BANC-132: FUNDAMENTALS OF BIOLOGICAL ANTHROPOLOGY

Tutor Marked Assignments

Course Code: BANC-132

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Total Marks: 100

There are three Assignments. All questions are compulsory.

Assignment A

Answer the following in about 500 words each.

1. Define Race. Discuss the criteria used for the classification of Race. 20

2. What is hominization? Describe major anatomical and cultural changes associated with the process of hominization. 20

Assignment B

Answer the following questions in about 250 words each.

3. What is Evolution? Discuss the major concepts and principles of evolution. 10

4. Write an essay on modern approaches of biological anthropology. 10

5. Differentiate between growth and development. Discuss the various methods of studying human growth. 10

Assignment C

Answer the following questions in about 100 words each.

6. Subfields of Biological Anthropology 5

7. Human Genome Project 5

8. Modern Synthetic Theory of Evolution 5

9. Aims and scope of Physical / Biological Anthropology 5

10. Ecological Rules 5

11. Classification and Characteristics of Primates 5

Answers

Assignment A

Answer the following in about 500 words each.

1. Define Race. Discuss the criteria used for the classification of Race. 20

Ans.: Race refers to classification of humans into relatively large and distinct population groups based on appearance through heritable phenotypic characteristics, often influenced by and correlated with culture, ethnicity and socio-economic status. Race is a concept, applied in various senses, even by human biologists. In the present context we are concerned with anthropological or biological concept of race. As a biological term, race denotes genetically divergent human populations that can be marked by common phenotypes.

Among humans, race has no cladistics significance- all human beings belong to the same hominid subspecies, 'Homo sapiens sapiens', each differing from other populations in the relative commonness of certain hereditary trait.

The word race is applied in a variety of ways, various aggressive actions from first-fights to large scale riots and countrywide civil wars- have stemmed from tension and misunderstanding among various "races".

Race science was never just human classification. It presupposed to be a distinctive relationship between "nature" and "culture", by understanding the differences in the nature and to generate different kinds of persons and the distinctive stage of cultures and civilizations that inhabit the world.

Race formation is a complex process where several factors are involved. These may be summarized as:

1. Mutation The basic mechanism by which genetic variability is introduced is through mutation. Mutation is a sudden change in genes resulting in hereditary variation. As soon as a new mutant gene appears, it multiplies from one generation to another and becomes a distinctive characteristic of the particular population, provided other conditions are favorable. In this sense mutation is an important process through which races are formed.
2. Natural selection Natural selection is an important factor that operates to pattern and maintain inter and intra specific variability, when applied at the genetic level to the alleles operating at individual loci, as it predicts the behavior of genes under specific conditions. Selection moulds the genotypes of an organism such that they produce phenotypes fitting to the environment in which organism lives. But natural selection does not operate directly on the genotypes; it acts through the phenotypes of the individuals and their

gametes. With natural selection advantageous genes are multiplied more rapidly than the disadvantageous genes, as the latter will be eliminated by nature.

3. Genetic Drift Chance fluctuations of gene frequencies may lead to appreciable genetic differences between completely isolated sub-populations. This effect becomes stronger, if the effective breeding size of population is small. There may be lessened variability owing to the random loss of alleles for a predictable proportion of genes. In this process, increase or decrease of the frequency of a gene in a certain population does not depend upon advantageous or disadvantageous conditions of life in a particular locality, but happens merely as an accident or chance. The different frequency of gene for tasting or not tasting PTC in different populations forms a good example of accidental fluctuation of genes.
4. Migration Migration plays an important role in racial differentiation. It helps in isolation, hybridization and mixing of different populations with the migrants. Groups of people migrate from mother population to different directions from the common centre and become isolated from one another and due to endogamy, pressure of natural selection and process of hybridization may cause formation of races.
5. Isolation Isolation may be geographical or social and is considered to be a great race maker. The natural selection and genetic drift, will act effectively only when a particular population is isolated from the neighbouring populations.
6. Hybridization Hybridization is a process by which genes within a species are introduced into other populations resulting in genetic combinations which are entirely new. Through hybridization, genetic variation is introduced in a population called as gene flow that leads to the formation of new race. For example, the mingling of Americans and Negroes has produced a new racial population, an ongoing process.
7. Sexual selection It is a process of selecting mates on the basis of some preferred qualities, as a result of which the sexually preferred type would become the dominant variety of the individuals. For example, in a population where blue eye colour was preferred to brown colour, the brown coloured individuals would get lesser and lesser number of mates. Ultimately the gene of brown eye might be eliminated by this process or, the blue-eyed would marry blue eyed and brown-eyed would marry brown-eyed. In such case two distinct types of subgroups would be formed.
8. Social Selection In social selection, breeding is regulated by artificially instituted barriers between socially approved individual and groups within a population, so that mating occurs between individuals preferred by such social standards rather than at random. In such situations strong isolating mechanisms are developed which in due course may produce modifications in a population.

