

Online ☒

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Q. No.	Page No.	Max. Marks	Marks	Total	Signature
1. (a)	4	10			
1. (b)	6	10			
1. (c)	8	10			
1. (d)	10	10			
1. (e)	12	10			
2. (a)	14	20			
2. (b)	18	15			
2. (c)	21	15			
3. (a)	24	20			
3. (b)	28	15			
3. (c)	31	15			
4. (a)	34	20			
4. (b)	38	15			
4. (c)	41	15			
5. (a)	44	10			
5. (b)	46	10			
5. (c)	48	10			
5. (d)	50	10			
5. (e)	52	10			
6. (a)	54	20			
6. (b)	58	15			
6. (c)	61	15			
7. (a)	64	20			
7. (b)	68	15			
7. (c)	71	15			
8. (a)	74	20			
8. (b)	78	15			
8. (c)	81	15			
			Grand Total		

Remarks

Observations:

SECTION-A

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Write notes on the following in about 150 words each:

(10 × 5)

Q.1 (a)

Monogenesis and polygenesis



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Q.1. Discuss the role of the state in the development of the Indian economy.

Ans. The role of the state in the development of the Indian economy has been a subject of debate for many years.

Some argue that the state has played a crucial role in the growth of the Indian economy, while others believe that the private sector is the primary driver of economic development.

One of the main arguments in favour of the state's role is that it has provided the necessary infrastructure and public services that have enabled the private sector to flourish.

For example, the state has built a vast network of roads, bridges, and railways, which have facilitated trade and commerce across the country.



Moreover, the state has provided subsidies and incentives to encourage investment in key sectors such as agriculture, manufacturing, and infrastructure.

On the other hand, critics of state intervention argue that the state has often been inefficient and corrupt, leading to a waste of resources and a slow pace of economic growth.

They claim that the private sector, if left to its own devices, would have been able to develop the Indian economy more effectively and efficiently.

In conclusion, the role of the state in the development of the Indian economy is a complex issue that requires a nuanced understanding of the country's economic history and current challenges. While the state has undoubtedly played a significant role in the growth of the Indian economy, it is also clear that the private sector has made substantial contributions to the country's economic development.

Q.2. Discuss the impact of globalization on the Indian economy.

Ans. Globalization has had a profound impact on the Indian economy, both in terms of opportunities and challenges. On the one hand, globalization has opened up new markets for Indian exports and attracted foreign investment to the country. It has also facilitated the growth of the services sector, which has become a major source of employment and revenue for India.

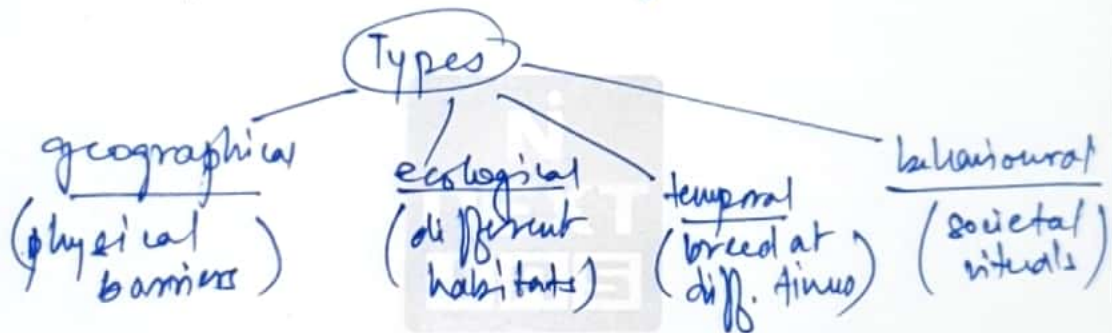
Q.1 (b)

Isolation and speciation

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Isolation and speciation are interrelated as isolation controls gene flow and speciation is emergence of new species from these isolated population.

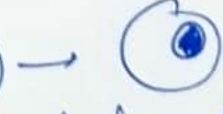
Isolation → separation of population of a species, preventing interbreeding.



Speciation → evolutionary process where new species arise through genetic divergence & reproductive isolation.

Types

① Allopatric →  → 
↳ due to geographic separation.

② Sympatric →  → 
↳ same area, due to behavioural isolation.

