Evolution (Darwin's Part)

Chapter 17--Topics 4.3, D2, D3 and D5

Chapter Outline:

People before Darwin—

- Lamarck---Stated that organisms passed acquired traits to their offspring
    - The long neck of the giraffe developed when a short-necked ancestor stretched its neck to reach the trees—its offspring inherited the longer neck, which stretched still further as they ate

Darwin—

- Evolution—the accumulation of inherited changes within populations over time
- Population—group of individuals of one species that live in the same geographical area at the same time
- Darwin studied birds and reptiles of the Galapagos—mainly finches
    - Each finch had a different beak, the beaks were adapted to get different foods
- Originally, before Darwin, scientists believed that island coastal life and island inner life were the same, but Darwin proved them wrong through his finches
- Natural Selection—the survival of the fittest—basically one organism will possess a more dominant better trait, and will therefore survive better and therefore pass that trait on.
- Artificial Selection—proved Darwin's theory—human interference in natural selection
- Adaption—modification that improves chances of survival and reproduction success—may lead to a new species

Darwin's Mechanisms of Evolution by Natural Selection--

1. Variation—
    a. Individuals in a population exhibit variation—different traits (color, size..)
2. Overproduction—
    a. The reproductive ability of each species causes its populations to geometrically increase in number over time.
        i. Each generation a species has the ability to produce more than is needed
            1. Turtles
3. Limits on Population Growth—
    a. Struggle for existence
        i. There is only so much food, water, sunlight, space etc…
        ii. Organisms compete with each other for these resources
        iii. Other limits on growth include predation, disease and harsh weather
4. Differential Reproductive Success—
    a. Those individuals that possess the most favorable combination of traits (those better suited to the environment) are more likely to survive.

Synthetic Theory—

- Combination of several theories of evolution
- Explains why and how natural selection occurred---through **Mutation**
- Scientists say that chance has zero effect on mutation and evolution

Fossil Records—

- Greatest asset and record for evolution

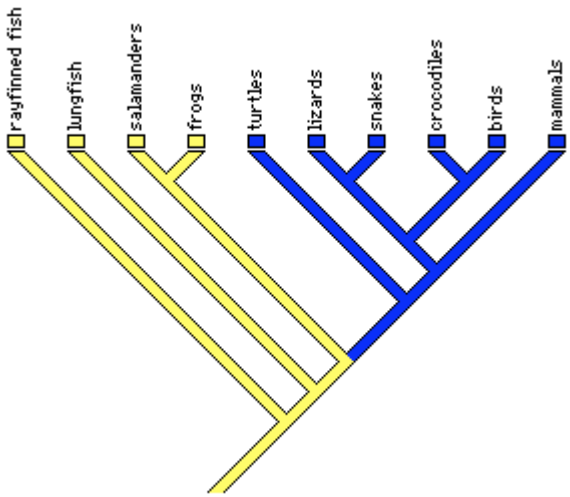
- Fossil—remains or trances typically in Sedimentary rock by previously existing organisms
- Fossil Index—fossil records
- Fossils are generally biased however—aquatic and hard bodied animals are shown better and last longer in the fossil index
- The big question with the fossil record is, that it should show transgression and evolution over time, animals mutating, but still keeping a similar structure to their ancestors—**Not enough fossil evidence to show this**

Features—

- Homologous features—features that are derived from the same structure in a common ancestor
    - Human arm, Fin, cat limb and bat wing all have different appearances, but same bone structure and nerve system
- Homoplastic Features—structurally similar features that are not homologous but simply have similar functions in distantly related organisms
    - Variation of wings—insects, birds
    - **Convergent Evolution**—Homologous structures help determine this evolution, things evolve in different places similarly
- Vestigial Structures—nonfunctional or degenerated structures
    - Appendix

Phylogenic Tree—

- Evolutionary history of a group of related species



Topic Questions:

D.2.1. Outline Lamarck's theory of evolution by the inheritance of acquired characteristics.

According to Lamarck's theory of evolution, an organism would acquire characteristics throughout its lifetime that it would then pass on to its offspring. An example Lamarck uses is the giraffe. He says that a short-necked ancestor of the giraffe stretched its neck which it then passed on to its offspring who, throughout its life stretched its neck and then passed on that longer neck to its offspring. Lamarck states that this cycle continues until the organism has acquired the perfect new characteristic.