Thus, it may be stated that mutation, natural selection, genetic drift, migration, isolation, hybridization, sexual selection and social selection, etc., are the main processes responsible for the formation of racial strains.

2. What is hominization? Describe major anatomical and cultural changes associated with the process of hominization. 20

Ans.: The earliest evidence of hominids that was found, included teeth and cranial pieces which were not enough to distinguish modern man from our closest relatives the apes. Then, how can we identify hominids from other types of animals, especially when these occur only as fragments of fossil remains?

The Olduvai Gorge in Tanzania is the most important site that yielded the fossil evidence in abundance about the skeleton and behaviour of hominids. The layers through which the Gorge cuts are divided into four numbered from the bottom as Bed I, Bed II, Bed III and Bed IV, the uppermost.

In 1960 Leaky's son found pieces of jaws, partial cranial vault and hand bones from Bed 1 dated to 1.8 million years ago. The bony remains were encircled by loosely piled stones. Leaky thought that it was a dwelling of a hominid which belonged to genus Homo. He named it Homo habilis (handy man) believing it to be a tool maker. The piled stones, according to Leakey were windbreak constructed by Homo habilis. The cranial capacity after reconstruction was found to be 680 cc which to Leakey was further proof for separating Homo habilis from the Australopithecus africanus.

The debate among the palaeanthropologists over which of the traits-tool making, large brain, and bipedalism-was critical in defining mankind. Yattersall has very rightly pointed out that the spin off of this mindset was the idea of hominization, that is, becoming human in some way was definable and separate process which could be studied. It must be noted that all these traits did not develop simultaneously as can be seen in hominid evolution over the last seven million years. The process of hominization may be examined in the biocultural nature of hominid evolution.

The homanization process may be viewed as the evolutionary transformation from prehomind to hominid status in the course of human evolution. It is also referred to as "aromophasis" by Severtson (1939) and "anagenis" by Hur Oley (1942) and Rensch (1960). The original meaning of the word 'hominization' was the emergence of human among other living things. It means the threshold which prehumans had to cross before becoming human. This process concerns the nature and adaptive significance of major anatomical and physiological transformation in the evolution of the body from an ape like higher primate to the single variable species, Homo sapiens.

The changes that have occurred in the evolutionary development of mankind since its divergence from the last common ancestor and are shared with any living ape can be categorized into two groups.

The Hominization process consists of evolutionary transformation of hominoids into hominids. It is a process that has occurred in the hominoid-line since its divergence from the last common hominoid ancestor shared with any living ape. Initially the term has a restricted meaning and implied emergence of modern man, different from all other forms. Currently, however, the term is broadened and includes all those aspects of structural and behavioral changes that occurred in the Hominid line, finally leading to the emergence of modern human group.

Assignment B

Answer the following questions in about 250 words each.

3. What is Evolution? Discuss the major concepts and principles of evolution. 10

Ans.: The diversity of the living world is staggering. More than 2 million existing species of organisms have been named and described; many more remain to be discovered—from 10 million to 30 million, according to some estimates. What is impressive is not just the numbers but also the incredible heterogeneity in size, shape, and way of life—from lowly bacteria, measuring less than a thousandth of a millimetre in diameter, to stately sequoias, rising 100 metres (300 feet) above the ground and weighing several thousand tons; from bacteria living in hot springs at temperatures near the boiling point of water to fungi and algae thriving on the ice masses of Antarctica and in saline pools at −23 °C (−9 °F); and from giant tube worms discovered living near hydrothermal vents on the dark ocean floor to spiders and larkspur plants existing on the slopes of Mount Everest more than 6,000 metres (19,700 feet) above sea level.

Darwin and other 19th-century biologists found compelling evidence for biological evolution in the comparative study of living organisms, in their geographic distribution, and in the fossil remains of extinct organisms. Since Darwin's time, the evidence from these sources has become considerably stronger and more comprehensive, while biological disciplines that emerged more recently—genetics, biochemistry, physiology, ecology, animal behaviour (ethology), and especially molecular biology—have supplied powerful additional evidence and detailed confirmation. The amount of information about evolutionary history stored in the DNA and proteins of living things is virtually unlimited; scientists can reconstruct any detail of the evolutionary history of life by investing sufficient time and laboratory resources.

Evolutionists no longer are concerned with obtaining evidence to support the fact of evolution but rather are concerned with what sorts of knowledge can be obtained from different sources of evidence. The following sections identify the most productive of these sources and illustrate the types of information they have provided.

