

**AS-2291**  
**Model Answer**

**M.A/M.Sc.- (First Semester)**  
**Examination- 2013**  
**Anthropology and Tribal Development**  
**Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)**  
**Paper-I: Basics of Physical/Biological anthropology-I**

**Full marks: 60**

**Passing Marks: 24**

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

**Section A**

**(Multiple choice questions)**

**Q1) Select the correct answer from the options:**

**10 x 2= 20**

I. The study of human variation is measured in:

a. Space; b. Trait; c. Time; d. None

Answer: a

II. Who is the father of modern physical anthropology?

a. J. F. Blumenbach; b. J. G. Herder; c. Washburn; d. None of the these

Answer: c

III. Who is the father of organic evolution?

a. Lamarck; b. A. Wisemann c. Bluemanback; d. Darwin

Answer: d

IV. Who designated the term Synthetic theory?

a. Darwin; b. Lamarck; c. Carolus Linnaeus; d. Huxley

Answer: d

V. Which one is the example of genetic variables?

a. ABO blood group; b. Nasal index; c. Hair colour; d. None of the above

Answer: a

VI. Racial classification of Linnaeuous has how many folds?

a. Five; b. Four; c. Two; d. One

Answer: b

VII. Who gave the Theory of Spontaneous creation?

a. Aristotle; b. John Ray; c. Lamarck; d. Weisman

Answer: a

VIII. Old world monkey is also known as?

a. Primate; b. Catarrhine; c. Platyrrhine; d. Hominids

Answer: c

IX. Lemurs are mainly confined with?

a. Srilanka; Africa; c. Madagascar; d. All the above

Answer: c

X. Who wrote the book "Duskeimplasm"?

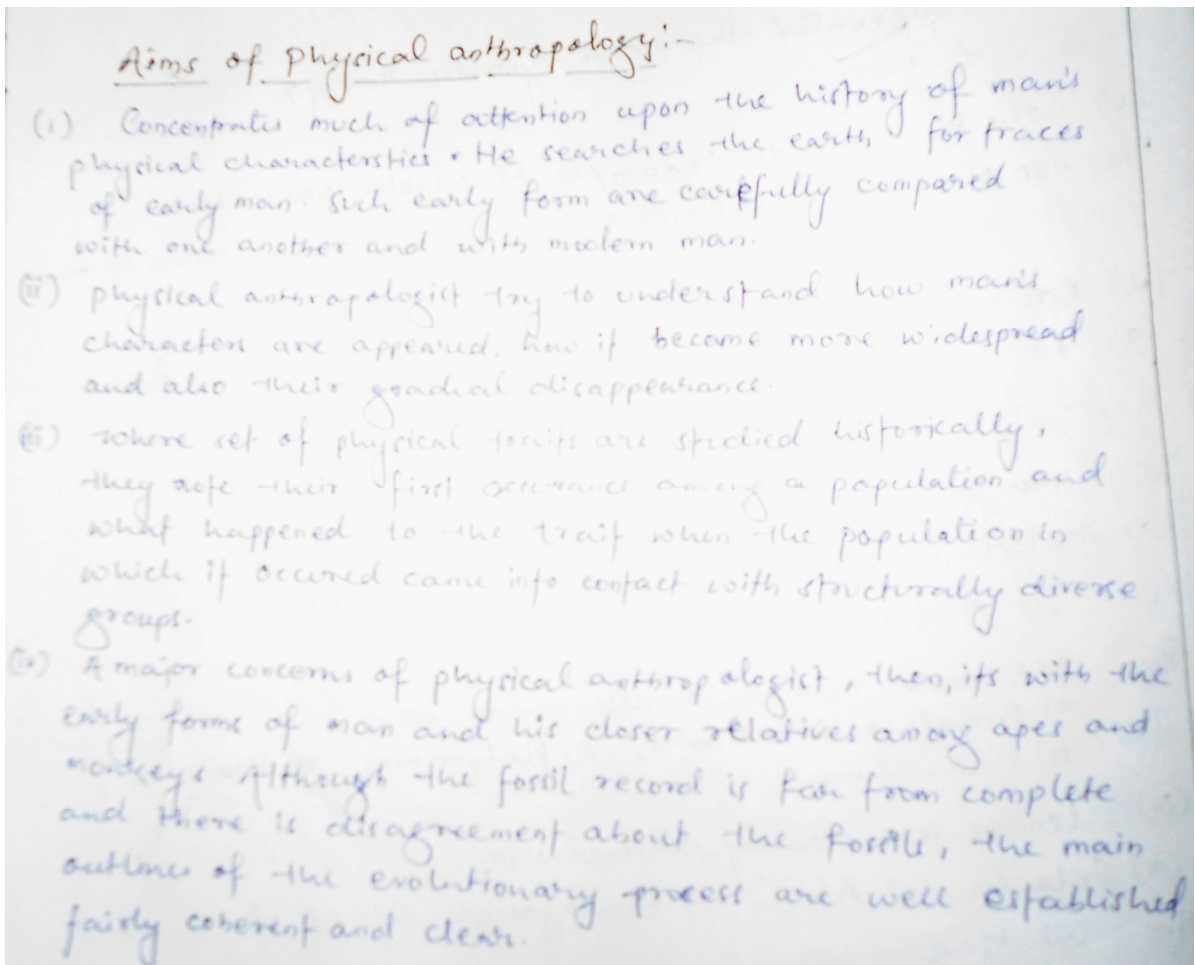
a. Darwin; b. Lamarck; c. Weisman; d. None of the above

