TEST CODE	8	3	1	2	0	3

ATS 2025

Time Allowed : Three Hours
समय : तीन घंटे

ForumIAS

Maximum Marks : 250
अधिकतम अंक : 250

Anthropology / एंथ्रोपोलॉजी (नृविज्ञान)

Name Of Candidate परीक्षार्थी का नाम	PRADHUMAN MEENA		
Roll No./अनुक्रमांक	1910134894	**Medium/माध्यम**	English ☑ हिंदी ☐
Center Code/परीक्षा केंद्र	1901	**Date/दिनांक**	15-11-2024

*Center Code : For Online – 1900 / Delhi : Karol bagh - 1901, ORN - 1902, Mukharji Nagar - 1903 / Patna : Boring Rd. – 2001 / Hyderabad : Jawahar Nagar - 2101

INDEX TABLE / अनुक्रमणिका

Q. No. प्र.सं.	Max. Marks अधिकतम अंक	Marks Obtained प्राप्तांक
1		
2		
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10		
Total/कुल अंक	250	

INSTRUCTION / अनुदेश

1. Please do furnish Name, Email, Roll No and Mobile in the answer sheet.
कृपया उत्तर–पुस्तिका में नाम, ईमेल, रोल नंबर और मोबाइल नंबर भरें।

2. There are EIGHT questions divided in two Sections in the question paper. Question 1 and 5 are compulsory. You can attempt any THREE out of the remaining, Choosing at least ONE Question from each section.
प्रश्न पत्र में आठ प्रश्न दो खण्डों में विभाजित हैं। प्रश्न 1 और 5 अनिवार्य हैं। आप प्रत्येक खंड से कम से कम एक प्रश्न चुनकर, शेष में से किसी भी तीन का प्रयास कर सकते हैं।

3. The number of marks carried by a question/part is indicated against it.
प्रत्येक प्रश्न/भाग के लिए निर्धारित अंक उसके सामने अंकित किए गए हैं।

4. Answers must be written in the medium authorized in the admission Certificate, which must be stated clearly on the cover of this Question-Cum-Answer (QCA) Booklet in the space provided.
उत्तर प्रवेश पत्र में अधिकृत माध्यम में लिखे जाने चाहिए, जो कि दिए गए स्थान में इस प्रश्न–सह–उत्तर (क्यूसीए) पुस्तिका के कवर पर स्पष्ट रूप से लिखा जाना चाहिए।

5. Word limit in questions, if specified, should be adhered to. Any page or portion of the page left blank in the Question-Cum Answer Booklet must be clearly Struck off.
प्रश्नों में शब्द सीमा, यदि निर्दिष्ट हो, का पालन किया जाए। प्रश्न–सह–उत्तर पुस्तिका में खाली छोड़े गये किसी भी पृष्ठ या पृष्ठ के भाग को स्पष्ट रूप से काट दें।

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Examiner's Discretion/मूल्यांकन कर्त्ता का विवेक :	**Start Time/प्रारंभ करने का समय :** 12:00	**End Time/समाप्त करने का समय :** 3:00
Total Marks/कुल अंक :	**Mode Of Examination/ परीक्षा की विधि :**	Online/ऑनलाइन ☐ Offline/ऑफलाइन ☑

*Examiner's Discretion is the marks awarded at the discretion of the examiner based on your overall impression, on the basis of (but not limited to) your handwriting, presentation, use of diagrams, flowcharts, facts and figures or absolutely anything that he/she liked in your copy.
मूल्यांकन कर्त्ता का विवेक अंक, आपकी लिखावट, प्रस्तुति, आरेखों के उपयोग, फ्लोचार्ट, तथ्यों और आंकड़ों या समग्र रूप किसी अन्य विषय वस्तु, जो मूल्यांकन कर्त्ता को आपकी कॉपी में पसंद आयी के आधार पर (लेकिन इन्हीं तक सीमित नहीं) पर दिए गए अंक हैं।

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ECN CODE/ ईसीएन कोड :	EG/ईजी : ① ② ③ ④ ⑤	Evaluation Date/ मूल्यांकन तिथि :

Note: Students are expected to incorporate suggestions from the feedback provided in the answers. Discussion classes for the tests are also available online in your portal to aid in your preparation. Further, students are requested to see the good copies of the tests and learn from them. You can also discuss your copy with a Mentor and discover ways and means to improve your answers, or if you have any issues with this test / copy. Ask specific questions, to get specific answers.

EXAMINER'S REMARKS

CRITERIA FOR THE FEEDBACK SECTION AT THE END OF EACH QUESTION

1. **AWIS = Answered What is Asked.** This means whether you have addressed the core demand of the question or not. Addressing the core demand of the question gets you an objectively fair score. It is examiner's perception if you have understood the question and if you know the answer in the first place. Creative answer writing, sometimes missing the core demand, may fetch very high or very low scores, and exposes your answer to the subjectivity of the examiner.
2. **CD & VA = Content Density & Value Addition**. Examiner will evaluate the quality and quantity of your content in the answer. In the same word limit and space limit have you (a) written what is asked (b) gone beyond what is asked (c) enriched answers through combination of (but not all!) suggestions, ideas, quotes, flowcharts, diagrams, facts and figures, data etc. This affects objective components of assessment.
3. **S & F = Structure & Flow** = Whether you have structured your answer properly or not. Whether the answer has been broken into parts and sub-parts and each part has been addressed appropriately or not. Whether the flow of the answer is maintained. Affects both subjective and objective components of assessment.
4. **P & R** = How your answer performs on the criteria of **presentation, ease of read, clarity and apparent effort** in writing the answer. This affects the subjective components of assessment.

Section- A

Q.1) Write short notes on the following in about 150 words.

a) Protein synthesis (10 Marks)

Process of protein synthesis is known as Translation. In translation, RNA helps in protein synthesis outside nucleus.

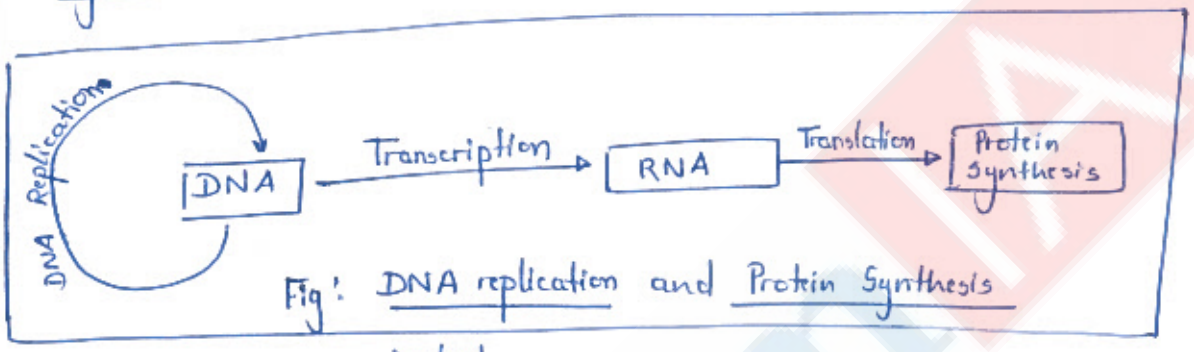


Fig: DNA replication and Protein Synthesis

→ Steps/Processes involved in Protein synthesis :-

1). DNA replication - Form DNA within nucleus.

2). Transcription - RNA formed from DNA within nucleus.
Only 1-2% of DNA to RNA.