4. Write an essay on modern approaches of biological anthropology. 10

Ans.: Biological anthropology is concerned with the origin, evolution and diversity of humankind. The field was called physical anthropology until the late twentieth century, reflecting the field's primary concern with cataloging anatomical differences among human and primate groups. Biological anthropology is one of the four subfields of anthropology, together with archaeology, linguistic anthropology, and social/cultural anthropology. Under the name of biological anthropology, it is an ever-broadening field that encompasses the study of: human biological variation; evolutionary theory; human origins and evolution; early human migration; human ecology; the evolution of human behavior; paleoanthropology; anatomy; locomotion; osteology (the study of skeletal material); dental anthropology; forensics; medical anthropology, including the patterns and history of disease; primatology (the study of non-human primates); growth, development and nutrition; and other related fields.Biological anthropology deals with human evolution and human biological variation. The place of disease in this framework is as an environmental stressor that can shape human population structure and variation through differential mortality and fertility. The emphasis on human–environmental interactions in the production of disease has obvious synergies with epidemiology, and it is no surprise that there are many biological anthropologists working with epidemiologists and in public health. Human ecology is a subfield of biological anthropology that deals with human adaptability, or the ability of populations to adjust, biologically and behaviorally, to environmental conditions. These are the processes that lead to human population variation. Humans inevitably change their environments while adapting, and this leads to new stresses. Understanding the interactions between humans and their increasingly complex environments, especially with economic modernization and change across the past 50 years, has also become part of the remit of human ecology and therefore also of biological anthropology. Since society and culture construct the environments that humans negotiate and the behavioral responses to them, the incorporation of social and societal factors into studies of human adaptability is essential. Biocultural anthropology is a subdiscipline of biological anthropology that considers this. With respect to health and disease, biocultural anthropology acknowledges different cultural models of disease (including biomedicine) and examines how society, culture, and behavior shape patterns of disease.

5. Differentiate between growth and development. Discuss the various methods of studying human growth. 10

Ans.: Many scientists have defined 'growth' in their own way. Richards and Kavanagh (1945) write: Growth is a fundamental attribute of living organism, manifested by a change in size of the individual or in the number of organism in a unit of environment. This change, according to Zuckerman (1950), is normally associated with increase but with a possibility of decrease in size under adverse conditions or negative growth.

The term growth and development as used in physical studies refer to the processes common to all living organism, processes intimately linked in time but partially independent unquestionably determined yet uniquely susceptible to environmental modification. Montage (1960) defines it as the increase in physical size of the whole body or any of its parts, while development is the increase in its complexity.

Development describes the growth of humans throughout the lifespan, from conception to death. It refers to development as patterns of change over time. It does not just involve the biological and physical aspects of growth, but also the cognitive and social aspects related to the development. The scientific study of human development seeks to understand and explain how and why people change throughout life. This field examines change across a broad range of topics including motor skills and other psycho physiological processes. Cognitive development refers to the areas of problem solving, moral understanding, conceptual understanding, language acquisition, social, personality, and emotional development, and self-concept and identity formation. Growth is defined as an increase in size. In other words development is defined as a progression towards maturity. Even though development is a continuous process with competencies developing, then disappearing, only to appear at a later age, it is not continuous in the sense that it increases constantly but rather in a series of waves with whole segments of development reoccurring repetitively. For example, new borns walk, if held, and then this ability disappears only to reappear at eight or ten months of age.

Growth refers to the development of children from birth to adolescence. From newborns to teenagers, parents often have questions if their children are developing normally. WHO is also coordinating an international effort to develop child growth standards for infants and young children (age 0-5 years). There is a process of child development, which makes a growth curve. Growth curve is defined as a statistical curve derived from plotting weight and height against chronological age for comparing an individual child's growth pattern with the average age of growth. In short we can say that personality is influenced by many factors and these factors are involved in the development of the personality of a child.

Often, developmental stages are defined by milestones. The term milestone refers to the development that has to take place according to the age of the child. For instance, almost all children start standing and walking at the age of 1 year and more, start saying a few words by the time they are one and half to two years etc. That a developmental stage has been successfully passed is indicated by the child mastering the developmental tasks of the particular period of development. Often, special milestones mark children's accomplishments, such as walking in infancy and entering school in early childhood, and these milestones can help mark children's movement inside and between developmental stages.

Assignment C

Answer the following questions in about 100 words each.

6. Subfields of Biological Anthropology 5

Ans.: Biological anthropology is the study of human biological variation and evolution. Biological anthropologists seek to document and explain the patterning of biological variation among contemporary human populations, trace the evolution of our lineage through time in the fossil record, and provide a comparative perspective on human uniqueness by placing our species in the context of other living primates. Students concentrating in biological anthropology are advised to take a course in statistics, as well as one or more advanced courses in biological sciences.

Biological anthropology, also called physical anthropology, studies people from the standpoint of human biology, the form and function of the human body, the environment, social behavior, and how we've evolved in respect to these aspects.