③ Peripatric → 

④ Parapatric → 

Interrelations

- ① Isolation prevents gene flow
- ② Allows populations to diverge genetically
- ③ This divergence leads to speciation due to accumulated differences & reproductive barriers.
- ④ New species formed.

However, the process of speciation is a macroevolutionary change and occurs over a long time period and with rapid globalisation, it is almost impossible for humans to have isolation & speciation, as of present.

Q.1 (c)

Biochemical Methods used in human Genetics

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Q.1 (d)

Mitochondrial DNA

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Mitochondrial DNA (mtDNA) is a type of DNA located outside the nucleus, in the mitochondria, enclosing a small number of essential proteins.

Structure

- ① Circular DNA
- ② Contains 37 genes.

Uniqueness

- ① Unlike nuclear DNA, which is inherited from both parents, mtDNA is inherited solely from the mother.
- ② This makes mtDNA an invaluable tool in studies of human evolution, genetics etc.
- ③ Maternal lineage can be traced.
- ④ Lack of recombination → thus preserving genetic information over generations.

- ⑤ Higher mutation rate → details
on evolutionary changes.

Applications

- ① Human evolution
→ concept of mitochondrial eve - most
common matrilineal ancestor.
→ study the migration pattern.

- ② Genetic Disorders
→ mitochondrial diseases → development
on MRT.
→ techniques of pronuclear transfer.

- ③ Forensic science
→ identify when nuclear DNA is
missing.
→ higher copy number → more resilient.

Case Study → Swante Paabo work on
sequencing Neanderthal genome used
mtDNA analysis, highlighting interbreeding.

This more research on mtDNA can
bring to light various aspects of
paleogenomics, etc.

Q.1 (e)

Relevance of Nutritional Anthropology

Nutritional Anthropology is a branch of Applied Anthropology that studies nutrients and nutritional status of an individual or a community.

Relevance

① Food intake, nutrition and health

↳ At least 50 different nutrients are required by our body for normal functioning. Unbalanced combination of nutrients during period of birth to 18 years may retard the genetic potential for growth.

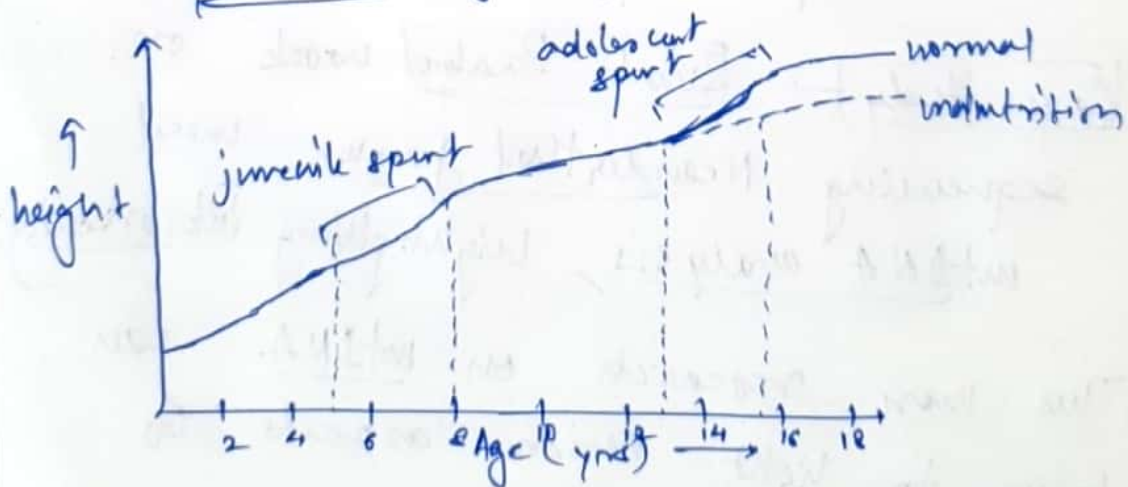


Fig. Effect of malnutrition on growth

② Population Dynamics & Nutrition:-

eg → malnutrition leads to delayed age of menarche & early onset of menopause.

↳ alter population dynamics.

③ Cultural ecology and nutrition

eg → [Lee (1979)] studied [!Kung], a hunter gathering tribe, and found low levels of nutritional stress due to their diverse diets.