Answer: c

Section B: Long answer type questions (Attempt any Four)

(4 x 10= 40)

**Q2. Answer:** Biological anthropology is the branch of anthropology that deals with the study of biological evolution, biological variation, biological growth and biological development of human being synchronically and diachronically. Physical anthropologist relies extensively on population genetics to study human diversity. The human races are now best considered as Mendelian population which is centered round a purely genetic concept. Because of this integrated biology-oriented approach of the present day physical anthropology it is thought desirable to call it biological anthropology.



- Behavioral studies of the higher animals are beginning to yield clues to the origin of human behaviour.
- (vi) Main aim is to know what type environmental factors are responsible for changing in humans bodily form, their interaction with environment and for their life style.

### Scopes of physical Anthropology :-

The study of biological anthropology is wider than the study of primates, fossils and brain evolution. Any scientist studying evolution as it relates to the human species, directly or indirectly, could be called a biological anthropologist.

This includes a number of related disciplines -

#### 1) Palaeoanthropology :-

- (i) When an exciting new fossil of an extinct form of human is found, palaeoanthropologists usually are responsible.
- (ii) It is the study of fossil record for human kind, and fossilized remains are the most direct physical evidence of human ancestry that we have to understand where we came from.
- (iii) The discovery of skeletal evidence of new ancestral species, or additional specimen of existing species, revises our view of human family tree.
- (iv) It also includes study of fossil record of the other primates apes, monkey & prosimians, dating back at least 65 million years.
- (v) The early fossils give us key clues about how, where and why hominids evolved millions of years later.

#### 2) Skeletal Biology and Human Osteology :-

- 1) Osteology is the study of bones.
- 2) Osteologists try to identify and the tiny part of fossilized bone, whether it is of animal or humans and study about that.
- 3) Among the first generation of biological anthropologists were the anthropometrists, who made detailed measurement of human body in all its forms and their work is still important today.

**Q3. Answer.** The *Synthetic Theory of evolution* or *Modern Synthetic* emerged around the middle of the 20th century from the ideas of three authors specialized in different branches of the evolution: **Theodosius Dobzhansky** in genetics, **Ernst Mayr** in the species of living beings and **George G. Simpson** in the great categories of the organisms. The *Modern Evolutionary Synthesis* has incorporated the latest advances of science in biology and genetics. If the *neo-Darwinism* or *neo-Darwinian Theory* explicitly incorporated the random variations or mutations within the population, the **Synthetic Theory of evolution** incorporates the random variations or mutations of the genetic information and accepts this mechanism as part of the evolution that, together with the mechanism of the natural selection, produce evolution as a whole.

The diversification emerges slowly, usually through gradual changes, and originates in the specialization. Therefore, it is part of the *Gradualism* trend as the initial *Theory of Darwin*.

