UNIT 5 HUMAN VARIATION AND EVOLUTION*

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Learning Objectives

After going through this unit you will:
  ➢ trace the early origin of life;
  ➢ gain insight into different theories of origin of life;
  ➢ understand the human variations and racialization of humans; and
  ➢ comprehend the racial classifications given by Francois Bernier, Carl Linnaeus and Comte De Buffon.

5.0 INTRODUCTION

The origin of life cannot be dated as precisely, but there is evidence that bacteria-like organisms lived on earth 3.5 billion years ago and they may have existed even earlier, when the first solid crust formed, almost 4 billion years ago (Noffke et al., 2013). From the biological point of view, the problem of origin and evolution of life requires a prior review and possible explanation. Scientists have always considered this question but no conclusive proof concerning this problem has been furnished. Though paleontological discoveries have greatly contributed to the question of gradual evolution, very little information is available on the earliest form of life due to severe changes that occurred in Archaeozoic era.

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“The question of evolution of life on the Earth and elsewhere in the Universe has ever been as challenging as the question of evolution of the Universe itself. Science does not provide authentic explanation regarding the origin of Universe in the controversial ‘Big Bang’ theory for evolution of the Universe, nor does it provide any satisfactory explanation regarding the origin of life despite considerable advancements in the fields of astrobiology, astrophysics and molecular biology in recent years. The hot inflationary ‘Big Bang’ model for evolution of the Universe is not secure enough to serve as a foundation for beliefs about the origin of life, which is exemplified very much by the fact that the most distant galaxies, we can see today, look as rich and fully evolved as our own, even though they are barely 5% of the current age of the Universe, i.e. about 700 million years after the Big Bang. Among the several factors leading to beginning of life on this planet, ‘panspermia’ appears to provide the most favoured hypothesis for emergence of life on our planet.” It hypothesizes that the primitive life may have originally formed extra terrestrially. As per this concept seeds of life are ubiquitous, and they may have delivered life to the Earth as well as to the other heritable bodies in the Universe (Lal, 2008).

The problem of creation has two aspects: the origin of life itself and the origin of forms of life. H. F. Osborn in 1960 posed the problem of the origin of life in the following questions:

- Does the appearance of life on earth constitute a new factor or it is rather the evolutionary continuation of forms of energy and matter found on the earth itself, on the sun and on other stars?
- Can the development of life be considered as part of the evolutionary process in the same sense as inorganic evolution or it is fundamentally a different phenomenon?
- Is there a creation in the strict sense of the term or that some new form of energy arises?
- Does life develop in an orderly fashion subject to certain natural laws or its development is due to chance? (Shukla and Rastogi, 1990)

Many of the potential researchers attempted to clarify the early evolutionary process but these clarifications are yet to be confirmed.

5.1 EARLY THEORIES ON THE ORIGIN OF LIFE

“Many religious persons, including many scientists, hold that God created the universe and the various processes driving physical and biological evolution and that these processes then resulted in the creation of galaxies, our solar system and life on Earth. This belief, which sometimes is termed “theistic evolution,” is not in disagreement with scientific explanations of evolution. Indeed, it reflects the remarkable and inspiring character of the physical universe revealed by cosmology, palaeontology, molecular biology and many other scientific disciplines” (Smith, 2014). Let us learn some of the major proposed theories on the origin of life:

5.1.1 Theory of Spontaneous Generation

The Theory of Spontaneous Generation is as old as human thought and has been a subject matter of great controversy and much discussion. The idea
of spontaneous generation can be traced back to Greek philosopher and scientist Aristotle. According to this theory, life originated from inert inorganic matter as a result of a series of physico-chemical conditions which must have existed at a given moment during the evolution of earth. For example life was generated in slime, compost and mud under the influence of moisture and heat. However, such a hypothesis was negated by Lazzaro Spallanzani, Francisco Redi and Louis Pasteur. These scientists disapproved the Theory of Spontaneous Generation by performing well designed scientific experiments. In a certain sense, ideas about spontaneous generation are still not quite dead. Many pseudo explanations for the origin of life due to ‘inherent properties of matter’, ‘emergent properties’, or self-organizing principles are still common in the literature (especially authored by non-biologists) that reflects a more less continuous tradition going back to Aristotle (Fenchel, 2002).