④ Social epidemiology of nutrition

eg → [Bolton] studied Orang Asli tribe of Malaysia and found that pregnant women could only eat small animals that possessed so called "weak spirits".

With possibility of climate change induced food crisis & lifestyle changes such as obesity, the scope of nutritional anthropology has further increased.

Q.3 (a)

How have Mendelian principles influenced our understanding of human variation and evolution?

20

In his last days, feeling overlooked, Mendel promised himself that "Meine Zeit wird kommen" i.e. "My time will come." Now we acknowledge, J. Gregor Mendel as the Father of Genetics.

Mendelism → principles of inheritance formulated by Mendel. Based on two type of experiments on Pisum sativum.

Mendel's Laws

① Law of Dominance → states that when

two homozygous individuals are crossed, each having contrasting set of characters,

then the character that

is exclusively expressed in the F₁

generation is called dominant and

the one that doesn't express

Parent	TT tt
F ₁	Tt × Tt
F ₂	Tt, TT, Tt, tt

itself is the recessive one.

- ② Law of Segregation → states that during gamete formation (meiosis), the pair of alleles are segregated from each other such that each gamete is a single allele. thereby retaining purity and identity.

- ③ Law of Independent Assortment → states that ~~each~~ genes don't influence each other with regard to sorting of alleles into gametes.

Influence Understanding of Human Variation and Evolution

- ① Dominance → explains why certain traits appear more frequently and helps predict likelihood.
- ② Segregation → explains why siblings can inherit different combinations of alleles, leading to genetic

diversity

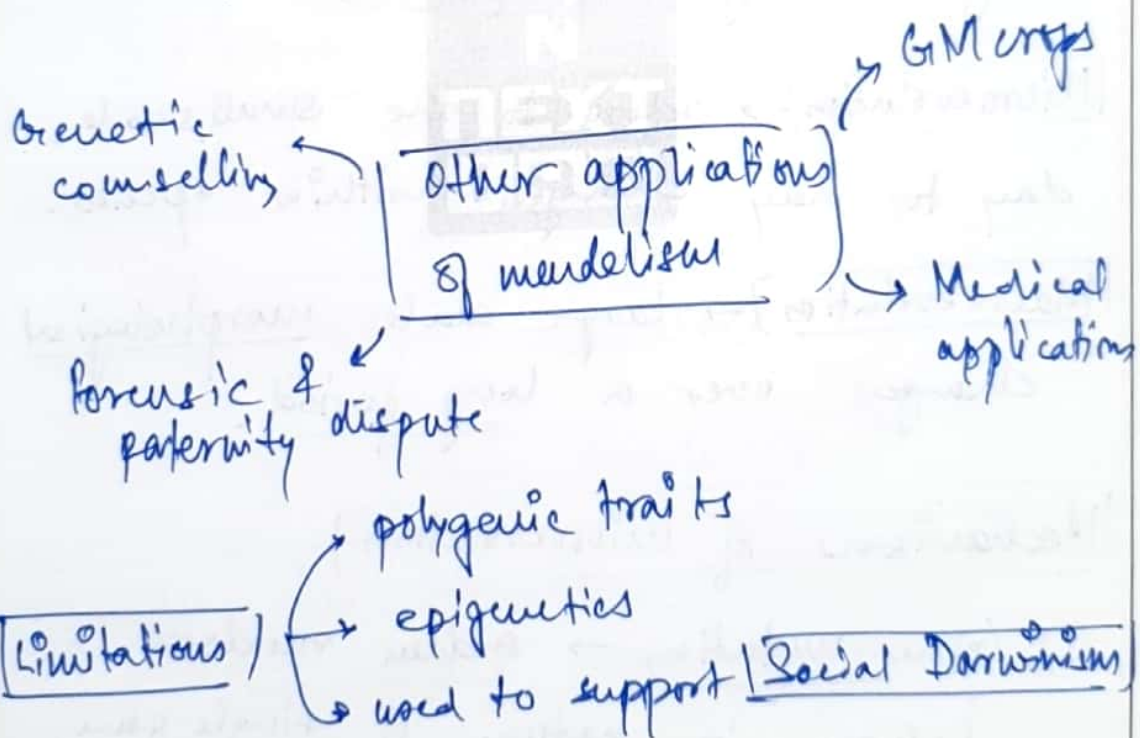
- ③ Assortment → accounts for genetic variations, creating numerous possibilities.
- ④ Genetic Disorders → crucial in understanding the inheritance patterns of single gene disorders.
eg → sickle cell anaemia, cystic fibrosis.
- ⑤ Evolutionary Biology → along with Darwinism, understand how variations are maintained and natural selection drives evolution.
- ⑥ Trace human ancestors and migration patterns based on genetic markers.
eg → studies of mitochondrial DNA and Y-chromosome.

