

AU-6307
MODEL ANSWER
M.A./M.Sc. (First Semester) Examination, 2014
ANTHROPOLOGY

Paper: First
(ANT-M101 Basics of Physical Anthropology)
Time Allowed: Three hours

Maximum Marks: 60

Pass Mark: 24

Note: Attempt questions of all two sections as directed.
Distribution of marks is given with sections.

Section – ‘A’

1. Select one of the most appropriate answer from the following objective questions:

- (i) In which year, S.S. Sarkar’s proposed India’s Racial Classification?
(a) 1961 (b) 1937 (c) 1947 (d) 1950
- (ii) Morphological Facial Index is calculated as _____ .
(a) Morphological facial length X 100 / Bizygomatic breadth
(b) Morphological facial breadth X 100 / Bizygomatic breadth
(c) Bizygomatic breadth X100 / Morphological facial length
(d) Physiological facial height X 100 / Bizygomatic beadth
- (iii) New world monkeys are known as -
(a) Catarrhini (b) Platyrrhini (c) Prosimii (d) Anthropoidea
- (iv) Vertebral column of human beings is _____ shape.
(a) S (b) J (c) P (d) L
- (v) Who described Ramapithecus as a hominid?
(a) Lewis (b) Simon (c) Leakey (d) Pilbeam
- (vi) Typical example of Neanderthal race is _____
(a) La Chapelle-aux-Saints (b) La Ferrassie
(c) La Quina (d) La Moustier
- (vii) In apes great toe is _____
(a) opposable (b) non-opposable (c) longest (d) both ‘a’ and ‘c’
- (viii) Who is the father of Physical Anthropology?
(a) Frazer (b) Bluemanbach (c) Haddon (d) Lawrence
- (ix) Origin of species by Charles Darwin was published in the year _____.
(a) 1859 (b) 1871 (c) 1890 (d) 1860
- (x) The mutation theory was proposed by _____.
(a) JF Bluemanbach (b) Hugo de Vries (c) C Linnaeus (d) C Darwin

Answer Keys:

- (i) a (ii) a (iii) b (iv) a (v) a (vi) a
(vii) a (viii) b (ix) a (x) b

Section – ‘B’

2. Write a short note on –

(i) Ramapithecus

Answer: Ramapithecus is one of the major groups of Dryopithecine primates which are considered as the common ancestor of the living anthropoid apes and man. Ramapithecus is assigned to the family Hominidae. It includes several types of like Brahmapihthecus and Kenyapithecus. They belong to the Miocene – early Pliocene period in Geological time

scale. In 1934 Lewis described Ramapithecus as a hominid. Some of the important salient characteristics of Ramapithecus are:

- The incisors and canines are smaller in relation to molar
- Dryopithecus pattern of molar cusps is absent
- Upper jaw is shortened and does not protrude forward but vertically long
- The palate is arched
- Face is short and deep
- Teeth are no longer used as weapons and hands are used for hunting

(ii) Mivart's definition of primate

Answer: "Ungulate clavicate placental mammals, with orbits encircled by bone; three kinds of teeth, at least at one time of life; brain always with a posterior lobe and calcarine fissure; the innermost digits of at least one pair of extremities opposable; hallux with a flat nail or none; a well developed caecum; penis pendulous; testes scrotal; always two pectoral mammae"

3. Compare different characteristic features between Sinanthropus and Pithecanthropus.

Answer:

| Sl. No. | Characters | Sinanthropus | Pithecanthropus |
|---------|---|--|---|
| 1 | Size | Large | Smaller |
| 2 | Maximum Length of Skull | Average 19.4cm | Average 18.5cm |
| 3 | Breadth of Skull | Varies between 13.7cm to 14.3cm | Average 13.0cm |
| 4 | Cranial Index | Dolichocephalic (72.2) | Dolichocephalic (70.0) |
| 5 | Vault of Skull | Higher | Lower |
| 6 | Cranial Capacity | Average 1075cc | Average 860cc |
| 7 | Cranial Bones | Extremely thick and massive | Not so much thick and massive |
| 8 | Cranial Sutures | Appear to close at an early age | More so |
| 9 | Frontal region | Forehead is receding, Region shows a bump-like development. | Forehead is receding instead of bump-like, development of the regions is flat |
| 10 | Supraorbital region | Heavy, projecting and continuous. Forehead is separated from the supraorbital region by a distinct furrow. | Heavy and continuous however the furrow is not present. |
| 11 | Occipital Region | Comparatively narrow and elongated | Broad and rounded |
| 12 | Frontal sinus | Very small | Large |
| 13 | Palate | Rough | Smooth |
| 14 | Molars | Smaller in size | Larger in size with increasing in size from first to the third |
| 15 | Diastema between upper canines and lateral incisors | Absent | Present |