3 types of RNA
- i). mRNA - messenger RNA
- ii). tRNA - transporter RNA
- iii). rRNA - Ribosomal RNA

3). Translation

i). Firstly, mRNA brings code ~~from~~ of DNA that in what order amino acids are to be placed.

ii). tRNA ⟶ read the code and accordingly, transfer amino acids from cytoplasm.

iii). tRNA ⟶ join the amino acids, transferred by tRNA and with it protein synthesis is complete.

⟶ Significance of Protein synthesis :-

- Protein synthesis is essential for cell function, growth and repair.
- Proteins are involved in nearly every cellular process including enzyme activity, cellular structure and immune response.

Thus, protein synthesis is key to the life of cells and organisms.

b) Nature v/s Nurture debate in Anthropology (10 Marks)

Nature refers to a person's biological makeup including genes, hereditary factors and physical appearance.

Nurture refers to environmental factors include family, nutrition, adaptation etc.

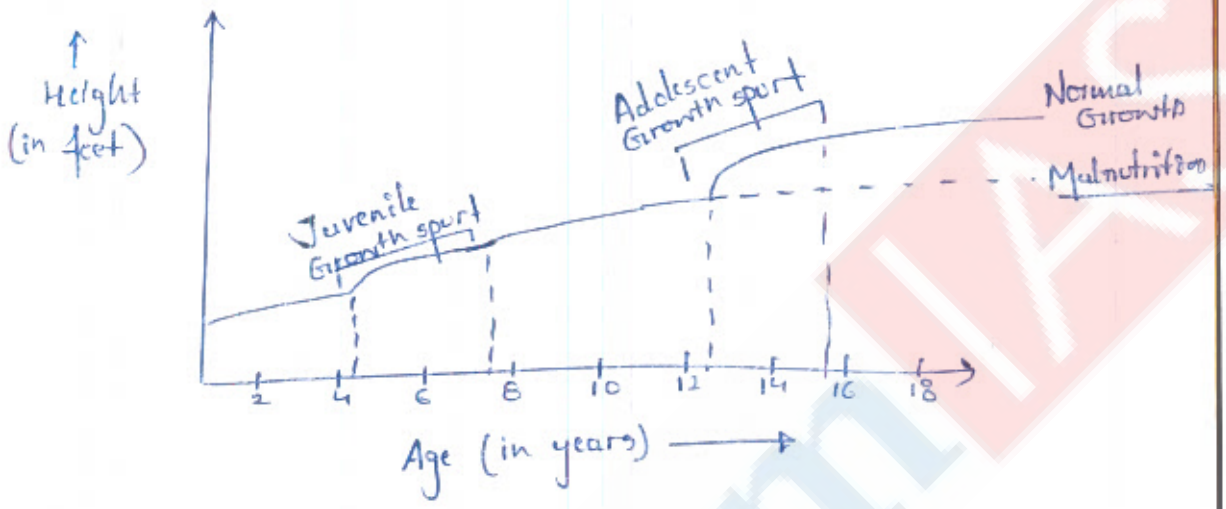
→ Nature's role in growth :-

- Genes control differentation of various organs and affect human survival.
- Heredity controls growth in following ways :-
  a). Phenotype - Morphological aspects of children depend on parent's phenotype.
  b). Sex - Sex is genetically governed.

→ Nurture's role in growth :-

- Emotional factor (Family)
  ↳ Emotional stress inhibits growth hormone secretion.
  e.g. Poor growth rate among orphanges.

- **Nutrition**
  - ↳ Prolonged malnutrition leads to impaired physical and mental development.



- **Environmental factors**
  - ↳ Adaptations according to environment.
  - a). Allen's rule → More temperature → Longer the appendages
  - b). Bergmann's rule → More temperature → lower Body size
  - c). High altitude → Increase in chest size
    → Decrease in body size

To conclude, growth and development are complex process governed by interplay of the above Nature and Nurture factors.

Feedback

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#	G	A	P
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Please put tick marks in the above table.
Here G is Good, A is Average and P is Poor.

TOTAL MARKS	

c) Thrifty genotype (10 Marks)

Thrifty genotype refers to certain genes that enable people to efficiently store fat during times of food abundance in order to survive periods of food scarcity.

→ Background :-

- Thrifty genotype hypothesis was given by J.V. Neel in 1962 to explain increasing incidences of diabetes in the western world.
- Also, explains obesity as the result of Westernised lifestyle.

→ Implication of Thrifty genotype :-

⇒ Positive Implications :-

i). Food security - Advantageous for peoples because it would allow them to face famines.

ii). Pregnant mothers fatten more quickly during times of abundance.

iii). Thrifty phenotype hypothesis proposed that early-life metabolic adaptations promote survival.

⇒ Negative implications :-

- In modern environments, can lead to obesity and type 2 diabetes.

→ Case study :-

- In 2010, a study found that Aboriginal Australians have almost 4 times diabetes prevalence of non-Aboriginal Australians due to lifestyle and dietary changes.

→ Criticism :-

- Thrifty genotype hypothesis ignores other factors such as genetics, environment etc. influencing obesity and metabolic diseases.
- lack of direct evidences linking specific "thrifty" genes to obesity and diabetes.
- lack of empirical data.

Despite criticisms, it enables us to understand the reasons behind increasing obesity and type-2 diabetes.

d) Fertility & Fecundity (10 Marks)

Fertility refers to actual reproductive performance while fecundity is the capacity to bear child.

Fertility	Fecundity
i) It refers to actual alive births.	i) It refers to maximum number of births can be given.
ii). It influenced by biological as well as social factors.	ii). Influenced by biological factors only.
iii). It always less than or equal to fecundity.	iii). It always more than or equal to fertility.

→ Factors affecting fertility and fecundity are :—

1). Biological Factors

a). Age of Menarche and menopause — Period between 2 events marks reproductive span and thereby, influences fecundity of female.

b). Frequency of sexual intercourse.

2) • Ecological factors

• Malnutrition results in delay in menarche and early menopause and thus, low reproductive span.

3). Socio - Economic factors

i): Age of Marriage - late marriage implies low fertility rate due to losing of reproductive years

ii). Contraceptive methods

iii). Government Policies - India's TFR is 2.0, as per NFHS-5 (below TFR 2.1).

iv). Economic conditions - High infant mortality rate in poor societies.

Thus, fertility and fecundity are the two key concepts that influences demographic transition of human population throughout world.

e) Genes affecting human survival (10 Marks)

Gene is a part of DNA which is forming complete RNA.

→ Genes affect human survival in following ways :-

i) Dominant lethal or semi-lethal gene

- Such genes affects human health with their heterozygosity because individual will exclusively show the dominant trait in the phenotype.

e.g. Autosomal Dominant inheritance — Polydactyly, Brachydactyly

X-linked Dominant inheritance — Rickets.

Y-linked Dominant inheritance — Hairy ears, Webbed toes.

ii) Inbreeding or Recessive lethal genes

- Inbreeding increases homozygosity and reduces genotype variability and if autosomal or x-linked lethal gene is present then recessive lethal gene also have greater chances of homozygosity.
- The moment it becomes homozygous, it's phenotype appears and it is eliminated through

natural selection.

e.g. Autosomal recessive — Hereditary blindness

~~Autos~~ X-linked recessive — Colour Blindness.

- However, inbreeding is not harmful in itself but presence of lethal genes cause problems.

iii). **Gene mutations**

- Sudden change in nature of single gene due to temperature, chemicals, radiations etc.
- It may have either positive or negative impacts such as cancers. Thus, affects human survival.

iv). **Genetic load**

- Relative decrease in average fitness of the population to that of the maximum fitness shown by optimum genotypes.

v). Many genes improve the human survival rate with their advantageous features.

In conclusion, genes affect human survival significantly in both - positive and negative ways -

Feedback

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Please put tick marks in the above table.