⑦ Population Genetics → study of allele frequencies in population and how they change over time.

(eg. Hardy Weinberg equation).

⑧ Understanding the evolutionary process currently ongoing.

⑨ microevolutions.



Despite this, the integration of Mendelian and modern genetic research continues to enhance our knowledge of biology and medicine.

Q.3 (b)

Explain various genetic mechanisms of microevolution and macroevolution.

15

The term [evolution] comes from latin "evolvere" which means "to unfold".

Thus, evolution refers to unfolding the truth of life on earth.

Genetically, evolution refers to change in gene frequencies.

[Microevolution] → refers to the small scale, day to day changes within species.

[Macroevolution] → large scale morphological changes over a long period.

[Mechanisms of microevolution]

① Gene mutation → sudden random change in nature of single gene.
↳ provides for the genetic variability

② Inbreeding & Hybridization → mating within and outside Mendelian population respectively.

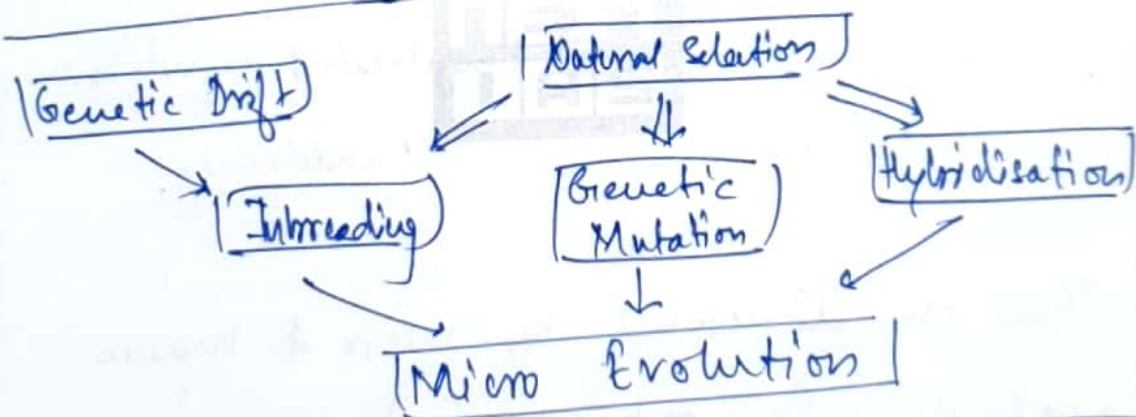
↳ increases homozygosity & decreases
genotypic variability (vice versa)

③ Genetic Drift → random change in gene
frequency.

↳ significantly impacts small population

④ Natural selection → results in adaptation
by selective reproduction.

↳ increases frequency of beneficial alleles.



Examples: Race formation, wisdom teeth
not needed, reducing menarche age.

Mechanisms of macroevolution

① Speciation → new species formation
↳ Allopatric & sympatric

⇒ Homo erectus ⇒ Homo sapiens

② Adaptive Radiation → multiple species from common ancestor due to different ecological niche.

eg → Darwin's finches (Galapagos)

③ Mass extinction → reset evolutionary landscape, allowing for new species.

eg → dinosaurs extinction.

④ Gradualism r/s Punctuated equilibrium
 ↳ slowly ↳ suddenly.

Thus the dichotomy of micro & macro evolution is only used for convenience. As the factors are same, and in fact, the evolution continues through microevolutionary changes. These add up to result in a macroevolutionary change.

Q.3 (c)

What is the role of Serogenetics & Cytogenetics in reproductive biology? Discuss. 15

Serogenetics & Cytogenetics are specialised branches of genetics.

Serogenetics → is concerned with the study of serological proteins.

Cytogenetics → concerned with the study of chromosome and how they relate to cell behaviour.

Reproduction

- special gonads: testes & ovaries
- entire system is regulated by sexum factors, produced by special cells.