4. Briefly describe the silent features of order primate.

Answer: Some of the common characteristics of order primate are –

- (i) Prehensile limbs (ability to grasp)
- (ii) Nails on digits (finger)
- (iii) Opposability of thumb and big toe
- (iv) Simple cusp pattern
- (v) Well developed clavicle
- (vi) Enlargement of brain
- (vii) Dentition is suited to an omnivorous diet and three kinds of teeth at least at one time of life
- (viii) Testes descend into scrotum
- (ix) Penis is pendulous
- (x) Present two pectoral mammae
- (xi) Developed visual sense
- (xii) Reduced small (olfactory) sense
- (xiii) Longer life span
- (xiv) Longer gestation period
- (xv) Longer postnatal growth
- (xvi) Social creature

5. Briefly explain the characteristics of racial criteria used for racial classification.

Answer: Some of the important characters used for racial determination are as follows –

(i) *Skin colour:* In the deeper layer of the epidermis lie various granules which make the skin pigmented. Thus with the varying frequencies of the granules the colour of skin also varies. Broadly, there are three shades of skin colours such as Leucoderms (white-skinned people eg. Caucasoids - Europeans, Western Asiatics, North Africans and Polynesians), Xanthoderms (yellow-skinned people eg. Asiatic Mongoloids) and Melanoderms (black-skinned people eg. Negroids, Papuans, Melanesians, Pre-Dravidians etc.).

(ii) *Hair:* It is considered as one of the most convenient striking character which provides the basis for a primary classification of present day racial groups. Some of the important characteristics of hair include –

- Hair form – Leiotrichous or smooth (stretched, smooth, flat wavy) eg. Represents by Mongoloid race; Cymotrichous or wavy form (broad wavy, narrow wavy, curly) eg. Represents by many peoples of Western Asia, North-Eastern Africa, Europe etc.; Ulotrichous or woolly form (frizzly hair) eg. Represents by Negroes, Negritos, Papuans etc.
- Hair Colour – Wide range of variation is observed across the world which includes darker colour, light brown to reddish brown, brownish to reddish tinge etc.
- Hair Texture – It may be coarse, medium or fine.
- Hair Quantity, Whorl and Cross-Section of Hair are other important characteristics of Hair used in racial classification.

(iii) *Head Form:* Cephalic Index (CI) – $[\text{Head breadth} \times 100 / \text{Head length}]$ is used and classified head into dolichocephalic (narrow), mesocephalic (medium), and brachycephalic (broad) groups. Generally it is observed that in Mongoloids dolichocephaly is comparatively rare, in Negroids brachycephaly, while in Caucasoid none of the head forms appear to be very predominant.

(iv) *Face:* Shape of the face is generally described as oval, round, square or pentagonal but it is expressed in terms of the relation of the breadth of the face to its length i.e. Morphological Facial Index ($\text{Morphological Facial length} \times 100 / \text{Bizygomatic breadth}$). This index provides form of face as euryprosopic (broad), mesoprosopic (medium) or leptoprosopic (narrow)

(v) *Nose*: The proportion of the nose, particularly its breadth in relation to its length i.e. Nasal Index (NI) – Nasal breadth X 100 / Nasal length. Broadly there are three types of nose such as leptorrhine (narrow), mesorrhine (medium) and platyrrhine (broad). The native Australian and Negro have markedly platyrrhine nose; Mongoloid with mesorrhine nose whereas leptorrhine nose is characteristics of the Caucasoid peoples of Asia, North Africa and Europe.