The basis of this theory was provided by Dobzhansky in his book '*Genetics and Origin of Species*' while the designation 'Synthesis Theory' was proposed by **Huxley**. Though many other scientists like Muller, Fisher, Wright, Mayr, etc. have contributed a lot other the final shape of the 'modern Synthetic Theory of Evolution' was given by Stebbins.

There are five basic factors involved in the process of organic evolution. These are (i) Gene mutation, (ii) Chromosomal mutation, (iii) Genetic recombination, (iv) Natural selection and (v) Reproductive isolation while the first three factors provide genetic variability; the last two are responsible for giving a direction to the evolutionary process.

### **1. Gene Mutation:**

The heritable characters of an individual depend on the genes those control them. These genes are portions of DNA molecules which have a complex polymer of nucleotides. Any structural change occurring in the chemistry of DNA molecule is called gene mutation. Changes in the genes alter the phenotypic characters of the individuals.

### **2. Chromosomal Mutation (Chromosomal Aberration):**

Specific types of genes present in specific amount of DNA at specific location is the characteristics of a particular species. A change in the number of chromosomes (aneuploidy, polyploidy, etc) or in the structure due to deletion, duplication, addition, inversion, or translocation brings about variations in the organisms phenotypes.

### **3. Recombination:**

Recombination of genes due to crossing over during meiosis is also responsible for bringing about genetic variability among the individuals of the same species, thus, contributing to the heritable variation.

### **4. Natural Selection:**

Natural selection is a guiding or driving force, which utilizes the above raw materials (mutations) and gives a direction to the evolutions. Harmful mutations are eliminated or suppressed while mutants with better survival value are preferred and encouraged. Hence, natural selection is the dynamic force for speciation.

### **5. Reproductive Isolation:**

Isolation plays a great role in speciation and particularly in preserving the identity of a particular species. Various isolating mechanisms operate in nature to isolate small groups of a population reproductively. So they can not breed freely. Moreover, related species are also isolated from each other which prevent hybrid formation. Isolations may be geographical, ecological, psychic, reproductive, etc. But the last one is the most important from evolutionary view point.

### **Accessory Processes:**

Besides the five factors described, there are two accessory processes as follows:

#### **1. Migration and Hybridization:**

Migration of individuals from one population to another result in the introduction of new gene into the gene pool.

Hybridization may also occur between two closely related species giving rise to a progeny with altered characteristics than those of the parental population.

#### **2. Genetic Drift:**

In small populations' chance plays a greater role than the natural selection.

In such populations individuals are rapidly become homozygosity. This may lead to the extinction of the species. But as competition is less in such populations the homozygous individuals may withstand the condition and survive well finally giving rise to this new species.

Thus we can say that the organic evolution is not merely the process of natural selection but there are various evolutionary (micro and macro) as well as social factors responsible for the formation of new species.

Concerning the evolutionary leaps and Modern Synthetic Theory, the controversy is currently present because of the fossil registry, about which there is not a clear position within the scientific community.