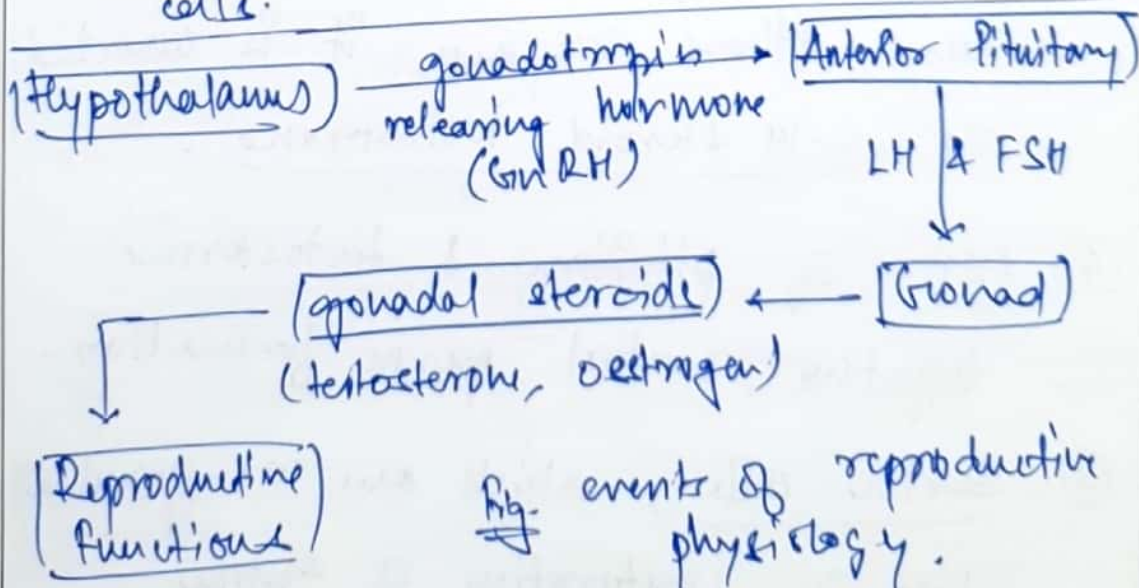


Fig. events of reproductive physiology.

Serogenetics → studies serum factors

Cytogenetics → concerned with special cells.

Male Reproductive Biology

- ① Hypothalamus, specialised neurons elaborate GnRH, targeting Anterior Pituitary producing LH & FSH.
- ② LH activates adenylyl cyclase of (Leydig cells), forming (cAMP).
- ③ Cholesterol is transported from serum into Leydig cells. In presence of cAMP and other enzymes, it is converted to C-19 steroid testosterone.
- ④ FSH of pituitary & testosterone together control sperm formation.
- ⑤ Sertoli cells, which are non-germinal help in maturation of sperm.

Female Reproductive Biology

- ① Oestrogen is secreted by theca cells of ovary. It is a C-18 steroid. Highest level during FSH/LH peak before ovulation.
- ② Progesterone (pregnancy hormone) by corpus luteum cells. Prolactin needed for breast development & milk secretion.
- ③ Granulosa cells secrete insulin, negative feedback on FSH.
- ④ Oxytocin contracts muscles and ejects milk.
- ⑤ Relaxin (by uterus) dilates vagina for child birth.

To conclude, serogenetics & cytogenetics have been instrumental in enhancing our understanding of human reproductive biology.

- Q.4 (a) What is an Anthropometric Somatotype? How Heath & Carter's method of Somatotyping was an improvement over Sheldon's method? 20

As per Sheldon (1940), "somatotypes are morpho-phenotypic ranges along constantly recognisable characteristics and are the functional end products of the whole genetic and development complex."

Aim → at analysis and quantification of the human body form.

Sheldon's method

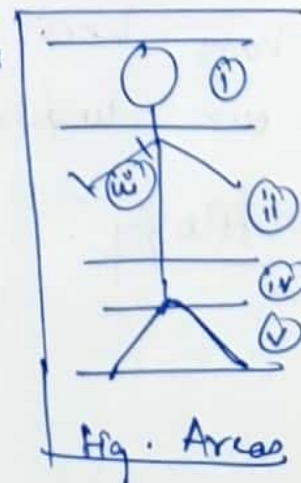
① Studied 4000 male students aged between 16-20 years, by taking photographs.