5.1.2 Theory of Extra Terrestrial Origin of Life

“The Swedish chemist Svante Arrhenius suggested in 1908 that life had originated somewhere else in the Universe and in fact permeates all of Cosmos. According to this view, the Earth had been colonized by microbes that had somehow escaped from their home planets and driven by light pressure, had arrived on the Earth at some time in the past. This idea, the so called Panspermia hypothesis, has haunted most of the 20th century”. Supporters of extra-terrestrial origin theory include many prominent persons such as Francis Crick (who together with James Watson and other discovered the structure of DNA) and Fred Hoyle (author of many science fiction novels) (Fenchel, 2002). It should also be noted here that the possibility of life in our immediate cosmic neighbourhood i.e. solar system is very unlikely. But even if it is considered against all odds then it is also extremely unlikely that any microorganism could survive exposure to cosmic radiation. It is hard to make the extra-terrestrial origin of life appear probable, but it represents only an attempt to export the problem to somewhere outside Earth without explaining how life could arise.

5.1.3 Life Had No Beginning

According to some philosophers, life had no beginning and it always existed. Life is as eternal as energy and matter and possibly may be considered a special manifestation of both. Such a theory in fact leads into the realm of imagination and metaphysics (Shukla & Rastogi, 1990).

5.1.4 Theory of Eternity of Present Conditions

This theory proposes the view that the universe is unchangeable. The organisms remain unalterable throughout their individual existence and will continue in the same unchanging state throughout eternity. J. Hutton (1726-1797) was the supporter of this view. This theory was accepted only by few because of its erroneous explanation.

5.1.5 Theory of Creationism

Creationism theory advocates that all forms of life were created by Almighty God. According to the ‘genesis’ book, Adam and Eve were the first man and woman created by God. Christians, Muslims and Jews have a common
agreement on the seven days creation of universe by God. According to this view, the world and all living things originated in a singular event of creation by God. The Spanish Jesuit, Father Suarej (1548-1617) was one of the believers and defenders of the theory of creationism. The great Naturalist Carl Linnaeus (1758) also believed that all genera and species are always the creation of God. He also supported the view of inalterability of the species. However, he did not rule out the possibility of the appearance of new forms or life by hybridization (Shukla & Rastogi, 1990).

5.1.6 Theory of Catastrophism

This theory is considered as an extension of the Theory of Special Creation. According to this theory, life is originated by the creation and it is followed by catastrophe due to many geographical disturbances. Each catastrophe destroyed life completely and each creation led to a higher level of organization that is different and complex from the previous one. George Cuvier (1769-1832), Professor of Comparative Anatomy, Paris University, was the main supporter of this theory. He believed that in the beginning there were corals, molluscs and crustaceans on the earth. Plants emerged in the beginning which was followed by fishes, reptiles, birds and mammals. He believed that man appeared after the last geological revolution. Cuvier’s theory of catastrophism was attacked on many grounds by the researchers as the question of initial origin of life and its origin after subsequent metamorphosis was left unexplained.

5.1.7 Theory of Organic Evolution

During the middle ages and at the beginning of the modern era new versions of organic evolution emerged. Avicenna, the foremost representative of Arabic Science (979-1037) considered fossils to be the rough draft of living beings. Albert von Bolletadt also known as Albertus Magnus (1206-80) accepted that plant and animal remains might have been transformed to fossils by petrification. The famous French Scientist Bernard Palissy also had the idea of lost species and extinct forms. Similarly Roberthook (1635-1703) and Leibniz (1646-1716) reflected an evolutionist tendency and believed that fossils can reveal earth’s past. These contributions indicated that all natural beings form a chain within which different classes are formed. J. Monboddo (1714-1790) suggested theories concerning the origin of species and the evolution of man. J. W. Goethe’s (1749-1832) ideas on evolution are also well known and hence he was considered a predecessor to Darwin. Immanuel Kant (1724-1804) had greatly influenced the biological doctrines of his time. Furthermore, Charles Darwin (1731-1802) in 1794 outlined the idea of heredity and natural selection and linked these to the concept of evolution (Shukla & Rastogi, 1990).