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TOTAL MARKS		

Q.2) a) Discuss in detail chromosomal aberrations with detailed explanation of 3 associated disorders. (20 marks)

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Feedback

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Here G is Good, A is Average and P is Poor.

TOTAL MARKS		

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b) Highlight the terrestrial and arboreal adaptations in primates in detail.

(15 marks)

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TOTAL MARKS	

c) Describe "Restriction Fragment Length Polymorphism" in applied genetics and its applications in various fields. (15 marks)

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TOTAL MARKS		

Q.3) a) Differentiate between the concept of "race" and "racism." Is race a biologically valid concept? Elaborate. (20 marks)

As per Ashley Montagu, race has defined as a group that differs from others with respect to certain gene frequencies.

Racism → Racism is a cultural concept and it refers to a belief of superiority and purity of one culture/race over others.

e.g. As per Hitler, Germans are Pure Aryan race.

→ Differences between Race and Racism :-

Race	Racism
i). Race is a biological concept.	i). Racism is a cultural concept.
ii). Race is result of human curosity and science studies.	ii). Racism got boost due to colonial powers and their desire to prove themselves as the superior race as compared to others.

iii). Main focus is on gene frequencies and genetic criteria.

iv). Concept of race is intended to understand and classify human differences.

v). Bases of Race

↳ a). Morphological
e.g. Head size, Hair and skin colour etc.

↳ b). Genetic
e.g. Blood groups

iii). Racism is result of comparison of physical features.
e.g. 'White supremacy' (on the basis of skin colour)

iv). It was intended to discriminate between people.

v). Bases of Racism

↳ a). Purity of Blood.

↳ b). Skin colour.

↳ c). Cultural superiority.

=> Race as basis of Racism :—

- UNESCO's Statement on Races (1951) concluded that —

i). Pure race do not exist among humans.

ii). Races do not differ significantly with respect to their capacities and capabilities.

iii). No harmful effects of inter-racial marriages.

→ Race as a biological concept:—

- As per biology / science, pure races exist among animals only, not exist among humans.
- As per 1st report of Human Genome Project (2001), all humans are genetically similar by 99.99% and thus, genetic variation of 0.01% is not enough for creating racial categories.
- This report busted the myth of racial supremacy. It means a race is neither superior nor inferior.
- Also, there is no hereditary role in race formation because only function of heredity is to pass traits in purest form to next generation if it continues like this, there will be no change in gene frequencies and hence, no race formation.

- Race formation is result of micro-evolutionary processes, that are environmental factors only.

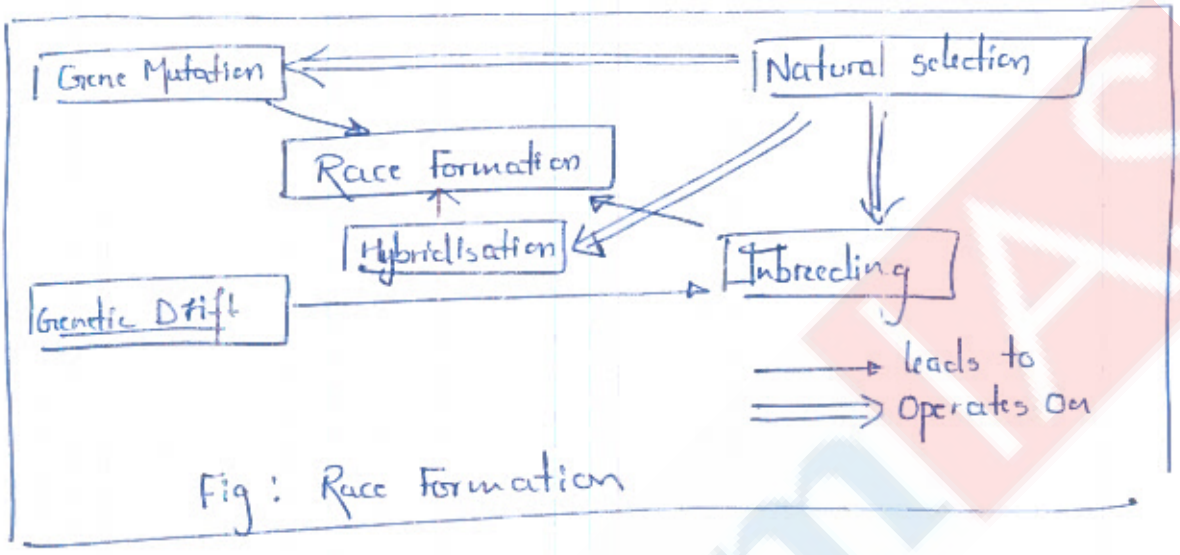

Fig: Race Formation

Thus, concept of racial superiority was scientifically disproven. The populations previously called races, today termed as Mendelian population or ethnic groups.

Feedback

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TOTAL MARKS		

b) Discuss the findings of the primate fossils of tertiary period. (15 marks)

Primates are one of the 16 orders of class Mammalia, predominantly came to existence since beginning of tertiary period.

- Tertiary period is the part of geological time scale, dated from 65 million years ago to 5 million years ago (65 - 5 mya).

→ Primate fossils of tertiary period :-

1). Paleocene Epoch (65-53 mya)

- This phase's fossil represent proto-primates or earliest primates.

2). Eocene Epoch (53 - 37 mya)

- Appearance of true primates, characterised by grasping hands, nails instead of claws and forward facing eyes for binocular vision.

  e.g. Prosimii sub-order — Lemur, loris and Tarsiers.

3). Oligocene (37 - 23 mya)

- Evolve to Higher primates such as old world monkeys and

new world monkeys.

4). Miocene (23 - 5 mya)

- Marked as 'Age of Apes'.

e.g. Dryopithecus, Sivapithecus, Gigantopithecus.

→ Major fossils of Tertiary Period:-

(i). Dryopithecus - means 'Ape of forest'.

Time span - 23 - 8 mya (Miocene epoch)

Discovery - By Lartet in South France.

Physical Features →
- Y-5 cusp pattern
- Cranial capacity - 167 cc
- Variable size from gibbon to gorilla.
- Limbs - Mixed characters of Apes and Monkeys
- Arboreal Habitat

(ii). Sivapithecus - means 'Ape of Shiva'.

Time period - 14-8 mya (Miocene epoch)

Discovery - In 1934, by Lewis, broken teeth and jaw discovered in Bilaspur district (Himachal Pradesh).

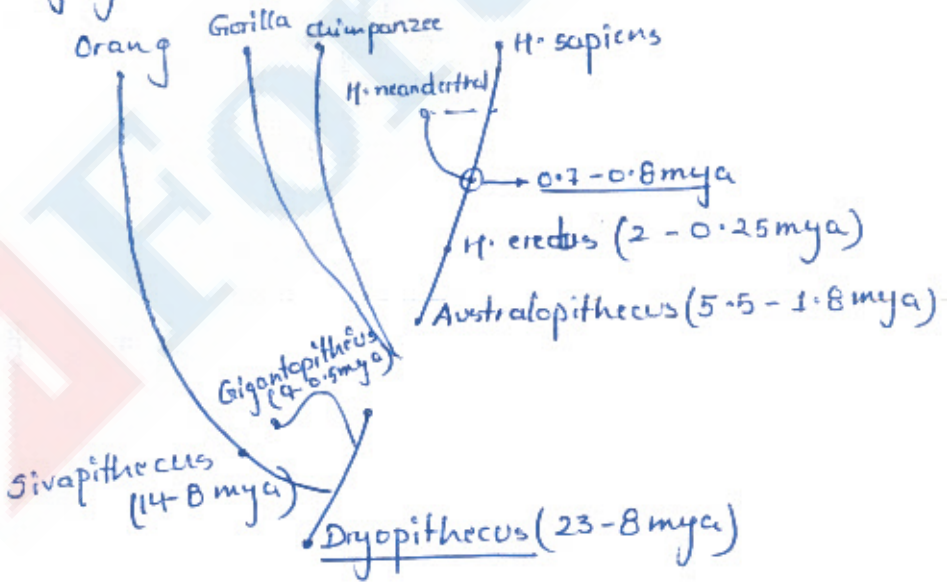
Physical features → Small face & small teeth.
→ U-shaped arcade and Diastemma present.
→ Size similar to ~~org~~ orangutan.
→ Swing on his arms.
→ spent most of time on ground.