② He divided body components into 5 areas:-

i) Head, face & neck

ii) Thoracic trunk

iii) Arms, shoulder & hands



iv) Abdominal trunk
v) legs and feet

- ② Each component
scored from
1-7 in
each of 5 areas.
- Eutomorphy
 - Mesomorphy
 - Eutomorphy

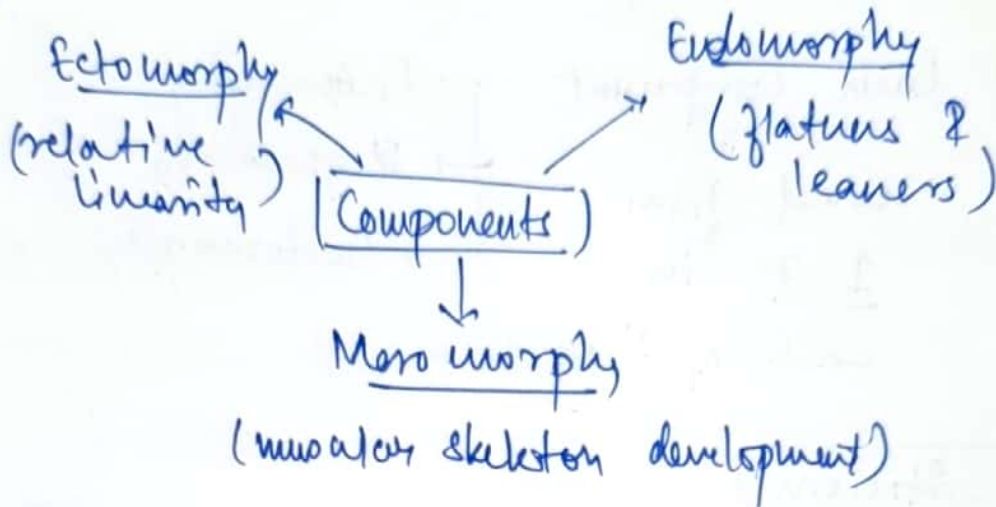
Criticism

- ① Subjective → as evaluator may assign different somatotypes to same photo if asked at different times.
- ② Developed on white males of limited age range, ignoring other ages, females and ethnic group.
- ③ Ignores role of environment and considers human physique to be static.

Heath & Carter method

- ① Heath (1963) critically analysed its shortcomings and together with Carter came up with a new method in "Somatotyping: Development & Application".

②



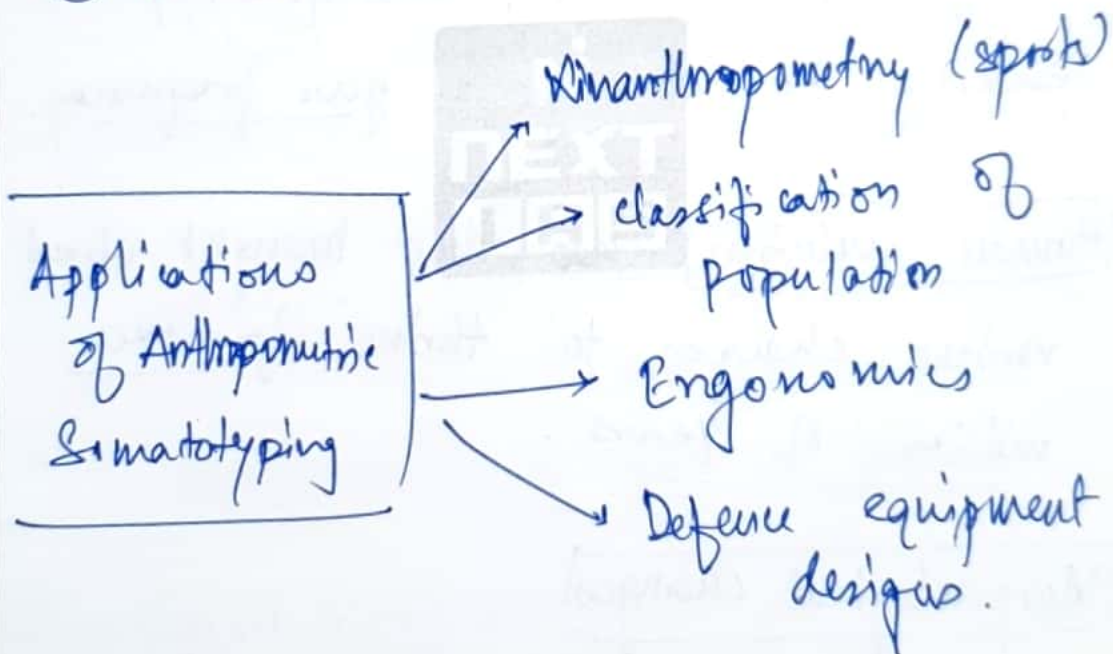
③ Criteria → ratings based on 10 Anthropometric measurements, including height, weight, triceps etc.