Charles Lyell (1797-1875) favoured the idea of considering majority of geological phenomena as a result of small gradual changes. This idea formed the basis of evolution and it demonstrated evolution as a universal law of living nature. Evolution was also considered the great intellectual achievement of 19th century. Lamarck and Darwin independently propounded the theory that all animals have been evolved from simple types. These simple types underwent gradual changes due to successive development in form and function. This theory of organic evolution brought a great revolution in the scientific world and was ultimately accepted. Contributions of Lamarck and Darwin remain supreme even today (Shukla & Rastogi, 1990).
Human Variation and Evolution

5.2 HUMAN VARIATIONS AND ORIGIN OF RACES

Biological Anthropologists primarily deal with the human physical variations. These variations are produced by the combined action of heredity and environmental forces that have been at work throughout evolution. The major sources of human variations include:

- Mutation, that is alterations in the molecular structures of the cell resulting in new genes or in the rearrangement of the number and order of genetic material.
- Selection, that is, pressures in the environment which favour the survival and reproduction of individuals with certain genes and impede the survival and reproduction of individuals with others.
- Gene flow, that is the acquisition by the population of new genes through occasional matings with members of other populations and
- Genetic drift, that is, the loss of genes through “sampling” accidents (Beals & Hoijer, 1959).

These sources of human variations result into many anatomical or morphological differences between humans and their population that also reflect underlying biological differences. “Some morphological differences are visible to the naked eye, including skin, eye and hair colour and body size and shape. Some other biological differences are just as real but are not as easily seen; these include blood type, fingerprint patterns and disease susceptibilities. Considering the differences in all of these traits, there is no doubt that Homo sapiens is a species with considerable biological variation. At a deeper level, these biological variations can be seen in relation to the geographical pattern of individuals for example people with dark skin color can be found in high frequencies in sub-Saharan Africa, Australia and certain islands in the Pacific, while people with very fair skin are more frequent in other parts of the globe, including Scandinavia and northern Europe and Asia. This kind of geographically patterned biological variation formed the traditional raw material for racial classification system (Anemone, 2015). Geographical variations in many biological traits that assisted in differentiation of human populations led to the origin of races.

5.3 RACIALIZATION OF HUMANS

The concept of race progressively evolved from genealogical sense to encompass a growing trend of “biologization”. The history of the concept includes a shift from lineage-based thinking to a naturalist approach which was first applied to humans and then extended to the rest of the animal kingdom (Hoquet, 2014). The explorations of the 15th, 16th and 17th centuries brought Europeans in contact with many new people and finally scholars became interested in the problem of finding order in the bewildering variety
of peoples with whom they were confronted. This led to attempts at more or less exhaustive classifications of the races of mankind (Slotkin, 1944). The idea of formation and formulation of races was first propounded by three “early taxonomists”: Francois Bernier (1625-1688), Carl Linnaeus (1707-1778) and G. L. Leclerc de Buffon (1707-1788). Many other potential scholars including Immanuel Kant, Johann Friedrich Blumenbach, John Locke and Thomas Hobbes also tried to explain the concept of race and human diversity. The following section describes the racial classifications proposed by Francois Bernier, Carl Linnaeus and De Buffon:

5.3.1 Francois Bernier

The first classification of the races of man was given by a French traveller, Francois Bernier. In 1684, the journal of the French Academy of Sciences, the *journaldes savans* published an anonymous article entitled “A New Division of the Earth, according to the Different species or Races of Men Who Inhabit It” written by Francois Bernier. This short piece of work has been cited as the first presentation of the modern concept of race, but it is usually mentioned as a mere curiosity (Boulle, 2003). In this article Bernier proposed anthropology a key for geography, by dividing the world according to “species or races of men”. Bernier’s first race included the people of Europe except a part of Muscovy; it also included those living in a broad band of territory extending from the Mediterranean coast of Africa to parts of Borneo, via Arabia, Persia, India and Siam. This first race was left undefined and the other three races consisted of the Africans, the Asians and the Samoeds of Lapland. Each of these three races was characterized by the combination of physical features and skin color. According to Bernier, under the first species, all Europe was comprehended except a part of Muscovy. Under this group, the Egyptians and the (East) Indians are very black, or rather copper coloured, that colour is only an accident in them and comes because they are constantly exposed to the sun; and for those individuals who take care of themselves and who are not obliged to expose themselves so often as the lower class, are not darker than many Spaniards. It is true that most Indians have something very different from us in the shape of their face and in their color which often comes very near to yellow; but that does not seem enough to make them a species apart, or else it would be necessary to make one of Spaniards, another of the Germans and so on with several other nations of Europe.