(vi) *Eye*: Hooton has distinguished “only two sharply contrasted varieties of eyes in modern man – the Mongoloid eye and the non-Mongoloid eye”. In typical Mongoloid eye the palpebral fissure is oblique, the outer angle being higher than the inner angle; the slit or opening of the eye is narrow; and inner epicanthus (epicanthic) or complete Mongoloid fold is present in varying degrees of development. In case of complete Mongoloid fold, a fold skin hangs over the free edge of the entire upper lid and conceals it thoroughly extending from its outer corner to the inner corner. The typical non-Mongoloid eye is wide and open and straight. The eye-fold is not observed. This is found to occur in the members of the White racial stock.

(vii) *Stature*: It is used to characterise various ethnic groups even with environment has an obvious effect on it. Martin’s classification is in general use which includes Pygmy, very short, below medium, medium, above medium, tall, very tall and giant stature.

(viii) *Dermatoglyphics*: It is the study of the ridge patterns of the skin of the fingers, palms, toes and soles. Ridges make certain patterns. Dermatoglyphic patterns have long since been used for various purposes for their permanency and unchangeability throughout life. Types of finger patterns include arches, loops (ulnar or radial), whorls, and composite. In general, loops (ulnar) are more frequent than whorls. Whorls are most frequent among the Mongoloid population and least among the Caucasoid whereas loops appear most frequent among Caucasoid. Arches are found in small numbers with highest among Negroids.

(ix) *ABO and Blood groups*: Relatively high incidence of A₂ among Caucasoid; Comparatively high incidence of B with A₂ and High incidence of A₁ with very low frequency of A₂ among Mongoloid.

(x) *Rh factor*: Highest frequency of Rh negative among Caucasoid; Moderate frequency of Rh negative; Rh negative is rare among Mongoloid.

6. Write an essay on Pongidae family with a suitable example.

Answer: Pongidae is one of the families of Hominoidea superfamily. The family Pongidae has one subfamily called Ponginae, which comprises three genera: Pongo, Pan and Gorilla. The Pongo is the Asiatic variety, while the other two form the African variety. They are commonly known as Apes.

Representative types of the Pongidae family (Any one of them):

(a) *Orangutan (Pongo)*: They are found in the islands of Sumatra and Borneo. It is represented by only one species. Its height is about 1.5 metre. Weight varies from 60 to 80kg. Orangutans are largely arboreal. They have long arms with powerful hands and mobile shoulders, which help them in brachiation. They live in small groups of two to four whereas male prefers to live alone. They live on vegetarian diet. They build nests in trees to sleep.

Their body is coated with reddish hair with brownish skin colour. Face is sinognathous, that is, concave in profile. Thumb is short and other fingers are long and narrow bearing flat nails. Cranium is small in comparison to the enormous facial portion. Supraorbital torus is absent. Forehead is rounded, nasal bones are fused together and very small in size. Mastoid process and glenoid processes are not developed. Average cranial capacity is 416cc. Mandible is very big and projected. Chin is absent.

(b) *Gorilla*: Gorillas are found in the equatorial region of West Central Africa. They are divided into two subspecies – lowland or coastal gorilla occupying the west central coast and

mountain or eastern gorilla living in the highland of central Africa. Their habitats are of different kinds, like low rain forests, bamboo forests, mountain forests, woodlands and open mountain slopes. The coastal gorillas are the largest in size of all the primates. A full-grown adult male stands about 1.8 metre tall and weighs about 200kg. Though like other apes, gorillas are also called brachiators, their normal locomotion is not brachiation. They usually walk with all the fours. They rarely walk bipedally on the ground. In time of chest-beating they stand almost erect. They are terrestrial animals, but they build their nests for sleeping in the trees. The young and females do more tree-climbing than the males.

The whole body except the face, palms and soles are covered with black, long, and coarse hair. The ears are small and bear no lobes. Head is very large with smaller cranium and enormous projecting face and jaw. The supra orbital ridges are enormous and continuous to form torus. Forehead is very low. Skull possess very prominent sagittal crest which are weaker in females than the males. The canines are enormous in size.