D.2.2. Discuss the mechanism of, and lack of evidence for, the inheritance of acquired characteristics.

Lamarck's theory of evolution by the inheritance of acquired characteristics was discredited by Charles Darwin's theory of evolution by natural selection and by the discovery of genetics.

D.2.3. Explain the Darwin-Wallace theory of evolution by natural selection.

The theory of natural selection states that better adapted organisms are more likely to survive and become the parents of the next generation. These organisms fit in better with the environment and they have a greater ability to reproduce.

D.3.2. Outline how remains of past living organisms have been preserved.

Include petrified remains, prints and moulds, and preservation in amber, tar, peat, and ice.

Past living organisms are often preserved as fossils. A fossil is any trace of an organism that had lived in the past. Fossils can be preserved as petrified remains, prints, or molds. Not only can organisms be preserved in those ways, but they can be preserved in different materials, such as tar, amber, peat, and ice.

D.3.3. Outline the method for dating rocks and fossils using radioisotopes, with reference to ^{14}C and ^{40}K.

Knowledge of the degree of accuracy and the choice of isotope to use is expected. Details of the apparatus used are not required.

Rocks and fossils can be dated 3 different ways; relative position in the rock strata, index fossils, or radioisotopes. Radioisotopes are usually used in dating rocks and fossils because the half-life of an element is always constant and accurate. ^{14}C, carbon 14, is used the most because most everything contains carbon. ^{40}K, potassium 40, is used most often because it has an extremely long half-life. ^{40}K, is helpful in dating very old rocks and fossils.

D.5.1 State that mutations are changes to genes or chromosomes due to chance, but with predictable frequencies.

Mutations are changes to changes or chromosomes due to chance but with predictable frequencies. A fruit fly species in Europe possessed larger wings in the north than in the south. This species was then introduced into North and South America. 20 years later, it was found that the species in the north had larger wings than those in the south.

Thus, natural selection appears to be a more important agent of evolutionary change than chance. If chance were the most important factor influencing the direction of evolution then fruit fly evolution would not have proceeded the same way on two different continents.

D.5.7 Discuss the definition of the term species.

Species comprises a group of organisms with similar structure, function, and behavior that are capable of interbreeding with one another.

D.3.4 Define half-life.

The period of time required for one half of the atoms of a radioisotope to change into a different atom is known as its half-life.

D.3.7 Explain the biochemical evidence provided by the universality of DNA and protein structures for the common ancestry of living organisms.

Organisms owe their characteristics to the types of proteins that they possess, which in turn are determined by the sequence of nucleotides in their mRNA, specified by the order of nucleotides in their DNA. Evidence that all life is related comes from the fact that all organisms use a genetic code that is virtually identical. The universality of the genetic code is compelling evidence that all organisms arose from a common ancestor. The genetic code has been maintained and transmitted through all branches of the evolutionary tree since its origin in some extremely early organism.

Because a protein's amino acid sequences are coded in DNA the differences in amino acid sequences indirectly effect the nature and number of underlying DNA base-pair changes that must have occurred during evolution.

D.3.10 Explain the evidence for evolution provided by homologous anatomical structures, including vertebrate embryos and the pentadactyl limb. Homologous anatomical structures are structures derived from the same part of a common ancestor. The limb bones of mammals are homologous features. A human arm, a cat forelimb, a whale front flipper and a bat wing are different in appearance but have a similar arrangement of bones, muscles and nerves. This similarity is particularly striking because arms, forelimbs, flippers and wings are sued for different types of locomotion, and there is no overriding mechanical reason for them to be so similar structurally.

D.3.11 Outline 2 modern examples of observed evolution. 1. Darwin noted that the Galapagos finches evolved by changes that accumulated in geographically separated populations. The 13 species are all descended from a single species that found its way from the South American mainland. The different islands of the Galapagos kept the finches isolated from one another, thereby allowing them to diverge into 13 separate species – 6 seed eaters, 6 insect eaters and one woodpecker type.