![Racial classification scheme of François Bernier](https://fi.wikipedia.org/wiki/Fran%C3%A7ois_Bernier)

Source: https://fi.wikipedia.org/wiki/Fran%C3%A7ois_Bernier
Under the second species, Africans are included who have peculiar features like thick lips, squab noses, black skin which is smooth and polished. There are very few among them who have aquiline noses or lips of moderate thickness. They have three or four hair of beard which is not properly hair, but rather a species of wool. Their teeth are whiter than the finest ivory, their tongue and all the interior of their mouth and their lips are as red as coral.

The third species comprehends people of Asia where people of all countries are truly white; but they have broad shoulders, a flat face, a small squab nose, little pig’s eyes long and deep set and three hairs of beard. The Lapps make the fourth species. They are little stunted creatures with thick legs, large shoulders; short neck and a face elongated immensely. As to the Americans, most of them are olive-coloured and have their faces modelled in a different way from ours. Besides, as in Europe, the stature, turn of the face, the colour and the hairs are generally very different (Burton & Loomba, 2007).

The division was rather disproportionate, as the first “species” included Europe, North Africa, the Middle East and India, along with part of Southeast Asia; the second, Africa; the third, a part of Asia (China etc.); the fourth, Lapland. Distinctions between “species” were not based on color, given that two among them were white: the Mongols, the Chinese and the Japanese are described as "veritably white," despite the very major differences in theirorporeal disposition. Bernier’s racial classification was based on the continents but he did not strictly follow them. Inhabitants of Africa (the entire Mediterranean coast) were grouped in the first division while position of Native American was not clear; they were kept at the end of enumeration by creating a fifth division. Bernier’s text was generally recognized for “launching” the idea of racial divisions of humanity in Europe. But the way in which he divided humanity was rather idiosyncratic and did not really presage what racial division would look like in the eighteenth and nineteenth centuries (Hoquet, 2014).

5.3.2 Carl Von Linnaeus

The first scientific classification of human races was given by Carl Von Linnaeus which was published in 1758 in the tenth edition of *Systema Naturae*. This taxonomic system which was based on the criterion of skin colour, laid the foundation for nineteenth century racial classification. In 1735, the first edition of *Systema Naturae* proposed four varieties of Homo: Europaeus albesc (white), Americanus rubesc (red), Asiaticus fuscus (dark) and Africanus nigr (black). After 1735, this edition was constantly reedited and transformed throughout the eighteenth century. Carl von Linné properly began the science of Anthropology by introducing the color based classification of races. Linnaeus’s taxonomy was referred to as first modern study of man by Anthropologist. In his publication he named and described four major geographical races of mankind that are still recognized and continued into the nineteenth century anthropological vocabulary. Linnaeus classified geographical races or subspecies on the basis of a curious collection of traits, including physical features, personality traits and aspects of culture. The four geographical races were described as:

- **Homo Americanus**: Reddish, choleric, obstinate, contented and regulated by customs
- **Homo Europeans**: White, fickle, sanguine, blue-eyed, gentle and governed by laws
- **Homo Asiaticus**: Sallow, grave, dignified, avaricious and ruled by opinions
- **Homo Afer**: Black, phlegmatic, cunning, lazy, lustful, careless and governed by caprice (Haller, 1971)

![Fig. 2: Racial classification scheme of Carl Von Linnaeus](https://fi.wikipedia.org/wiki/Fran%C3%A7ois_Bernier)

