVIDENCE – MUTATIONS

- A mutation is a change in the _____ sequence of a DNA molecule or of a chromosome.
- A mutagen is a chemical or a form of _____ that can cause a mutation.
- Since DNA controls the synthesis of _____ (e.g. skin collagen, hair keratin, muscle myosin, hormones, enzymes, haemoglobin, antibodies), the proteins formed may be affected.

- Mutations can occur naturally. However, they are _____ events (about 1 in every 100000 generations).
- However, mutations of fruit flies are believed to be _____ since mutated flies seem to be in few numbers.
- One of the bases on which the theory of evolution is built is that chance mutations formed new organisms which could no longer mate with the rest of their species and eventually formed new species. However, since mutations observed in fruit fly experiments are so rare and often cause harm to the individuals, creationists argue that evolution in this way is not plausible.

BIOCHEMICAL EVIDENCE – DNA HYBRIDISATION

- The DNA strands of different species of primates can be compared when they are unwound and the strands compared for similarities in _____ sequence.
- DNA of humans and _____ have a much greater similarity (97.6%) than humans and gibbons (94.7%), leading to the idea that humans may have evolved from chimpanzees, and not from _____

BIOCHEMICAL EVIDENCE – AMINO ACID SEQUENCING

- When comparing the amino acid sequence of haemoglobin in various primates, the sequences are also more similar for humans and chimpanzees, than for humans and gibbons.
- Again, an assumption could be made that _____ evolved from chimpanzees.