Biological anthropology is the study of the biology of humans and their nearest biological relatives. "Biological relatives" include both humankind's ancestors and our nearest living relatives, the non-human primates. Biological anthropologists fall under 3 major categories:

- Human biology (human biological diversity, genetics, adaptations to environmental stressors, etc.)
- Primatology (non-human primate biology, evolution, behavior, ecology, etc.)
- Paleoanthropology (human origins and human evolution)

7. Human Genome Project 5

Ans.: The Human Genome Project was an international research effort to determine the sequence of the human genome and identify the genes that it contains. The Project was coordinated by the National Institutes of Health and the U.S. Department of Energy. Additional contributors included universities across the United States and international partners in the United Kingdom, France, Germany, Japan, and China. The Human Genome Project formally began in 1990 and was completed in 2003, 2 years ahead of its original schedule. The work of the Human Genome Project has allowed researchers to begin to understand the blueprint for building a person. As researchers learn more about the functions of genes and proteins, this knowledge will have a major impact in the fields of medicine, biotechnology, and the life sciences.

8. Modern Synthetic Theory of Evolution 5

Ans.: The Modern Synthetic theory of Evolution explains the evolution of life in terms of genetic changes occurring in the population that leads to the formation of new species. It also explains the genetic population or Mendelian population, gene pool and the gene frequency. The concepts coming under this synthetic theory of evolution include the genetic variations, reproductive and geographical isolation and the natural selection.

The Modern Synthetic populations of Evolution describes the merging of the Darwinian evolution with the Mendelian genetics, resulting in a unified theory of the evolution. This theory is also referred to as the Neo-Darwinian theory. Synthetic theory of Evolution was introduced to us by few legendary evolutionary biologists naming T. Dobzhansky, J.B.S. Haldane, R.A. Fisher, Sewall Wright, G.L. Stebbins, Ernst Mayr in the years 1930 and 1940. The Modern Synthetic theory of Evolution showed a number of changes as to how the evolution and the process of evolution are conceived. The theory gave a new definition about the evolution as "the changes occurring in the allele frequencies within the populations, " which emphasizes on the genetics of evolution.

9. Aims and scope of Physical / Biological Anthropology 5

Ans.: Physical Anthropology studies human as an organism in time and space. Time refers to different stages of human evolution; space refers to variation among the human beings living in different parts of the globe.

Physical Anthropology basically studies man in two main aspects of origin and variation. Methodologically, it embodies human paleontology, primatology, human ecology and adaptation, auxology and demography and genetics with a view to understand the phenomenon of evolution as well as to study the ongoing trend of microevolution. The tools of physical anthropology, viz. anthropometry, biochemical tests, physiological and genetic traits, etc. are of great applied value in the field of ergonomics and designing of articles for use, sports science (kinanthropology), health and medicine, medio-legal and forensic purposes.

10. Ecological Rules 5

Ans.: Ecology is the scientific study of the interaction between organisms and their surrounding environment. It largely includes the study of communications of the organisms which they have with each other or similar species or with other organisms and their relationships with abiotic components of the environment. Ecology has been a focus for the human race for as long as we existed as a species; our survival and environmental adaptations depended upon how well we could analyze and observe the variations in the surrounding milieu and predict the responses of various organisms to those variations Several ecologist has tried to explain the interaction between organism and their environment in a different perspective of analysis. In this section, we have mentioned some major concepts which laid the foundation of close observation of environment and the impact of the environment on the living organisms residing in the milieu.

11. Classification and Characteristics of Primates 5

Ans.: A primate is a member of the mammalian order Primates, which comprises two suborders: the prosimians (lemurs, lorises, and tarsiers) and the anthropoids (monkeys, apes, and man). According to fossil records, primates originated in the Late Cretaceous (97.5 to 66.4 million

years ago) as forest-dwelling creatures. Evidence that modern man is a descendant of these early primates was first provided by Charles Darwin in his Origin of Species, published in 1859.

The anatomical and behavioral features that distinguish primates from members of other mammalian orders include a lack of strong specialization in structure; prehensile hands and feet, usually with opposable thumbs and great toes; flattened nails instead of claws on the digits; acute vision with some degree of binocular vision; relatively large brain exhibiting a degree of cortical folding; and prolonged postnatal dependency. No primate exhibits all these features, and indeed the diversity of primate forms has produced disagreement as to their proper classification.

Primates exhibit four different forms of locomotion: vertical clinging and leaping; quadrupedalism, which involves use of both the forelimbs and the hind limbs in walking, climbing, and swinging; brachiation, in which the primary form of movement is swinging by the forelimbs; and bipedalism, the upright striding of man. All primates are able to sit upright, many can stand upright, and some can even walk upright for short periods, but only man is capable of the upright striding gait.