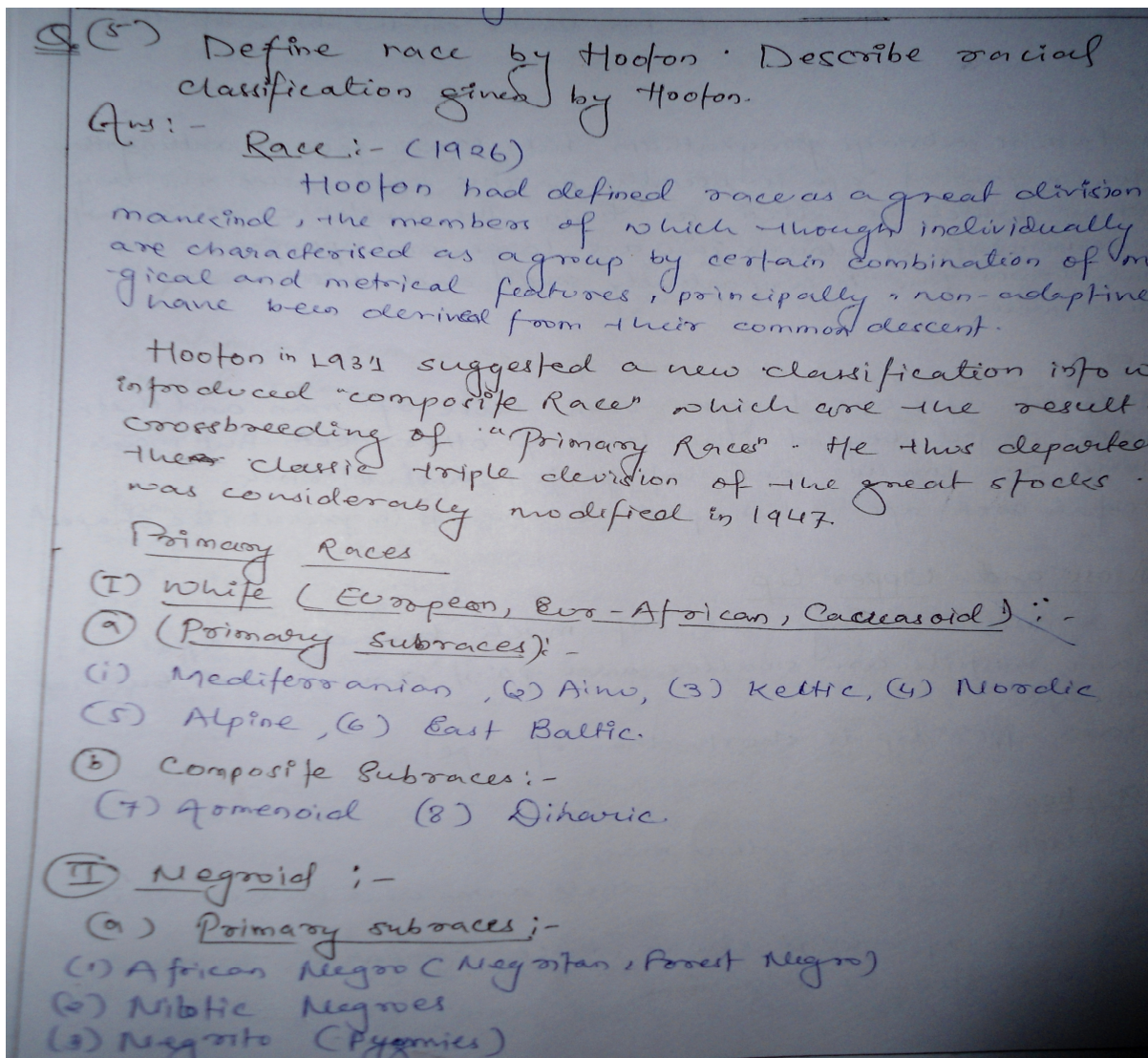
Q4. Answer: In biological terms humans are sometimes described as **highly evolved primates** because of the similarities in the physical and biological structures of the bodies of humans and modern primates such as monkeys, apes, orang-utans, gorillas and similar animals, in addition to humans perceived superiority over those primates.

**Compare human anatomy with ape anatomy**

Human Anatomy	Ape Anatomy
<ul style="list-style-type: none"> <li>• Limited proportion of skin covered in hair e.g. top, back and sides of head, armpits &amp; genitals (adults), sometimes chest &amp; limbs (adult males).</li> </ul>	<ul style="list-style-type: none"> <li>• Dense hairs cover most the skin <i>except</i> face, plantar surfaces of feet and palmer surfaces of hands.</li> </ul>
<ul style="list-style-type: none"> <li>• Skull supported on top of vertebral column</li> </ul>	<ul style="list-style-type: none"> <li>• Skull hangs forward from vertebral column</li> </ul>
<ul style="list-style-type: none"> <li>• Cranium larger than face (cranial volume twice that of apes)</li> </ul>	<ul style="list-style-type: none"> <li>• Face larger than cranium</li> </ul>
<ul style="list-style-type: none"> <li>• Facial Structure:               <ul style="list-style-type: none"> <li>○ small eyebrow ridges</li> <li>○ protruding nose</li> <li>○ flattened jaws</li> <li>○ large lips (beneficial for facial expression)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Facial Structure:               <ul style="list-style-type: none"> <li>○ prominent eye ridges</li> <li>○ flattened nose</li> <li>○ very large jaw (for eating)</li> <li>○ thin lips</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Walking upright (called "bipedal gait") enhanced by:               <ul style="list-style-type: none"> <li>○ legs longer than arms</li> <li>○ wide pelvis (relative to</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Shuffling on all fours ("quadrupedal gait") supported by:               <ul style="list-style-type: none"> <li>○ long arms (proportionately longer than in humans)</li> </ul> </li> </ul>

apes)		o	narrow pelvis (relative to humans)
o	ability to straighten the knee	o	knees bent - to greater or lesser extent
o	arched feet	o	flat, fat, feet (relative to humans)
o	large buttocks (relative to apes)		