(iii). Gigantopithecus — means Giant Ape.

Discovery – Discovered by G.R.K Chopra.

Physical feature → large size ⇒ 6-9 feet tall
→ Dentition – Inter-locking canines, diastema.

→ Phylogenetic status :—



In conclusion, primate fossils of tertiary period has played a key role in understanding Human evolution.

Feedback

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Please put tick marks in the above table.
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TOTAL MARKS	

c) What is "Action Anthropology"? Discuss with relevant case studies. (15 marks)

"Action Anthropology" term was coined by Sol Tax in 1957. In it, anthropologists are themselves involved in planning and administering policy of development.

→ Features of Action Anthropology :-

i). Action anthropology facilitates work with community to seek solutions.

ii). More participatory in nature and requires long-term engagement.

iii). Anthropologists become the agents of change directly, not depending on others to use their knowledge.

iv). Action anthropologists works as a member of local community.

v). Focus on empowerment and capacity building of community.

→ Significance of Action Anthropology :-

i). Policy formation by acknowledging grassroot level problems.

ii). Capacity building of community by changing ties with outside world

e.g. TRIFED - provides marketing platform to tribals to connect outside world.

iii). Tribal welfare using principles of action anthropology

iv). Facilitate conflict resolution and promote social cohesion.

→ Case Studies :-

1). Baiga Tribe Advocacy for land Rights

- V. Xaxa worked with Baiga tribes to document traditional land use and cultural practices tied to forest resources.

2). Tribal sub-plans (TSP)

- Result of action anthropologists who work for tribal welfare.

3) Acts such as PESA (1996), FRA (2006)

- Result of continuous efforts of action anthropologists along with Tribals.

→ Criticism of Action Anthropology :-

- Time consuming approach - requires participation as community manner.
- Also, not free from anthropologist's biasness.
- Many-a-times result in One size fit solutions or policy for all communities.

Despite criticisms, action anthropology provides a key framework for participating with communities and addressing contemporary social issues.

Q.4) a) Discuss the approaches in Applied Anthropology with relevant case studies. (20 marks)

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Feedback

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TOTAL MARKS		

b) What do you understand by the concept of "genetic drift"? Discuss with relevant examples. (15 Marks)

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TOTAL MARKS	

c) Discuss the "Hardy-Weinberg law," its assumptions and drawbacks in detail.

(15 marks)

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Feedback

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TOTAL MARKS		

Section- B

Q.5) Write short notes on the following in 150 words.

a) Applicability of Mendel's laws of inheritance in humans (10 Marks)

Mendel's laws are laws of inheritance formulated by J. G. Mendel.

→ Mendel's laws :-

1) Law of Dominance

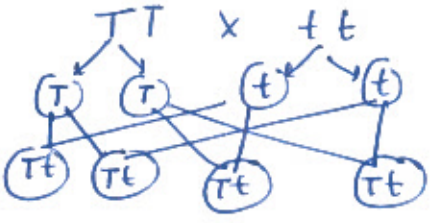
- It states when 2 homozygous individuals are crossed, each having contrasting set of characters, then hybrid offspring will exclusively show dominant trait in phenotype.

Parents → Pure Tall (TT) X Pure Dwarf (tt)

F1 generation → Tt, Tt, Tt, Tt ⇒ Phenotype ⇒ All tall

2) Law of segregation

- As per it, during gamete formation, pair of alleles are segregated from each other such that each gamete has a single allele.



3) Law of independent Assortments

- Genes are independent of each other and therefore, each gene gets assorts independently into Hardy-Weinberg proportions in F_2 generation.

→ Applicability of Mendel's law :—

i). Medical application

- To study modes of inheritance of various metabolic disorder and development of their cures.

  e.g. Cure of Rh- compatibility between mother & foetus.

ii). Development of Hybrid Varieties

- As mendel's laws are applicable on both animals and plants and thus, help in forming hybrid seeds, animals.

  e.g. Green revolution

iii). Medico-legal application

- Solve paternity disputes.
- Around 10-15% cases can be solved by ABO blood group system inheritance.

Thus, Mendel's laws have extensive applications for betterment of humankind.

Feedback

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Please put tick marks in the above table.

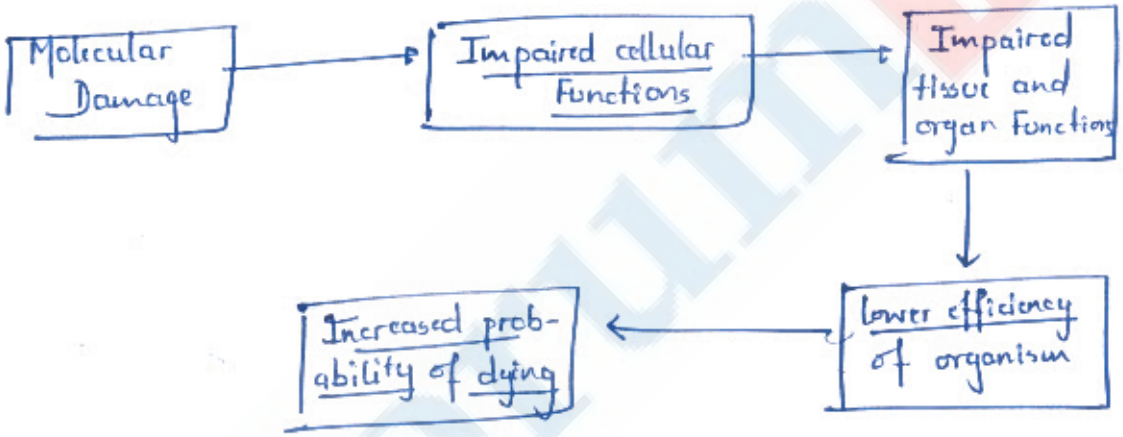
Here G is Good, A is Average and P is Poor.

TOTAL MARKS		

b) Ageing & Senescence (10 Marks)

Ageing simply implies growing older, along with changes related to age, regardless of when they occur in life span. While Senescence implies post-reproductive period, resulting in decreased survival capacity.

⇒ Ageing and Senescence include following steps :—



⇒ Factors affecting ageing and Senescence :—

1). Biological Factors

- As per Programmed theories, ageing is genetically progrommed by harmful genes, which become active in late life. It also suggests that human life span is an inherited trait.

- Also, ageing is result of inability of cells to combat natural deteriorative processes.

2) **Social factors**

- Early senescence due to social disengagement and decline in activity levels.
- Emotional stress affects human health.
- lifestyle such as smoking habit, exercise regime, diet etc. also influences ageing and senescence.

Thus, ageing and senescence are the result of interplay of biological and social factors.

c) Genetic Counselling & Eugenics (10 Marks)

Genetic counselling is a communication process which deals with human problems associated with risk of occurrence of a genetic disorder in a family.

⇒ Stages of Genetic Counselling :-

1) History and Pedigree construction - Study of medical history of affected individual.