(c) *Chimpanzee (Pan)*: Chimpanzee is an example of the Homidae family. It is an anthropoid ape. They are found in the tropical forests of Africa. Their habitats include varieties of environmental settings, mountains, woodlands, rain forests etc. There are three species of their type such as – The common chimpanzee, bald headed and Pygmy chimpanzee. Each of them occupied different geographical regions. Their body are not so strongly built as Orangutan. Average height of the common chimpanzee male is about 5feet and that of the female is 4feet. The average body weight is 110 pounds (~50kg). They are expert in climbing and brachiating. They are capable of walking erect and when it walks their arms reach below the level of knee joint. Their body is sparsely covered with long coarse shaggy hairs cover the body somewhat sparsely. Skin colour is somewhat variable. The vault of the head is low. The supraorbital ridges are prominent and continuous to form torus. The average cranial capacity is 400cc. The nasal bones are much reduce in length and fused in early stage. Jaw is strong with a forward projection. Canines are sharp, large and pointed. Diastema is present. The head is elongated and narrow. The fingers are long, opposable. The foot is large and narrow. They live in small families and depend on fruits, roots, leaves, insects etc.

7. Briefly discuss on basic differences between Lamarckism and Darwinism.

Answer:

Life & works of Lamarck: Jean Baptise Pierre Antoine de Monet, Chevalier de Lamarck (1744-1829) was a French naturalist. He served as an assistant in the natural history museum in Paris & published a number of articles on plants. In 1793, he was appointed as professor on the 'Inferior animals' invertebrates. He lectured on invertebrates, studies diverse animals. To him species was a temporary concept as its stability is shortened. He also applied his ideas to human species by suggesting how quadruped race could have become bi-pedal as a result of use and disuse of body parts. He published his ideas for transformation or change in his *Philosophie Zoologique* in 1809. Although he never used the word evolution, yet his theory is referred to as the Lamarckism theory of evolution or Lamarckism.

Salient features of Lamarckism:

In 1809, Lamarck published *Philosophie Zoologique* which included his theory of evolution that explained principles involved in the formation of new types. Although his theory has been totally rejected, he still occupies a very important place in the history of evolutionary thought. His theoretical insight broadly addressed two concepts – (i) Theory of use and disuse of Organs and (ii) Inheritance of acquired adaption

Theory of use and disuse of Organs : Lamarck stated that new structures appear because of 'inner wants' of the organism that is the internal forces of life tend to increase continuously the size of organism and its component parts if it is in use or functional. If any

body part or component of the organism is not functional or in use, it would tend to reduce. He illustrated the phenomena of elongated feature long neck of giraffe in Africa, webbed foot of aquatic birds, appearance eye on the both side of flat fishes, long leg of wading birds are examples of modification of body part or limb as a consequence of prolonged use by organism for adopting to new environment. Similarly, examples of disuse are: loss of hind limb of whales and snakes, reduced eyes in moles.

Inheritance of acquired adaption: Lamarck propounded that organisms acquiring change or new modification in their body parts due to process of use and disuse with in their life time transmit the changed characteristic or adaptation to next generation.

Lamarck's theory of use and disuse of organs and inheritance of acquired adaptation failed miserably to explain the phenomena of evolutionary change.

Life & works of Charles Darwin: Charles Darwin (1809-1882) was the son of a rich and successful physician Dr. Robert Charles and the grandson of Erasmus Darwin, the author of *Zoonomia*. From the very beginning of childhood, he has shown the sign of an enthusiastic naturalist. Darwin studied in the Edinburg initially, then moved to Cambridge, where he became interested in natural science. He had good association with scholars like Henslow, a botanist, Sedgwick and Lyell both geologist. He went on voyage in the HSM Beagle on recommendation of Prof. Henslow for nearly 5 years (1831-1836). Darwin studied several objects of nature during the voyage touching different part/regions, which are follows:

- (i) Beetle collecting and dissecting marine invertebrates with keen observation.
- (ii) Most of his zoology notes are about marine invertebrates starting with Plankton collected in a calm spell.
- (iii) At St. Jago, he found huge quantity of volcanic rock cliff with seashells.
- (iv) Near Brazil, Darwin made a major find of fossil bones of huge extinct mammals.
- (v) Darwin found in Galapagos Island that species of finches differed from island to island but showed general resemblance.
- (vi) He also saw that species occupying a particular niche in some region was replaced by some very closely similar species in adjoining region.
- (vii) The fossils that he observed were built on the same plan as those now extant. For Darwin these were enough proof to revolt against the immutability of species.
- (viii) Darwin observed the living and extinct organism in the flat plains of the Argentina pampas and Galapagos islands, and sowed in him the view of evolution. He dug up bony remains (fossil) of extinct animals such as *Toxodon*, *Macranchenia*, *Pyrotherium* & *Thoatherium*. The presence of *Thoatherium* testified that a horse has been among ancient inhabitants of the continent. Darwin confirmed an observation from the study of animal remains that species gradually become modified with time, and not all species survived through age.
- (ix) The detailed study of remains of giant *armadillos* and *sloths* on an Argentina pampas made Darwin to infer that fossil sequence of a given animal species is observed through ages and causes of extinction.
- (x) He observed that one species was replaced by similar but slightly different species.
- (xi) His study on a rare species of Ostrich along with common species, led Darwin to infer that species not only change in time but also with geographic distance.
- (xii) The observed variation in the form of tortoises in Galapagos island drove home Darwin a point that island tortoises shared a common ancestor with the mainland forms. The same was true of a group of small black birds known today as *Darwin's finches*. He observed that the finches were different on various island in these structure of beaks yet they were closely related to each other. Therefore a single ancestral group gave rise to several varieties of species. Some had stout beaks, other had small beaks, in some the beaks are straight, in other

those were parrot like etc. The variation in beak structure is associated with feeding habits and natural environment.

Salient features of Darwin's theory of Natural Selection

Darwin was an inductivist. His theory of natural selection was based on empirical evidences. He put his observation and finding in form of theories in his monumental publication on 'The Origin of Species' published in 1859. Another naturalist Alfred Wallace equally presented similar theory as that of Darwin in 1858 and Darwin accepted Wallace's view on evolution and submitted joint paper in the Linnaean society in London on July 1, 1858 for presentation. Darwin's major contribution along with Wallace was development of theory of natural selection as the primary force of evolution. For him evolution was meant as descent through modification. He proved that species evolved from previously existing species, and secondly the mechanism of evolution is through the principles of natural selection. His monumental publication 'The Origin of Species' with its impressive weight of evidence and argument could scientifically substantiate for the first time the role of natural selection in bringing out evolutionary changes in the species. It may be generalized that organisms endowed with favourable variant tend to produce more offspring than their conferrers and in course time or over generations favoured organism with adaptive variables ultimate emerge as a new species. Darwin observed the following facts from nature though his pain staking travel to different islands in HMS Beagle.

(i) Prodigality of reproduction: Each and every organism has the innate capacity to produce its offspring in a given environment. However, reproductive success of organism differs considerably. Nature imposes restriction on the actual survival of offspring, which vary from species to species.

For example, a salmon produces 28,000,000 eggs in a session. A pair of English sparrow would be the ancestors of over 275 billion individuals in 10 years if their descendents could produce at their natural without any check. Therefore, if all the offspring of any species remained alive and reproduced they would soon cross all over species from the earth. Darwin was greatly influenced by the writing of T.H. Malthus who said the reproductive of capacity of mankind far exceeds the food supply, available to nourish an expanding human population. Hence these will be always struggle for food and basic amenities.

Struggle for existence: Struggle for existence is a phenomenon which is witnessed in nature in every moment. Organisms struggle for survival through competition, which may be of three types: intra-species struggle, inter-species struggle and environment and species struggle. The outcome of struggle leads to survival of organisms that are fittest in changing environment in terms of reproductive fitness.

Universal occurrence of variation: Darwin explained with empirical evidences that variation is a fact of nature. Organism endowed with favourable variation tend to survive and reproduce its own self to next generation in greater number than the organism with less favourable or unfavourable variation. To him, variation is the raw martial upon which evolution acts. However, he didn't have the conception of mechanism of variation.

