Evolution of Human Beings

1.0 *Introduction*

1.1 Three conditions are essentials for evolution of life. First, coming together of molecules that have capacity to reproduce. Second, products of these molecular combinations need to exhibit variation, so that some are better able to take advantage of resources and withstand challenges in the environment. Third, the variation need to be heritable, so that some variants would increase in number under favourable environmental conditions. No one yet knows which combination of molecules first met these conditions, but scientists have shown how this process might have worked.

1.2 Many seminal research papers are on record on the subject of evolution of human beings. Two streams of scientists have mainly contributed in this field. They are Paleontologists and Chemical Biologists. The first group studies fossils to learn about ancient organisms. The second group studies and examines biological molecules, particularly, RNA and DNA sequences. Fossil discoveries produce new evidence about evolutionary history. DNA sequencing establishes genetic relationships among species. DNA evidence has both confirmed fossil evidence and allowed studies of evolution where the fossil record is still incomplete. The two groups of scientists have, however, agreed that biological evolution can best explain the origin and history of our species. Literatures on this subject are abundant. Thus, there is nothing new that one can find in this volume of ***Anuranan***. What we have attempted is to present such a complex subject in a concise and reader-friendly manner.

2.0 *Contribution of Paleontologists*

2.1 The fossil record of long-extinct animals provides evidence of occurrence of evolution and geographical distribution of species. Fossils resembling contemporary organisms appear in relatively young sediments, while fossils distantly resembling contemporary organisms occur in older sediments. Based on these observations, many naturalists, proposed that organisms had changed over time. Others identified natural selection as the driving force behind evolution.

2.2 They found traces of soft-bodied multi-cellular organisms in sedimentary rocks that are 540 to 635 million years old. Worm like creatures were found in rocks that are about one billion years old. Some of these organisms are the intermediate forms between the single-celled organisms that were Earth's sole inhabitants for the initial two to three billion years of life's history and the hard-bodied organisms that were in abundance beginning about 540 million years ago. Many of the organisms were transitional forms between earlier soft-bodied organisms and major evolutionary lineages such as the fishes, arthropods, and molluscs that have survived to the present day. Paleontologists discovered layered rocks known as stromatolites resulted from the actions of bacteria at least 3.4 billion years ago. Age of the fossils of cyanobacteria, known as blue-green algae, is estimated as 3.5 billion years. No fossil evidence of life forms older than 3.5 billion years has yet been found.

2.3 The discovery of fossils of a creature in an outcropping of rock on the side of a hill located in northern Canada is an outstanding contribution of Paleontologists. They named it ***Tiktaalik*****.** Tiktaalik lived during the period when freshwater fishes were evolving the adaptations that enabled four-legged animals to live out of water. Tiktaalik may have lived before or after the ancestral species that gave rise to all of today's limbed animals, including humans. The evolutionary lineage that contained Tiktaalik may have gone extinct or it may have been part of the evolutionary line leading to all modern ***tetrapods***. Fossils from about 330 million years ago document the evolution of large ***amphibians*** from the early tetrapods. Well-preserved skeletons from rocks that are 230 million years old show ***dinosaurs*** evolving from a lineage of ***reptiles.*** A long-standing example of a transitional form is ***Archaeopteryx***, a 155-million year-old fossil that has the skeleton of a small dinosaur but also feathers and wings. More birdlike fossils found in China are about 110 million years old and have smaller tails and clawed appendages. In this way, Paleontologists have uncovered the evolutionary paths of many modern organisms, such as whales, elephants, armadillos, horses, and humans.

3.0 *Contribution of Chemical Biologists*

3.1 Discovery of chemical structures of RNA and DNA and their sequences are the greatest contribution of this group of scientists. It has been found that sequence of nucleotides in DNA can change from one generation to the next because of mutations; if these changes give rise to beneficial traits, the new DNA sequences are likely to spread within a population over multiple generations. In addition, neutral mutations that have no effect on the traits of an organism can be maintained within a population as DNA passes between generations. As a result, DNA contains a record of past genetic changes, including the changes responsible for evolutionary adaptations. By comparing the DNA sequences of two organisms, biologists have uncovered the genetic changes that have occurred since those organisms shared a common ancestor. Biological evolution has explained why other organisms should be studied to understand biological processes critical to human life.