2) Genetic screening - Testing individual's genetic material.

3) Diagnosis - Based on screening results, geneticist confirm or discard disorder.

4) Counselling / Interview - Geneticists detail the associated physical, socio-economic and psychologic disabilities to individual.

5) Treatment - Treatment ranges from simple surgery to gene therapy, or even general medical advice.

Present scope of genetic counselling is limited to surgery or advice in most cases. However, with recent advancements in gene therapy such as CRISPR Cas 9 technology the future scope looks bright.

Eugenics

↳ It refers to making genetic improvements of human race, in order to improve future generations.

Eugenics

Positive Eugenics

- It attempts to increase & preserve best types of germplasm.

⇒ Steps :-

↳ Marriage of those having desirable traits.

↳ Artificial insemination.

↳ Avoid wasting of best germplasm by ending social barriers to marriage.

Negative Eugenics

- It attempts to eliminate defective germplasm.

⇒ Steps :-

↳ Genetic counselling to eliminate lethal genes at population level.

↳ Marriage restriction

e.g. In Cyprus, thalassemia screening is mandatory before marriage.

↳ Sterilisation of defective.

↳ Control on immigration to prevent entry of defective genes.

⇒ Criticism
- Challenged on ethical ground.
- Promotion of elitism.
- Restrict individual freedom – forced sterilisation.

Thus, it depends on the motive/intentions behind Eugenics whether it is ethical ⇒ right or wrong.

Feedback

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Please put tick marks in the above table.

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TOTAL MARKS	

d) Polygenic Inheritance in man (10 Marks)

Polygenic Inheritance refers to inheritance patterns resulting from multiple factors or genes. (Monogenic → resulting from single factor/gene).

⇒ Polygenic Inheritance in man :-

- There are several quantitative traits such as height, skin colour etc. that display continuous variations and cannot be explained by simple mendelian inheritance.
- To account for such quantitative traits, R. A. fisher proposed multiple factor hypothesis.
- Multiple factor hypothesis is also known as Polygenic Inheritance.
- It postulates that there are traits whose inheritance determined by multiple factors such as genetical and environmental.

Multiple Factors

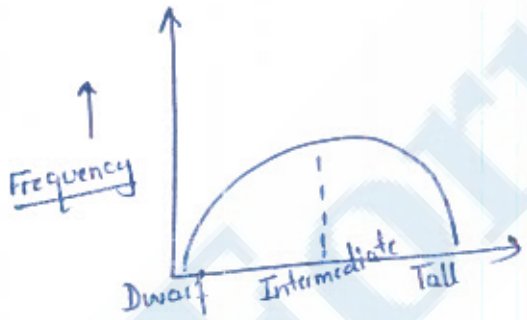
Genetic factors

- Genotype of parents.
- Heredity → Sexes.
- Genes

Environmental factors

- Nutritional
- Emotional stress
- Environmental stress.

For example – Mating between homozygous tall and homozygous dwarf parent will have heterozygous medium tall progeny.



⇒ Criticisms :–

- Not follow law of dominance in true sense.
- Lack of scientific backing.

Despite criticisms, it is able to explain inheritance of quantitative traits in a better way.

Feedback

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TOTAL MARKS		

e) Genomic imprinting (10 Marks)

Genomic imprinting is defined as the differential inheritance of genetic material from mother and father.

⇒ Key aspects of Genomic imprinting :-

- It is visualised that male and female parental contribution to a genome is not truly equivalents and function of a chromosome differs depending upon whether it is maternally or paternal derived.
- Paternally derived genes are important for development of Placental tissues while maternally derived genes for embryo.
- Theory of genomic imprinting suggests that in certain cases genetic defects will produce a phenotype only when derived from a particular parent.

e.g. — Angelman Syndrome - always maternally derived.

Prader-Willi Syndrome - always paternally derived.

→ Significance :-

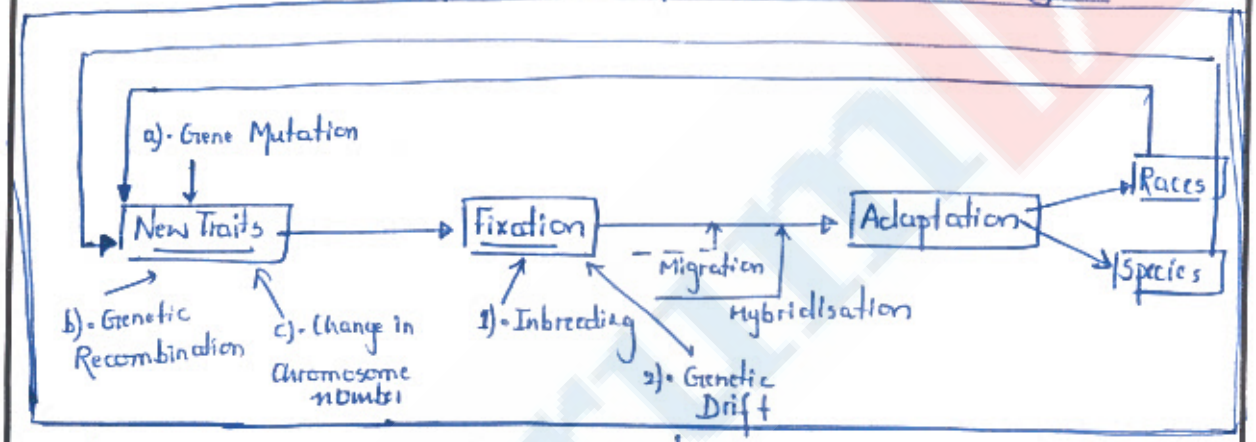
- Enables to trace origin/pattern of syndrome with respect to parents and accordingly, address it.

Thus, genomic imprinting helps to know the effects of chromosomal deletions in different sexes and variations of diseases as per the gender.

Q.6) a) Highlight the broad postulates of the synthetic theory of evolution in detail with its significance. (20 marks)

Synthetic theory is a post Darwinian theory of organic evolution. It is synthesis of Darwinism, Mendelian genetics, Population genetics and molecular biology.

→ Broad postulates of Synthetic theory :-



Synthetic theory

Evolutionary Process

- Synthetic theory explains sources of variations and factors that distribute or redistribute these variations. (not explained by Darwinism)
- It does this by recognising 5 essential and 3 secondary process.

⇒ **5 essential factors:-**

1). **Gene Mutation** — sudden change in nature of a single gene.

- It can be caused by change in temperature, chemical, radiations etc.

2). **Change in Chromosome number**

Euploidy

- Increase or decrease in multiples
  e.g- n, 3n, 4n
- It results in spontaneous abortion in upper species of animal.

Aneuploidy

- Increase or decrease in certain odd chromosomes.
  e.g. 2n-1, 2n+1 etc.
- It depends on length of chromosome can be still birth, neo-natal death, juvenile mortality.
  e.g. Trisomy of ch-21 - Down syndrome

3). **Genetic Recombination**

- Number of chromosomes remains same but sequence or order of genes on chromosomes changes.
- **4 ways** of genetic recombination

a). Deletion - Part of chromosome get deleted.
b). Duplication - Part that gets deleted fixes on it's homologous partner.
c). Inversion - Deleted part fixes on same but in inverted position.
d). Translocation - 2 non-homologous chromosomes - 2 deletion exchanges their position.

These aforementioned 3 factors causes variations.

4). **Natural selection**

- It is process that results in adaptation of an organism to it's environment by selective reproduction of it's genotype.
- Above 3 factors cause variations but it is natural selection which decides the survival of variations.

5). **Isolation**

- Isolation results in inbreeding, i.e., mating within a Mendelian population.
- Inbreeding increases homozygosity and reduces genotype variability.

