EVIDENCES IN FAVOUR OF EVOLUTION

COMPARATIVE ANATOMY

The study of comparative anatomy predates the modern study of evolution. Early evolutionary scientists like Buffon and Lamarck used comparative anatomy to determine relationships between species. Organisms with similar structures, they argued, must have acquired these traits from a common ancestor. Today, comparative anatomy can serve as the first line of reasoning in determining the relatedness of species. However, there are many hidden dangers that make it necessary to support evidence from comparative anatomy with evidence from other fields of study.

Homology

These are organs that are similar embryologically but serve different functions in different organisms. This phenomenon is known as homology.

- Homology in plants: Thorns of a Bougainville are homologous to tendrils in creepers such as a money plant.

- Homology in animals: The structure of the heart in animals is an example of homology. The chambers in the heart are present in most animals -some have 2,3 and 4 chambers are seen in higher vertebrates. The forelimbs are present in all animals but modified to perform different functions- fins in aquatic animals, wings in birds, hands in humans etc.

Analogy

These organs perform the same function in but develop from different structures in different species.

- Analogy in plants: In some plants leaves and in some their stems perform photosynthesis. Here, two differently originated structures perform the same function.

- Analogy in animals: Wings of an insect, bird and a bat(mammal) originate from different structures but all perform the same function of enabling the organism to fly.

Vestigial organs

These organs are non- functional and rudimentary in nature. However, they were very functional in the ancestors of the organism. This occurs due to the decreasing use of the organ which leads it to become small or non- functional in nature. Example of such a structure is the appendix and the wisdom teeth in human beings.

EMBROLOGY

Another difficulty in comparing traits between species rests on the fact that homologous structures not present in the adult organism often do appear in some stage of embryonic development. In this way, the embryo serves as a microcosm for evolution, passing through many of the stages of evolution to produce the current state of the organism. Species that bear little resemblance in their adult form may have strikingly similar embryonic stages. For example, in humans, the embryo passes through a stage in which it has gill structures like those of the fish from which all terrestrial animals evolved. For a large portion of its development the human embryo also possesses a tail, much like those of our close primate relatives. This tail is usually reabsorbed before birth, but occasionally children are born with the ancestral structure intact. Tails and even gills could be considered homologous traits between humans and primates or humans and fish, even though they are not present in the adult organism.

GENETICS

The genetic code is made up of nitrogen bases. These base combinations are almost the same in all the organisms. Certain triplets of amino acid sequences also produce the same proteins in different organisms. This genetic code called the 'universal genetic code' remains identical to a large extent in most organisms proving the possibility of a common ancestry.

COMPARATIVE BIOCHEMISTRY

Although the biochemistry of organisms was not well known in Darwin's time, modern biochemistry indicates there is a biochemical similarity in all living things. This comparison of biochemical processes with ancient species is called **comparative biochemistry.** For example, the same mechanisms for trapping and transforming energy and for building proteins from amino acids are nearly identical in almost all living systems. DNA and RNA are the mechanisms for inheritance and gene activity in all living organisms. The structure of the genetic code is almost identical in all living things. This uniformity in biochemical organization underlies the diversity of living things and points to evolutionary relationships.

Origins and biochemical evidence

By studying the basic biochemistry shared by many organisms, we can begin to piece together how biochemical systems evolved near the root of the tree of life. However, up until the early

1980s, biologists were stumped by a "chicken and egg" problem: in all modern organisms, nucleic acids (DNA and RNA) are necessary to build proteins, and proteins are necessary to build nucleic acids - so which came first, the nucleic acid or the protein? This problem was solved when a new property of RNA was discovered: some kinds of RNA can catalyze chemical reactions — and that means that RNA can both store genetic information and cause the chemical reactions necessary to copy itself. This breakthrough tentatively solved the chicken and egg problem: nucleic acids (and specifically, RNA) came first — and later on, life switched to DNA-based inheritance.

Another important line of biochemical evidence comes in the form of surprisingly common molecules. As you might expect, many of the chemical reactions occurring in your own cells, in the cells of a fungus, and in a bacterial cell are quite different from one another; however, many of them (such as those that release energy to power cellular work) are exactly the same and rely on the exact same molecules. Because these molecules are widespread and are critically important to all life, they are thought to have arisen very early in the history of life and have been nicknamed "molecular fossils." ATP, adenosine triphosphate (shown below), is one such molecule; it is essential for powering cellular processes and is used by all modern life. Studying ATP and other molecular fossils, has revealed a surprising commonality: many molecular fossils are closely related to nucleic acids, as shown below.