

## **EVOLUTION ANSWERS**

1. The embryos of different chordates have remarkably similar shapes overall, and also possess a tail which degenerates in some chordates such as humans.
2. Vestigial organs which no longer function in humans are the appendix and wisdom teeth.
3. Homologous structures are those similar structures in different animals which carry out the same function e.g. teeth for biting and grinding, limbs for mobility.
4. Proteins such as haemoglobin and antibodies differ markedly between more unrelated animals such as a horse and a human, but are more similar between a chimpanzee and a human. Since proteins are made from DNA, this would indicate similarities of the DNA structure between species that are closely related, which evolutionists may interpret as these species descending from a common ancestor.
5. There are 5 types of adaptations:
  - \* structural (e.g. streamlined structure of fish)
  - \* physiological (e.g. hibernation of animals in cold climates)
  - \* colour (e.g. camouflage, mimicry)
  - \* behavioural ( e.g. nocturnal feeders in hot climates)
  - \* reproductive (e.g. peacock's feather fanning to attract hen)
6. Each species has adaptations that help it survive better in its surroundings. Each individual in each species also has its own features that are either poorly or better suited to its environment. Hence some individuals will survive better than others.
7. The ability to rapidly grow roots following rain can be an adaptation that allows the plant to take in water in arid areas, and hence increase the chances of survival.
8. (a) Fossils are the remains or signs that a particular organism existed at least 10 000 years ago. Some examples are mummified remains in desert, frozen mammoths, insects caught in amber, petrified wood, footprints and trails, carbonised fern remains, and dinosaur bones.

8. (b) Fossils are usually found in sedimentary rocks made of successive deposits of particles such as clay and sand over time. Prehistoric marshes were probably the most common burial site for fossilised organisms, as a quickly distributed layer of clay or sand particles could cover the dead organism, depleting the oxygen supply to the decomposing bacteria which would normally decompose the remains.

8. (c) Organisms such as jellyfish contain too much soft tissue and are not found as often as are organisms with exoskeletons such as trilobites. Also the conditions required for the formation of the fossils described in Q8(b) are rare.

8. (d) It is assumed by palaeontologists that the lives of prehistoric organisms bear a resemblance to the lives of present-day organisms. For example, the molar teeth of animals today are used for grinding certain kinds of food, and it is assumed that a fossil animal with molar-like teeth ate the same kind of food. Examination of fossil limb structure, stomach contents and teeth type give indications to the structure, movement type and diet of fossilised animals. If fossil remains are found in coal veins, the animal probably lived in a prehistoric forest. If the remains are found in a fossilised burrow, the animal probably lived there in life. Fossil remains in the same location of animals of the same species but of differing ages may indicate the animals had a social structure like a family group.

9. Conditions for fossilisation to occur are very rare. Many organisms with much soft tissue would either not have fossilised or have been distorted in the process. Other earth movements such as volcanoes or earthquakes may have destroyed or distorted fossils. On the other hand, the creationist view is that the intermediary organisms which might support a continuous evolution may not have existed.

10. Fossils formed in the way described in Q8(b) would occur in areas of still water such as marshes and ocean beds unaffected by waves. The activity of decomposing bacteria also must be reduced by either rapidly depleting the oxygen supply when the organism is quickly enveloped in a layer of silt or sand, or by very cold or very dry conditions. Best represented in future fossil phyla would be organisms with little soft tissue, e.g. cockroaches, plants with thick bark. It should be noted also that much of our processed food such as hot dogs contain preservatives that inhibit bacterial growth, are also possible candidates for future fossilisation if buried deep in rubbish dumps.

11. Angiosperms are flowering plants, many of which which require pollination by birds or insects. It is thought flowering plants appeared on the earth at the same time as birds and insects as they have a mutual relationship.

12. Fossils found in layers deep under the earth's surface are assumed to be older than those closer to the surface. Radioactive dating of either the fossil (carbon-14 dating) or the rock in which it is found gives an approximate age. Also index fossils (e.g. trilobites) which occurred at a certain time in history are used to state that layers of rock in different locations are of the same age if they contain these index fossils.

13. Isolation is of 3 types:

\* geographic (e.g. birds on different islands, wind-pollinated plants on different sides of a mountain)

\* behavioural (e.g. nocturnal and diurnal feeders which will not interbreed)

\* reproductive (e.g. specific frog mating calls that are not understood by another frog group)

14. The Continental Drift Theory states that all the continents were once joined about 200 million years ago, and probably had common ancestors of all existing organisms on all continents then. The continents have since moved to the present positions.

15. It is thought that during the Mesozoic era, Australia and New Zealand were separated from the rest of the world and had their own climate and topography, and that the primitive marsupial and monotreme mammals never had any competition from the placental mammals which eliminated the marsupials and monotremes in other parts of the world.