Q5. Answer: Hooton in 1926 define race is "a great division of mankind, the members of which, though individually varying, are characterized as a group by a certain combination of morphological and metrical features, principally non-adaptive, which have been derived from their common descent.



#### 4) Mongoloid

##### (a) Primary Races :-

- (i) classic Mongoloid (ii) Arctic Mongoloid (Eskimoid)

##### Composite Races :-

##### (a) Predominantly white :-

- (i) Australians (Archaic white + Tasmanian + recent minor fraction of Malnesian Papua)  
(ii) Indo-Dravidian (Class Mediterranean + Austroaloid + Negritoid + minor fractions of Armenoid, Aloradic, Mongoloid)  
(iii) Polynesian (Indonesian + Mongoloid + Malnesian + Papuan)

##### (b) Predominantly Mongoloid :-

- (i) American Indian (Mongoloid + Armenoid + Austroaloid + very small Negritoid element)  
(ii) Indonesian - Mongoloid or Indonesian Malay (Mongoloid + Primitive + Mediterranean + Ainu + Negrito)

##### (c) Predominantly Negroid :-

- (i) Malnesian - Papuan or Oceanic Negroid (Negrito + Austroaloid + Convex nosed Mediterranean + Minor fractions of Malay and Polynesian)  
(ii) Bushman-Hottentots (Negrito + Palaeolithic Boskop + Mediterranean in Hottentots)  
(iii) Tasmanian (Negrito + Australian)

Q6. Answer: Race is a population which differs in the frequency of some gene or genes which is capable of exchanging genes across whatever boundaries separate it from other population of the species.

Racism is the belief that some human population is superior or inferior to others because of inherited, the member genetically transmitted characteristic.



## Mutation as one of factor for racial formation:-

Mutation is defined as an alternation in the genetic material is a change in the base sequence of DNA.

Mutations defines the condition in which a particular gene undergoes a permanent change of some sort, resulting in the appearance of new form of an old character.

It can also be said as a sudden change in chromosomal DNA or sudden heritable structural change in DNA. In other words, an actual alternation in genetic material is called mutation.

Mutation is of two type:-

- (i) Gene Mutation
- (ii) Chromosomal mutation.

### (i) GENE MUTATION:-

The heritable characters of an individual depend on the genes that control them. These genes are portions of DNA molecules which have a complex polymer of nucleotides. Any

structural change occurring in the chemistry of DNA is called gene mutation. Changes in the genes alter the phenotypic characters of the individual.

### (ii) Chromosomal Mutation:-

Specific types of genes present in specific amount of DNA at specific location is the characteristics of a particular species. A change in the number of chromosomes (aneuploidy, polyploidy etc) or in the structure due to deletion, duplication, addition, inversion, or translocation brings about variations in the organism's phenotypes.

Mutation can be caused spontaneously or be induced by exogenous agents. Exogenous agents which induce mutations are called mutagenic agents and include -

- (a) Ionizing radiations like X-rays.
- (b) Chemical like mustard gas, formaldehyde etc.
- (c) Some viruses

Spontaneous mutations, presumably since the inception of life on earth are the source of new genes which have provided a basis for evolution. Mutation of genes for certain characters have almost certainly occurred independently at different rates, and have affected different characters. For such changes to have evolutionary significance, they must occur in sex cells (egg or sperm), which are passed between generations. If mutation do not occur in sex cells but in somatic cells, they will not be passed to the next generation and no evolutionary change can result.

However, if a genetic change does occur in the sperm or egg of the individual (A mutates to x, for example) the offspring's blood types also will be altered causing a change in allele frequencies of that generation: example are sickle cell and albinism alleles.