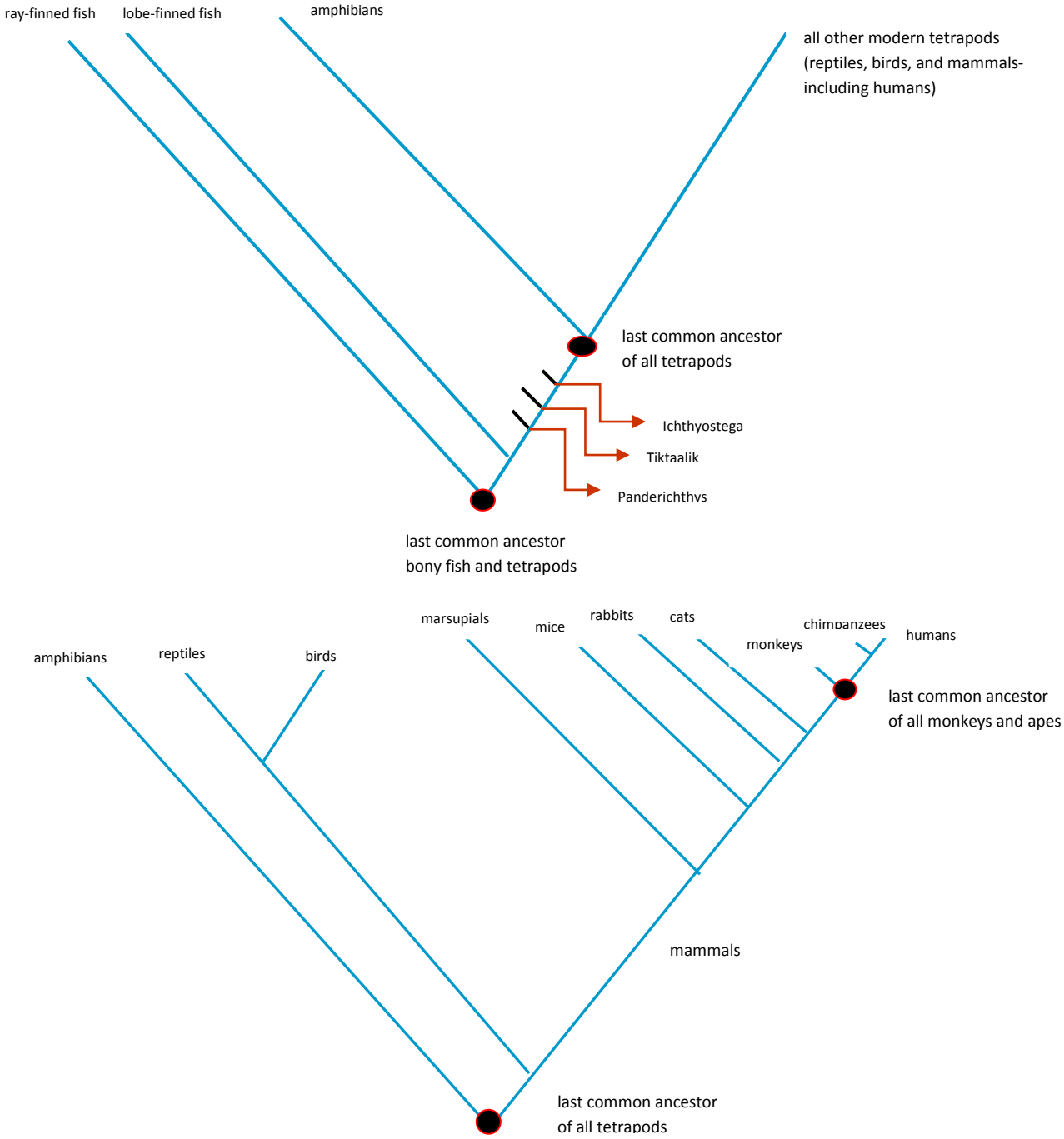
3.2 The study of biological molecules has done more than documenting the evolutionary relationships among organisms. It has helped reveal how genetic changes produce new traits in organisms over the course of evolutionary history. Biologists have discovered that very similar sets of regulatory proteins occur in organisms as different as flies, mice, and humans, despite the many millions of years that separate these organisms from their common ancestors. Critical researches on DNA sequencing has helped to find out the evolutionary lineage of human beings.