16. (a) Before each of these natural events, common ancestors were widespread. Isolation by these natural phenomena allowed individuals of the same species to be geographically isolated, and then to pass on only their characteristics to successive generations.

16. (b) Earthquakes, changes in the earth's magnetic field.

17. If the frogcalls' purpose was for attracting a mate, a difference in the mating call could lead to reproductive isolation.

18. Major climatic changes (e.g. Ice Ages, volcanic eruptions spewing widespread ash), earth's magnetic field changes, or cosmic catastrophes (e.g. impacts by meteorites, near-misses by comets) could cause sporadic evolutionary changes.

19. Variation is caused by mutations, chromosomal changes during meiosis and mitosis, and the varying combinations of chromosomes in sexual reproduction.

20. More variation of chromosomes occurs during meiosis and following sexual reproduction, and this gives rise to a variation in sexually-reproducing individuals who can have adaptations which allow faster evolution to take place.

21. The shorter the life-span, the faster would be the evolutionary process. Genetics experiments that are conducted in laboratories to study this, are performed with fruit flies rather than animals with longer life-spans.

22. Migration, Isolation and Adaptation all change the Gene Frequencies of the species in that area, thus leading to the possible formation of separate species.

23. The Natural Selection Theory has 3 main parts:

\* Gene Pool has genetic Variation due to mutations, chromosomal changes during meiosis and mitosis, and sexual reproduction which causes various combinations of chromosomes from the gametes. (e.g. The finches of the Galapagos Archipelago showed much variation of beak characteristics.)

\* Migration, Isolation and Adaptation cause changes in the Gene Frequencies between one area and another. (e.g. Finches with beaks best-adapted for the diet of their particular island increased in number and were distinctly different from those of other islands with other diets.)

\* A new Species forms. The different species can no longer interbreed to form fertile offspring. (e.g. The finches on different islands of the Galapagos Archipelago cannot interbreed.)

24. A Species is a taxonomic classification for a group of organisms which are alike in their structural and functional characteristics probably due to a common ancestry, and which in nature breed only with each other to produce fertile offspring.

25. "Survival of the fittest" describes only the ability of better-adapted organisms to perform better in their environment and hence pass that characteristic to their offspring.

For a more complete description of the Theory of Natural Selection, refer to Q23.

26. The species does not possess the adaptive characteristics to survive in changing climatic changes or other natural phenomena. Therefore the species dies out and becomes extinct. The most plausible theory for dinosaur extinction is that they died out when a 10 kilometre-wide asteroid slammed into the earth 65 million years ago.

27. The genes of these individuals would become less frequent in the gene pool, and may even disappear completely. Hence some characteristics of these individuals would disappear from the species.

28. Through mutations, individual bacteria will contain the genes of antibiotic resistance. The numbers of these bacteria will increase, while the numbers of non-resistant bacteria will decrease in the bacterial population over many years. Some decades ago, doctors squirted a small amount of the liquid antibiotic that was in syringes into the air to remove any air bubbles before giving the injections. This led to the proliferation of antibiotic-resistant bacteria becoming endemic in hospitals. The present-day practice is to squirt a small amount of the liquid into a cotton wool ball which is then carefully disposed.

29. In Britain in the 1950's, there were peppered moths (*Biston betularia*) with both dark and light colourings. With increased pollution, the bark of forest trees, which was the natural habitat of the moths, darkened. Those darker moths which were better camouflaged to avoid predators increased in number in the population, and those lighter moths were preyed upon and reduced in frequency in the peppered moth population.

30. In the European population, those individuals with inborn ability to survive measles, were prevalent, as those without such immune ability had probably died or reduced in number over many centuries. When the aboriginal Australians were exposed to measles after European settlement, those individuals with an inborn immunity to measles would have thrived, and others without immunity would have been more greatly affected by measles.

It is said that when the Spanish Conquistadores invaded the Aztec lands of Mexico, many Aztecs were killed by warfare, but the majority died as a result of introduced European diseases.

31. (a) Divergent Evolution shows adaptive radiation where a single ancestral type gives rise to several descendant lines that are adapted in different ways to different environments.

31. (b) Convergent Evolution is the evolution of similar sets of characteristics in groups of quite different evolutionary ancestry (e.g. development of wings in flying reptiles, birds, mammals and insects).

31. (c) Parallel Evolution is the evolution of similar organisms (e.g. marsupials) in quite different locations such as on unconnected continents.

32. To maintain gene banks with a wide variety of different seed types with great variation of characteristics of disease-resistance, flour-productivity and climatic durability, would allow scientists of the future to have at hand a wider range of genetic weaponry to combat future diseases that are not presently so recognizable, or to overcome future problems associated with increased global warming and carbon dioxide levels.