⇒ **3 secondary factors** :—

1). **Hybridisation** - Mating outside mendelian population

- It increases heterozygosity and ~~reduces~~ increases genotype variability.

2). **Migration**
- Temporary migration - (No) effect on evolution
- Permanent migration - it's effects can be understood in terms of **Hybridisation**

3). Chance factor — It results in genetic drift i.e. sudden random changes in gene frequencies without role of mutation and natural selection.

→ Significance :-

i). Unlike Darwinism, ables to explain causes of variations and factors that spreads or restricts these variations.

ii). Include population and Mendelian genetics as well.

iii). Most scientific theory of organic evolution so far.

→ Criticisms :-

i). It completely ignores lamarckism and therefore, only ables to explain till fixation stage.

ii). It gives undue importance to factors such as change in chromosome number and genetic recombination.

iii). Also, downplay the significance of factors like hybridisation and genetic drift.

Despite criticisms, it sufficiently explains genuine elements of organic evolution and therefore, it can be said to be the most scientific theory of organic evolution so far.

Feedback

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TOTAL MARKS	

b) Human evolution is bio-cultural. Substantiate. (15 marks)

Human evolution is a result of complex interaction between biological and cultural factors.

→ Bidogical Factors :—

1) • Size and complexity of Brain

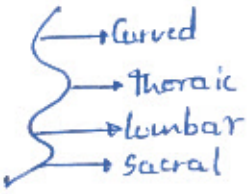
- Brain size has almost tripled in the last 3 million years.
- There were strong selective pressure behind this, with this factor providing basis of all other evolutionary transformation.

2) • Erect posture and Bipedalism

- Provide upgrade in efficiency over knuckle walking.
- Anatomical changes behind bipedalism are :—

Femur

Arched Foot



Double S- Shaped vertebral Column

3) • Hyoid bone Complex

o Shape of hyoid bone is unique in hominids and reflects their ability to speak.

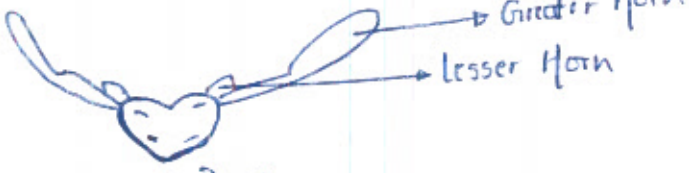


Fig: Hyoid Bone

→ Cultural Factors:-

1) • Tool Making

• With bipedalism, hands were free for carrying objects and making tools.

• This in turn further led to improved coordination between eyes and hands.

2) • Hunting and Gathering

• To meet protein demand, human began to hunt animals with tools.

3) • Cooperation

• During hunting of big animals, need of cooperation may be required and thus, results in human

cooperation.

4). Speech development

- With social cooperation and to warn during hunting, speech became necessity.

5). Social institution

- During Neolithic Age, with agricultural surplus there was requirement of administration.

Thus, Modern Human is the result of way long biological and cultural evolutions that accumulate together at todays time.

c) How is human physique studied? Discuss in detail various somatotypes associated with this study. (15 marks)

Human Physique is studied under Somatotypes, that is a method to analyse and quantify human body form.

→ Various Somatotypes (methods) are :-

1) Viola's Method - Somatotype based on relative indexing of individuals.

a). Longitype - Having relative long limbs compared to trunk.

b). Brachitype - Opposite to longitype.

c). Normotype - In between longitype and brachitype.

d). Mixed - Individuals who exhibit characteristics of above 3 types in different body parts.

2). Kretschmer's Method - based on anthroposcopic inspection

a). Pyknic - Broad, round and flat.

b). Leptosome - long, thin and linear.

c). Athlete - Heavily muscled, larger shoulders and narrow hips

⇒ 3). Sheldon's Method

a). Endomorphy – reflects softness and roundness of body.

b). Mesomorphy – reflects massiveness and sturdiness

c). Ectomorphy – reflects thin and lean body with weak muscles.

- Each of 3 components of physique were scored from 1–7 in 5 areas.

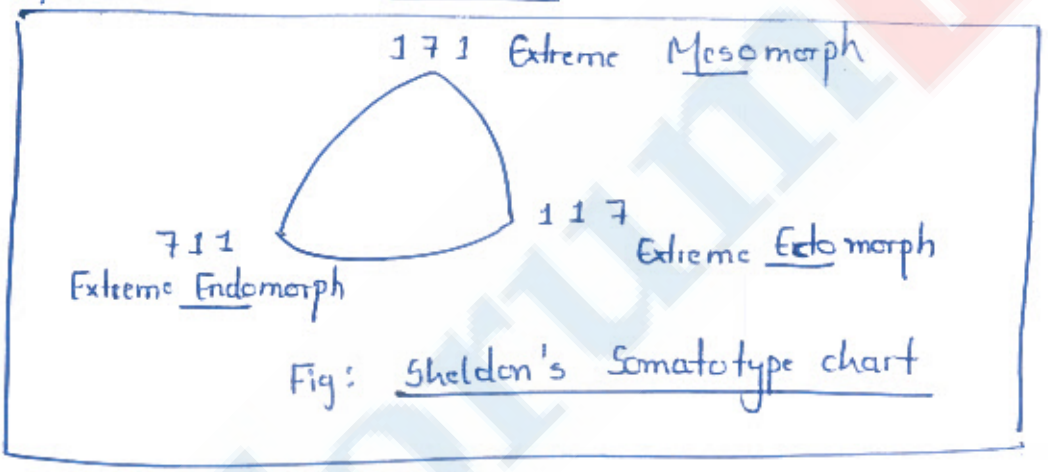


Fig: Sheldon's Somatotype chart

⇒ Drawbacks → Subjective method
→ Ignores role of environment in human physique
→ Ignores factors like ages, gender etc.

⇒ 4). Heath and Carter Method

a). Endomorphy – Reflects flatness & leanness.

b). Mesomorphy – reflects muscular skeleton.

c). Ectomorphy – reflects relative linearity.

- These 3 components of Heath & Carter method are based on 10 anthropometric measurements such as height, weight etc.

⇒ Significance → Objective
→ Females can also also be subjected.
→ Temporal variation.

Currently, Viola and Kretschmer's methods are no longer used as they classify humans into fixed classes. While Sheldon and Health-Carter methods are used.

To conclude, somatotypes play crucial role in Kinanthropometry, ergonomics and design of defence equipment.

Feedback

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TOTAL MARKS	

Q.7) a) Elaborate on primate taxonomy. (20 marks)

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TOTAL MARKS	

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b) What do you understand by the concept of "Ecological Anthropology"? Elaborate. (15 marks)

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TOTAL MARKS	

c) What are "genetic markers"? Discuss the prominent genetic markers in human beings. (15 marks)

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TOTAL MARKS		

Q.8) a) Discuss the concept of adaptation, adaptability & acclimatization with relevant examples.

(20 marks)

Adaptation refers to the process of making changes as per it's natural environment.

Adaptability – refers to the capacity of a species to change itself to it's natural environment.

Acclimatisation – refers to the temporary changes made by species as per it's environment.

→ Human responses to environmental stresses

Heat stress

- Human maintains 37°C temperature of it's body and above it can cause problems

⇒ Desired response by body

- Continuously lose heat to surroundings by sweating to cool down body

Cold stress

- Dip in external temperature below 28°C results into persistent heat loss from body & may impair bodily activity.
- Reduce heat loss to surroundings.