A consideration of Linnaeus’s classification suggests that one of the unspoken pedestals on which it is built is the notion of hierarchy and inequality. With respect to many of the personality and cultural traits that he used, a clear Eurocentric bias was present. The linear hierarchy of Linnaeus’s classification was influenced by the Judeo-Christian concept of the “great chain of being” or “ladder of creation”. In this conception, all of God’s creatures, from the simplest and most primitive life forms to the most complex, were thought to be arrayed in a linear fashion, like the links in a chain or rungs of a ladder. When Linnaeus created his four subspecies or races of humans and under the influence of notions like the great chain, it was natural for him to build into his scheme a linear hierarchy, with some races closer to angels and others closer to the apes. So it seems that the first scientific classification of race resembles modern racial classifications in several important aspects, including the notion of inequality with respect to innate intelligence and a linear raking or hierarchy of races and the broad-brush stereotyping of millions of people with supposedly platonic essences (Anemone, 2015).

### 5.3.3 G. L. L. Comte de Buffon

In 1749 G. L. L. Comte de Buffon introduced the word race into the literature of Natural History. Buffon recognized the difference between species, which could not mate with each other and reproduce and varieties within a species, which could. Like Linnaeus, Buffon was a believer in single origin of *Homo sapiens*, with racial differentiation occurring at some later time after human population had multiplied and spread across the globe. An advocate of the unity of the human species, Buffon’s categories for man included Laplanders, Mongolians, Southern Asiatics, Europeans, Ethiopians and Malays. As with other racial writers, Buffon gave a central role to value judgements of the relative worth of the races in his writings. He argued that the original race was the European one and others could be understood as “degenerations” from that norm. Americans were perhaps the least degenerated by the climate in which they lived, Africans and Lapps perhaps the most. Assuming the colour white to be norm, Buffon blamed the vagaries of climate for other
skin tones. According to Buffon climate, food, soil, air and other aspects of the local environment had a direct effect on human morphology and physiology. Thus, the differences in racial type, particularly skin color, can be readily attributed to environmental characteristics. Buffon’s classification system was structured primarily around geographic placement. Indeed, Buffon was, like Linnaeus, a firm believer in the notion of *special creation* of all the kinds or species of living things by a divine creator and in the *fixity of species*. They both envisioned biological change occurring only at the level of the divinely created species (d’Souza, 1996; Jackson & Weidman, 2004; Anemone, 2015).

The earlier classifications of mankind did not differ essentially from the present day classification, either in regard to methodology or criteria. The greatest improvement has been in the refinement of the criteria employed as the basis for classification, both qualitative and quantitative (Slotkin, 1944).

**Check Your Progress 2**

4) Who propounded the Theory of Eternity of Present Conditions?
   a) Francis Crick
   b) J. Hutton
   c) Francois Bernier
   d) Theodosius Dobzhansky

5) Who introduced the word race into the literature of Natural History?
   a) Comte de Buffon
   b) Francois Bernier
   c) Carl Von Linnaeus
   d) Theodosius Dobzhansky

6) Who wrote the book *Systema Naturae*?
   a) Carl Von Linnaeus
   b) Comte de Buffon
   c) Charles Lyell
   d) Erasmus Darwin

7) How many varieties of Homo species were proposed in the first edition of *Systema Naturae*?
   a) Three
   b) Four
   c) Two
   d) Five

### 5.4 SUMMARY

Theories and statements about the origin and early evolution of life date back to antiquity. These theories ranged from religious and spontaneous origin of life to evidential organic evolution of man. Evolutionary process created the fundamental basis for human diversities and variations. Globally, human
species consist of many biological variations in terms of genes and morphology. Many human biologists and anthropologists have attempted to analyse and describe these human variations. In pre-Darwinian times, major emphasis was placed on the enumeration and classification of human races, an approach that stressed variation between groups in a typological framework. Many researchers attempted to reduce human variations to a set number of discrete races. The fact that there have been centuries of debate over the number of human races is a reflection that the underlying model of discrete variation expected at a level of subspecies is not the most suitable means of analysing human variation.

5.5 REFERENCES


5.6 ANSWERS TO CHECK YOUR PROGRESS

1) George Cuvier
2) Genetic Drift
3) Charles Darwin
4) b)
5) a)
6) a)
7) b)