Survival of the fittest: The survival of the fittest is the major outcome of Darwin's empirical observation. He borrowed this concept from Herbert Spencer. According to Darwin, fitness is not physical fitness. It is relative reproductive fitness of organisms that are characterized by favourable variation. The surviving individuals by virtue of being favoured in evolutionary process will tend to transmit their favoured genotypes to the next generation. The less fit will tend to be eliminated before they have reproduced.

Origin of species: Successive generations of organism in this way tend to become better adapted to their environment and ultimately a new species is formed with favoured characteristics which become different from ancestral ones.

8. Briefly discuss scope of biological anthropology.

Answer:

(1) Biological or physical anthropology is one of the major branches of anthropology- The Science of man, the science devoted to the comparative study of man as physical and cultural being. The physical anthropologists study man's physical features, their origin, evolution and present state of development and diversities observed among human groups inhabiting different geo-graphical zones.

(2) Since man, in all his variety, examined at any moment, may be regarded as a complex of the effects of past causes and of the operation of present ones, it is possible to study him both from historical and contemporary perspectives.

(3) The vital questions which are being addressed by biological anthropologists are: (a) how did man come to be the kind of physical organism that he is today? (b) How did he happen to develop particular type of culture?

From contemporary point of view, it is asked - what is the nature of the conditions which have made man what he is here and now in all his wonderful variety?

In order to answer the above basic and fundamental questions regarding human origin, evolution and variation, the biological anthropology widens its scope and come closer to many biological disciplines in solving the problems of human origin and variation

(4) To learn more or less precisely how much of biological enters in to the expression of any social process and how much of social enters in to expression of any biological process is one of the principal aim of biological anthropology. Hence, the physical anthropologists must be something as a social biologist.

(5) Man is a product of environment: Natural and cultural, both past and present. Several natural and cultural factors have played paramount role in the overall development of physical and mental makeup of man. Therefore, man must be studied in relation to his environment, past as well as present including cultural ones. Therefore, physical/biological anthropology is defined as the comparative science of man as physical organism in relation to his total environment, social or cultural as well as physical.

The scope of biological anthropology is diverse and broad, in view of the fact that it intends to unravel many biological perspectives of man as a bio-cultural being. The following broad branches of biological anthropology are more or less illustrated by several scholars. The horizon of biological anthropology is not constant and it is changing all time.

Branches concerning with Evolutionary perspective: Since origin and evolution of man is one of the primary focuses of study of biological anthropology, the study of man's evolution occupies the central theme in biological anthropology. Man is an animal whose closest kinship is the apes and monkeys and with them he is classed in the mammalian and of primate. Hence **Primatology** is an integral part of biological anthropology which investigates in which way man is placed among primates both in terms of closeness as well as in distances. Without appropriate comparative study of primates, understanding the evolutionary process, starting from lower primates to higher primates would not be possible. The study of anatomy, physiology and behaviour of non-human primates throws an invaluable light upon the evolution of man. Without the knowledge obtained from these studies we should be virtually in dark concerning the pre-human history of man. Not only the study of living primates is necessary division of physical anthropology, but equally important, in another way, is the study of extinct or fossil primates which are ancestral or related to their living today and which flourished many millions of years ago, long before the appearance of man upon the earth. **Primate Paleontology** constitutes another important area of study biological anthropology.

(6) Biological evolution of man necessitates understanding of some knowledge of geo-ecological variation observed during prehistoric times. Hence study of geo-ecology of earth is

essentially important for biological anthropologists for reconstruction of bio cultural evolution of man. Geo-chronology that deals with time scale of man's prehistory provides scientific evidence with respect to occurrence of evolution of man.

(7) **Paleontology** thus emerged as a distinct area of study in biological anthropology which gives weightage in the study of bio-cultural evolution of man from pre-historic times to contemporary period emphasizing on both paleontology as well as cultural anthropology.

(8) The study of **skeletal biology** of ancient and living human beings enriched our knowledge on comparative anatomical difference between them and other primates including embryology or developmental anatomy and the anatomy and physiology of growth.