Altitudinal stress

- Above 2500m, hypoxic condition prevail.
  ⇓
  low oxygen availability
- To maximise oxygen intake from surroundings

Human Adjustment

- Biological response
  - Acclimatisation
  - Adaptation
- Cultural response

→ Responses to heat & cold stresses :—

=> Biological response

i). Acclimation - The mechanism is as follows :—

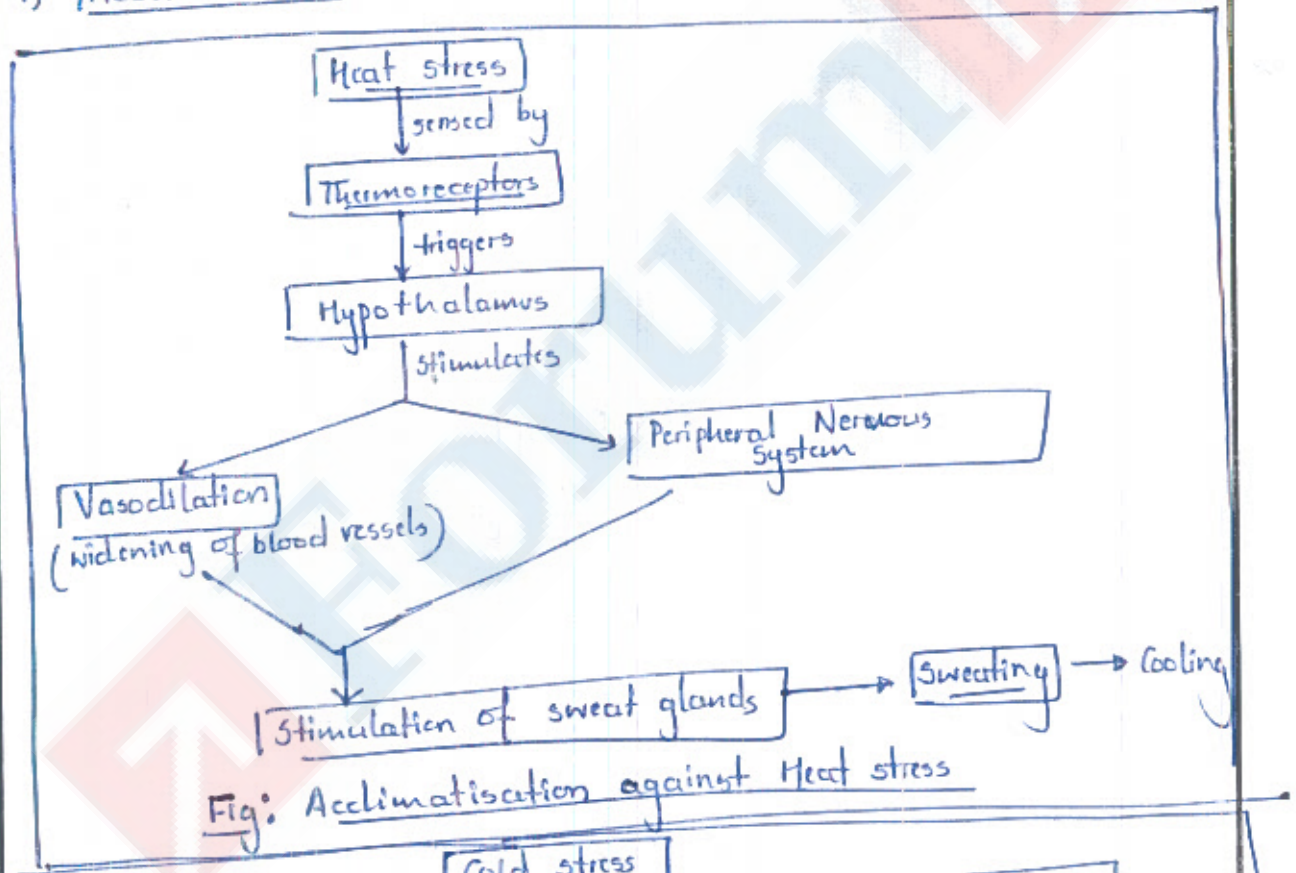


Fig: Acclimatisation against Heat stress

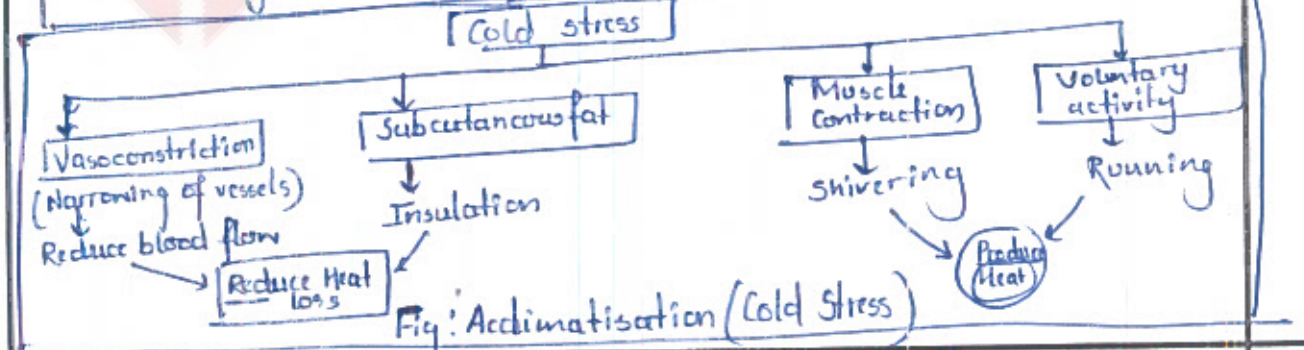


Fig: Acclimatisation (Cold Stress)

ii). **Adaptation**

a). Bergmann's Rule
- Warmer area ⇒ lower body size
- Colder area ⇒ larger body size

b). Allen's Rule
- Warmer area ⇒ longer body appendages
- Colder area ⇒ shorter body appendages

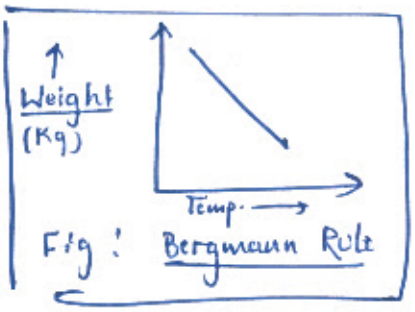


Fig : Bergmann Rule

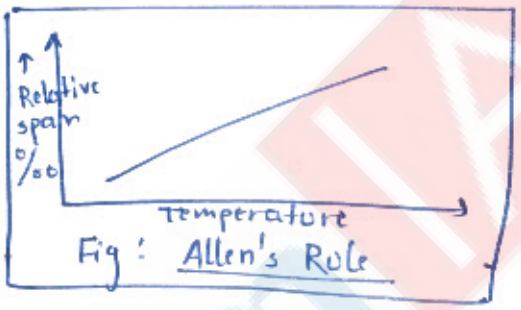


Fig : Allen's Rule

⇒ **Cultural Response**

Heat stress

a). Shelter – Heat reflective materials
e.g. Mud Houses.

b). Clothing – loose clothes

c). Diet – High percentage of water in diet.

Cold Stress

a). Insulated House
e.g. Igloos.

