

## 8. EVIDENCES FROM BIOCHEMISTRY AND PHYSIOLOGY

The most convincing evidence of common ancestry comes from the similarities in the biochemical composition, reactions and physiological activities of living beings—

**1. Metabolic processes**—A remarkable similarity is noticed in the biochemical processes occurring during metabolism in all living beings from bacteria to man and in all plants and animals. For example, the process of protein synthesis, biosynthesis of various organic molecules in the body and catabolism of organic substances during respiration involves the same biochemical reactions and the same organic substances. For example, energy in all living beings is released by the biological oxidation of glucose and is stored in ATP. The various biochemical pathways involve identical steps or reactions.

**2. Enzymes**—In the above mentioned biochemical pathways the various steps are regulated by the same enzymes from bacteria to man and all plants.

In all animals the same digestive enzymes are present, for example, trypsin digests proteins and amylase helps in the digestion of starch.

**3. Cytochrome C**—It is a respiratory pigment present in all eukaryotic cells. It forms a part of the electron transport system and in all eukaryotes accepts electrons from  $H^+$  ions. It is formed of 104 amino acids.

- (i) In chimpanzees and humans cytochrome-C molecules are identical.
- (ii) Cyt. C of *Neurospora* differs from human's cyt. C in 44/104 amino acid position.

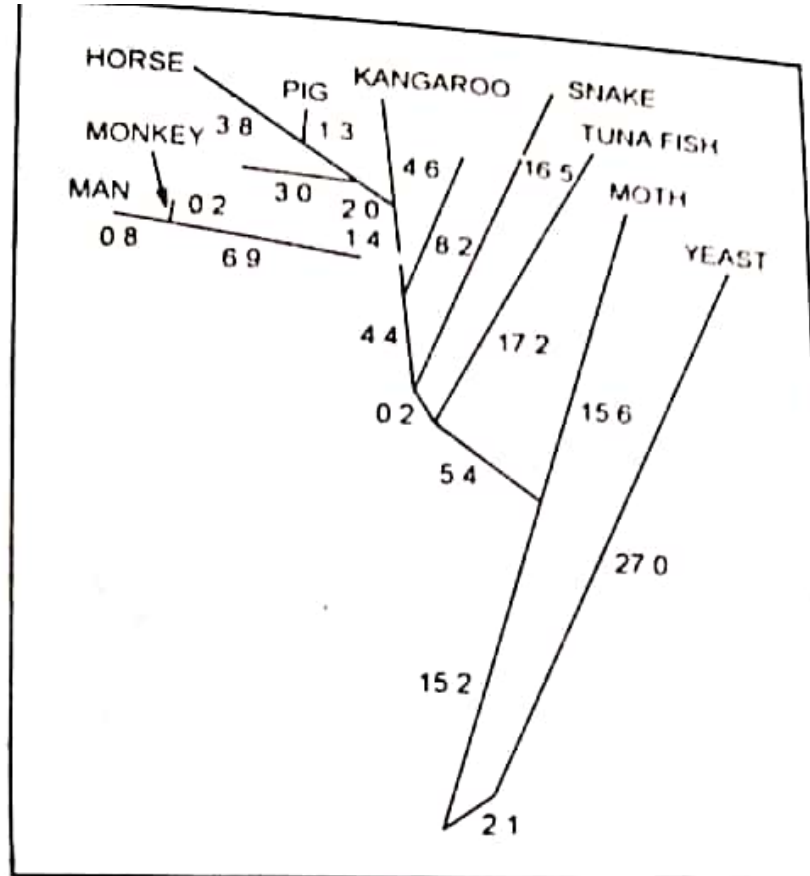


Fig. 3.35. Phylogenetic tree of living beings prepared by computer analysis of cytochrome-C.

**4. Insulin**—Insulins analysed from different animals (beef, sheep, pig, whale, horse, rabbit) differ only in one to three amino acid positions. Beef insulin is so similar to human insulin that it has been used for treatment of human diabetes. Even human immune system fails to detect the differences.

**5. Hormones**—In the same manner similar or identical hormones are found in large number of animal groups. **Thyroid hormone** which is found in all vertebrates is found to be identical and interchangeable. Beef thyroid can be used in the treatment of human thyroid deficiencies and even human thyroid can induce metamorphosis in frog tadpole.

**6. Haemoglobin**—Haemoglobin is a conjugated protein. It is formed of two identical alpha chains and two identical beta chains. Each alpha chain has 141 amino acids and each beta chain has 146 amino acids.  $\beta$ -chain of haemoglobin of human and gorilla differ in one amino acid, of human and pig in ten amino acids and of human and horse in 26 amino acids.

The above account makes it clear that gorilla is the nearest living relative of human beings and that the two species have evolved from a common ancestor.

**7. Blood and lymph**—The body fluids like blood, lymph and tissue fluid are similar in their composition and physiological role in all vertebrates. This indicates relationship among vertebrates. All vertebrates have haemoglobin in their RBCs, but in annelids it is dissolved in plasma.

**8. Blood groups**—Blood groups also help in tracing out relationship. Human beings have four blood groups A, B, AB and O. Apes are found to possess blood groups A and B but not monkeys. This indicates human beings are more closely related to Apes than to monkeys, though they have common ancestry.