Q7. Answer:

## Natural selection is one of factor for Racial Formation -

A result of natural selection is a change in allele frequency relative to specific environmental factors. If the environment changes, then the selection pressure changes as well. Such a functional shift in allele frequencies is what we mean by adaptation.

Adaptation can be defined as genetic change is response to selection factors.

If there are long-term environmental changes in a consistent direction, then allele frequencies should also shift gradually each generation. If sustained for many generations, the results may be quite dramatic.

The best historically documented case of natural selection acting in a contemporary organism deals with changes in pigmentation among peppered moths near Manchester, England.

Before 19th Century, the common variety of moths was a mottled grey colour that provided extremely effective camouflage against lichen covered tree-trunks. Also, present, though in much lower frequency, was a dark variety of the moth. While resting on such trees, the dark, uncamouflaged - against the light tree trunks were more visible to birds and were therefore eaten more often. Yet in 50 years, by the end of 19th century, the common grey, camouflage form had been almost completely replaced by the black variety. This change was came because of ~~an~~ rapidly changing

environment of industrialized 19th cent...  
 released in the area settled on trees, killing the...  
 turning the bark a dark colour. Moths living in the area  
 continued to rest on trees, but the grey (or light) variety was  
 increasingly conspicuous as the trees became darker.  
 Consequently, they began to be preyed upon more frequently  
 by birds and contributed fewer genes to the next generation.  
 In the 20th century, increasing control of pollutants has  
 allowed some forested areas to return to their lighter, pre-  
 industrial conditions, with lichen growing again on the trees.  
 As would be in these areas the black variety is now  
 being supplanted by the grey.

The substance that produces pigmentation is called melanin,  
 and the evolutionary shift in the peppered moths, as well as  
 in many other moth species, is termed Industrial Melanism.  
 Such an evolutionary shift in response to environmental change  
 is an excellent example of what we have defined as an  
 adaptation.

A trait must be inherited to have importance in natural  
 selection. A characteristic that is not hereditary (such as a  
 change in hair pigmentation brought about by dye) will not be  
 passed on to succeeding generations. In moths, pigmentation  
 is a demonstrated hereditary trait.

Natural selection cannot occur without variation in inherited  
 characteristics. If all the moths had initially been grey (some  
 dark form are present) and the trees become darker, the  
 survival and ~~popu~~ reproduction of all moths may have  
 been so low, that the population would have become  
 extinct. Such an event is not usual in evolution and, without  
 variation, would nearly always occur. Selection can only  
 work with variation already present.

Q8. Answer: a. Evolutionary trend: Evolutionary trend is the change in the pattern of growth of different parts of an organism in an environment across generation. It is often

leads to the specialization of an organism. Example: Horse evolution i.e., from Eohippus----- Mesohippus----- Merychippus -----Equus (Present day horse).

But, it is not always provides the specialization for an organism it also leads to the extinction of an organism (beyond the adaptive stage), example: Sabre tooth tiger.

In human evolution examination of hominid remains indicates several trends, including changes in posture, cranial capacity (brain size), and facial angle. Such trends are often misused, e.g. in popular illustrations, to give the impression that evolution has proceeded in a linear manner, from some primitive ancestor through a series of descendants, to culminate in our own species. It's important to remember that the evolutionary history of humans, as of most organisms, is best reconstructed as a bush, where there are often several related species in existence at any one time. Other morphological features that show evolutionary trends are: Reduced sexual dimorphism, Changes in size of ribcage:

b. Humans and many other mammals have unusually efficient internal temperature regulating systems that automatically maintain stable core body temperatures in cold winters and warm summers. In addition, people have developed cultural patterns and technologies that help them adjust to extremes of temperature and humidity. Example: In very cold climates, there is a constant danger of developing hypothermia, which is a life threatening drop in core body temperature to subnormal levels. The normal temperature for humans is about 98.6° F. (37.0° C.). However, individual differences in metabolism , hormone levels, physical activity, and even the time of day can cause it to be as much as 1° F. (.6° C.) higher or lower in healthy individuals. It is also normal for core body temperature to be lower in elderly people. Hypothermia begins to occur when the core body temperature drops to 94° F. (34.4° C.). Below 85° F. (29.4°C.), the body cools more rapidly because its natural temperature regulating system (in the hypothalamus) usually fails. The now rapid decline in core body temperature is likely to result in death.

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