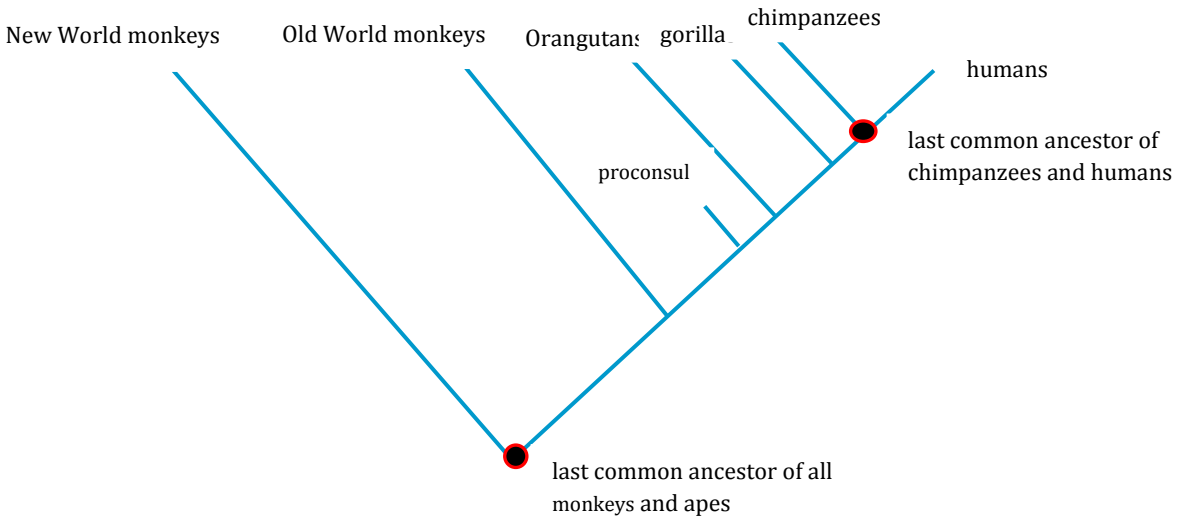
4.0 *Origin and History of our Species*

4.1 Study of all the forms of evidence has led to the conclusion that humans evolved from ancestral primates. In the 19th century, the idea that humans and apes had common ancestors was a novel one, and it was hotly debated among scientists in Darwin's time and for years after. But today there is no scientific doubt about the close-evolutionary relationships between humans and all other primates. Using the same scientific methods and tools that have been employed to study the evolution of other species, researchers have compiled a large and increasing number of fossil discoveries and compelling new molecular evidence that clearly indicate that the same forces responsible for the evolution

of all other life forms on Earth account for the biological evolution of human characteristics.

4.2 The diagram given below would give an idea of evolutionary lineage. Time is represented by the lengths of the lines; modern groups of organisms are listed at the top of the figure.





4.3 The early reptiles split into several major lineages. One lineage led to reptiles, including dinosaurs, and also to birds. Another lineage gave rise to mammals between 200 and 250 million years ago. The evolutionary transition from reptiles to mammals is particularly well documented in the fossil record. Successive fossil forms tend to have larger brains and more specialized sense organs, jaws and teeth adapted for more efficient chewing and eating, a gradual movement of the limbs from the sides of the body to under the body, and a female reproductive tract increasingly able to support the internal development and nourishment of young. Many of the biological novelties seen in mammals may be associated with the evolution of warm-bloodedness, which enabled a more active lifestyle over a much larger range of temperatures than in the cold-blooded reptilian ancestors. Then, between 60 million and 80 million years ago, a group of mammals known as the primates first appeared in the fossil record. These mammals had grasping hands and feet, frontally directed eyes, and even larger and more complex brains. This is the lineage from which ancient and then modern humans evolved.

4.4 Based on the strength of evidence from DNA comparisons, the last common ancestor of all monkeys and apes lived about 40 million years ago. The common ancestor of humans and chimpanzees lived approximately 6 to 7 million years ago in Africa. The evolutionary tree leading from this ancestral species to modern humans contains a number of side branches, representing populations and species that eventually went

extinct. At various times in the past, the planet appears to have been populated by several human-like species.

4.5 About 4.1 million years ago, a species appeared in Africa that palaeontologists place in the genus *Australopithecus*, which means '**southern ape**.' The brain of an adult of this genus was about the same size as that of modern apes and it appears to have spent part of its life climbing in trees, as indicated by its short legs and features of its upper limbs. But *Australopithecus* also walked upright, as humans do. Footprints left by one of the earliest *Australopithecus* species have been discovered with remarkable clarity in hardened volcanic ash.

4.6 About 2.3 million years ago, the earliest species of *Homo*, the genus to which all modern humans belong, evolved in Africa. This species is known as *Homo habilis* (***handy or skilful man***). Its average brain size as determined from skulls that postdate 2 million years ago, was probably about 50 percent larger than that of earlier *Australopithecus*. The earliest stone tools appear about 2.6 million years ago.

4.7 About 1.8 million years ago, a more evolved species *Homo erectus* (***upright man***) appeared. This species spread from Africa to Eurasia. The subsequent fossil record includes the skeletal remains of additional species within the genus *Homo*. The more recent species generally had larger brains than the earlier ones.

4.8 Evidence shows that anatomically modern humans (*Homo sapiens* – 'wise' or 'knowing man') with bodies and brains like ours, evolved in Africa from earlier forms of humans. The earliest known fossil of a modern human is less than 200,000 years old. The members of this group dispersed throughout Africa and, more recently, into Asia, Australia, Europe, and the Americas, replacing earlier populations of human then living in some parts of the world.

5.0 *Conclusion*

Navigating one's mind deeply through the stream of evolutionary process that might have started from the beginning of earth's formation, one may wonder if it is possible to accept biological evolution as the only reason for producing such an incredible array of living things. Many questions come in our mind. In such a state of mind, one tends to believe the existence of a supernatural power which is omnipotent, omniscient, omnipresent and omnivorous. Scientific evidences, on the other hand, have proved beyond any trace of doubt that evolutionary biology has been and continues to be a cornerstone of modern science. We may reconcile in this way. Science and transcendental thinkings are two different ways of understanding the world. Needlessly placing them in opposition reduces the potential of each to contribute to a better future.