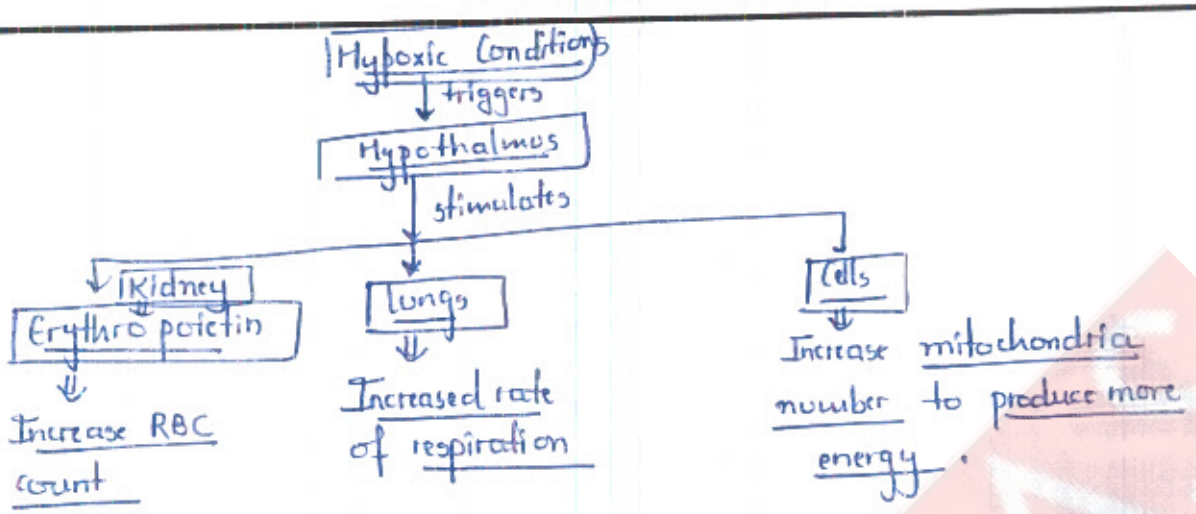
b). Woolen clothes

c). More heat producing food

→ **Response to high altitude :–**

⇒ **Biological response**

i). **Acclimatisation** :– Mechanism is as follows :–



ii) Adaptation
- Increase in Chest size e.g. Bods of Ladakh.
- Decrease in body size → (less) oxygen requirement.
- Smaller size of babies.

⇒ Cultural response
- Diet focused on maximum utilisation of glucose.
- Migration to lower altitudes during pregnancy.

Thus, it is a combination of acclimatisation, adaptation and cultural responses that is behind human adjustment to different types of environmental stresses.

Feedback

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TOTAL MARKS	

b) Describe the immunological methods in human genetics with appropriate examples. (15 Marks)

Immunological methods study genetic basis of immune response. It includes study of normal immunological pathways and the identification of genetic variations that result in immunological defects.

⇒ Scope :-

- Immunogenetics is based on the principle that immune reactions are result of complex gene regulation in White Blood cells (WBCs).
- These immune reactions are dependent upon antigen-antibody interactions, which form basis of study of immunogenetics.

⇒ Focus of immunogenetics revolves around following :-

1). Immunoglobins (Ig) —

- In placental mammals there are 5 Ig Isotopes known as IgA, IgD, IgE, IgG and IgM.

- Variations in these Isotopes are made use of in immunogenetics.
- Suitable antigen is injected and antibodies are separated and then purified.
- Thus, their amino acid components are determined.

2) **Auto-immune disorders**

- Immunogenetics study the genetic basis behind diseases like Arthritis and Crohn's disease.
- Such diseases are caused by an extreme reaction of immune system against body's own tissue.

3) **Blood group system**

↳ ABO blood system →

- A group → Antigen - A; Antibodies - B
- B group → Antigen - B; Antibodies - A
- AB group → Antigen: A & B; Antibodies: None.
- O group → Antigen - No antigen; Antibodies - A and B

- Accordingly, blood is transferred.

- Current research topics deal with forecasts on course of immune diseases and identification of new therapeutic targets for subsequent gene therapy.

- In addition, new studies are being carried out to support stem cell and organ transplantation. Immunogenetics of aging has also emerged as a hot topic, focusing on maintaining human longevity.

Thus, Immunological methods played significant role in understanding immunological pathways and human genetics.

Feedback

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TOTAL MARKS	

lighlight the skeletal changes that have occurred in humans due to erect posture i its implications. (15 marks)

First major development in human evolution took place was erect posture with bipedal locomotion in Homo erectus (2-0.25 mya).

→ Skeletal Changes as result of erect posture :-

1) Skull

- Forward foramen magnum under skull. Thus, there is need of less robust neck muscles to hold head upright.

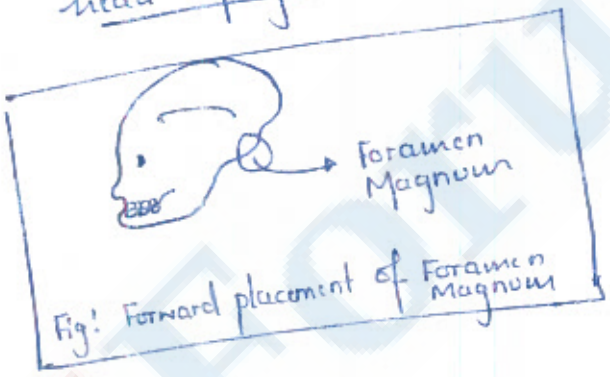

Fig: Forward placement of Foramen Magnum

2) Spine

- Double S shaped vertebral column.
- These curves bring body's centre of gravity directly above feet.
- Body weight is borne down the spine onto hips and finally to legs.

Fig: Human Vertebral Column

3). **Pelvis**

- Pelvis is shaped in form basin to support internal organs.
- Also, shorter and broader thus stablising weight transmission.

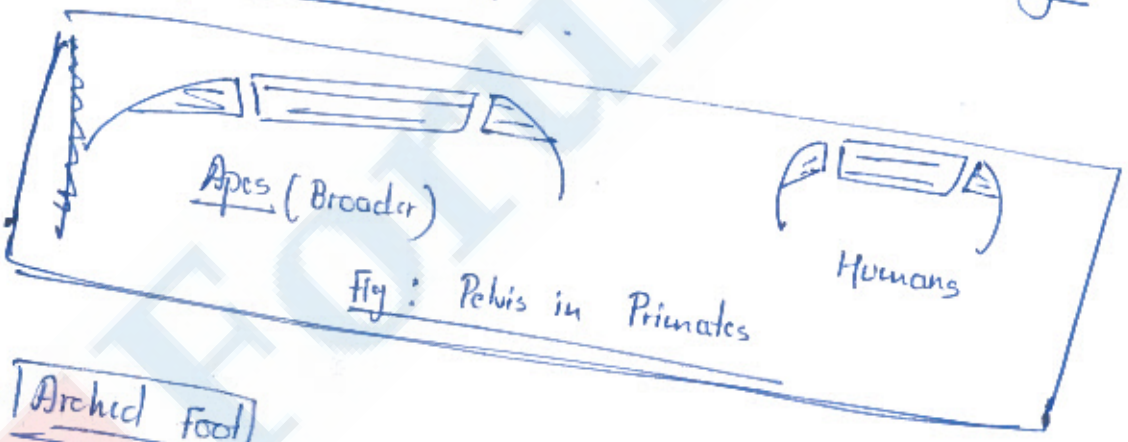

Fig: Pelvis in Primates

4). **Arched Foot**

- Arched foot and non-opposable hallux offers stability and weight bearing ability.

Human Arched foot

longer relative to body trunk and arms
ing ability to stride with minimal energy.

Implications of Erect Posture

Biological implications

Positive

- More efficient walk.
- Greater heat dissipation as lower body surface area.

Negative

- Painful birth process
- lower back problem

Socio-cultural implications

- Free hands – used for other purposes like tool making.
- Enhanced social bonding for support during hunting.

As positive implication outweighed negative ones, natural selection worked in favour of erect posture with bipedal locomotion.

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