The study of **physical growth and development** constitutes an important subject matter of physical/biological anthropology. It enriches our knowledge on process and pattern of human physical growth from fetus to adult stage including pattern of variation observed with respect to skeletal and muscular growth of different tissues. This area of study has tremendous application for assessment of nutritional status of different population groups of human societies. Hence Nutritional anthropology stands close to biological anthropology since nutritional anthropometry helps in a great deal in the assessment of different grades of malnutrition: stunting & wasting. Therefore, the values of physical anthropology for the analysis and ability to direct the growth and development is not undermined.

Human and Population Genetics: The study of genetics of man is one of the central concerns of biological anthropology. Without the proper study of heredity of man our understanding of human variation will be incomplete Biological anthropology gives much emphasis on the study of genetic structure of primitive population and with the proper scientific knowledge of human genetics, biological anthropologists are able to explore the following:

(i) Genetic evolution of human population; (ii) Genetic abnormalities and genetic disorders in human population; (iii) Genetic epidemiology; (iv) Genetics of communicable & non communicable diseases; (v) Genetic load in human population; (vi) Pharmacogenetics chromosomal; (vii) Cytogenetics of abnormalities; (viii) Gene environment interaction and many others.

The study of Human Race

Race is an important concept in Anthropology both biological and socio-cultural. The study of human diversities in physical make up is generally known as Race. The development of anthropometry in biological anthropology ushered a new era in solving the long standing problem of scientific usage of the term race apart from other scientific studies; the racial division of mankind in to different race was made with the application of anthropometry.

Molecular Anthropology: With the rapid development of tools & techniques in molecular genetics, the entire genome of man could be decoded. Elucidation of complete sequence of human genome made perceptible impact on many disciplines and biological anthropology was no exception to it. Biological anthropologist dealing with variation within and between human groups and tracing the origin of human on the basis of genomic variation are identified as molecular anthropologists. Molecular anthropology has brought about a new insight with reference to origin of humanity or Anatomically Modern Human (AMH) in Africa and subsequent dispersal to other part of the world. Molecular anthropology is also making all efforts to highlight molecular basis of different types of genetic disorders: communicable and non communicable, behavioral traits, multi-factorial traits etc. It is also inflicting upon new ideas with respect to gene-environment interaction for certain complex traits like diabetes, hypertension, CAD, cancer etc.

Human Behavioural Ecology: As closely related to biological anthropology, it studies human behavioral adaptations (Foraging, reproduction, ontogeny) from an evolutionary ecological perspective.

Human adaptations Studies: The study of human adaptive responses to different climatic responses such as physiologic, developmental and genetics is a central focus of study in biological anthropology. It tries to explain how different human groups adapt to varied ecology through the mechanism of bio-cultural adaptation.

Palaeopathology: It is becoming a major theme of research in biological anthropology. The study focuses not only on pathogenic conditions observed in bones or mummified soft tissue but also on nutritional disorders, variation in stature or the morphology of bones over time, evidence of physical trauma, or evidence of occupationally derived bio mechanic stress.

Bio-medical anthropology: It is a sub field of anthropology which incorporates perspectives from the biological and medical anthropology. It seeks to improve medical practice and bio medical science through the historic integration of cross-cultural or bio-cultural behavioral and epidemiological perspective on health.

Ergonomics: The study of ergonomics science gaining more significance in biological anthropology since it lays emphasis on man-machine relationship. It is concerned with making work more convenient, efficient, stress and strain free, safe, there by looking after, workers wellbeing and health in its broad sense. Studies on the relationship between pilots performance and human factor like body dimensions and constitutions are areas of human ergonomic applications.

Forensic anthropology being a division of biological anthropology uses the tools and techniques of biological anthropology such as osteology, serology, dermatoglyphics in the identification of crime events & criminals scientifically and at the same time help solving legal issues.

Similarly application of **anthropometry** in standardization of size and design of manufactured goods, from machines, furniture, garments to preparation of small artifacts is now well recognized. Applications in sizing and designing of military equipment, garments in defence as well as in other manufacturing industries are no less significant.

Apart from the above discussed narration, Biological anthropology contributes immensely to other areas of knowledge such as Bio-demography, pharmaco-genetics, medical and clinical genetics, community genetics pre-natal diagnosis and genetic counselling, proteomics, physiological anthropology, social, biology, genetic epidemiology, ecological anthropology, medical bio-technology etc.