④ Difference from Sheldon

- it evaluates the physique at the given time of assessment & thus it may change.
- contrasts with unchanging somatotype of Sheldon.
- proper study and measurements rather than photographs.
- diverse study conducted.

Evaluation

- ① Highly objective as results based on measurement.
- ② Can explore spatial - temporal variations
- ③ Females can also be subjected.
- ④ Easy, accurate & efficient
- ⑤ Workable in both lab & field.



Thus, gradually due to these improvements, Heath & Carter method has gained popularity over Sheldon's method.

Q.4 (b)

"Human evolution is characterized by several morphological, developmental, physiological, and behavioural changes". Elaborate.

15

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According to Darwin, organic evolution is "descent with modification". It means that living beings modify & adapt according to the ever changing environmental needs, consequently leading to change in gene frequency.

Human evolution has thus brought about various changes to thrive for over millions of years.

Morphological changes

① Bipedalism and Upright posture →

- efficient locomotion and freed hands for tool making.
- gave way to other bodily changes.

- ② Increased cranial capacity → leading to better cognitive abilities and complex behaviours.
- ③ Reduced sexual dimorphism

Developmental changes

- ① Prolonged infant dependency → due to
↳ lesser maturation at birth.
↳ helps in greater brain growth & socialisation.
- ② Neoteny → due to delayed bodily development
↳ retention of juvenile features.

Physiological changes

- ① Thermoregulation and homeostatic.
↳ sweat glands to efficiently regulate heat.
- ② Diet and digestive changes.
↳ changes in dentition.

↳ shift from plant based to
meat based diet.

Behavioural changes

① Creation and Tool usage

↳ crude tools → specialised

② Speech development leading to
better communication.

③ Division of labour { hunting
household work

④ Creation of social organisation
↳ complex socio-political structures.

Thus, the evolutionary journey of
humans involves various changes
to adapt as per the needs and
thrive through natural selection.

Q.4 (c)

"In small, reproductively isolated populations, chance factors produce rapid changes in gene frequencies totally independent of mutation, recombination, and natural selection"
Elaborate.

15

Chance factor also known as Genetic Drift and Small Wright Effect, refers to the sudden change in the gene frequencies of a population by sheer chance, without the role of gene mutation or natural selection.

The probability of genetic drift acting as a factor of evolution has been mathematically developed by Small Wright.

According to Wright

$$\frac{L_T}{L_0} = e^{\left(\frac{-T}{2N_e}\right)}$$

where $\left(\frac{L_T}{L_0}\right)$ is the probability of genetic drift.

① → number of generations

② → population size.

Conditions required

- ① The parental population must be small and the part that separates must be proportionately smaller.
- ② At least one of the alleles must have a very low frequency for the sudden change to occur.

Bottleneck effect

→ when a natural calamity removes a good proportion of population so that population grows with the residual part.



Example: spread of TD gene in USA.

Founder Effect

→ when a population either migrates to a barren land or populated

land and practices endogamy.

→ migrant population may differ in genetic composition from parent population as the founders of daughter population were not representative sample of parent population.

[Case Study] → 200 Anish people migrated from Germany to Pennsylvania in 18th century. This migrated population shows prevalence of rare genetic disorders like

Six-fingered dwarfism, which is uncommon. This is because one or few of the original migrants were carriers and due to inbreeding, the frequency increased sharply (sudden change)

Thus genetic drift, plays an important role in formation of different gene combinations and success of disadvantageous genes.

SECTION-B

Write notes on the following in about 150 words each:

(10 × 5)

Q.5 (a)

Sociobiology

Sociobiology is a field of biology that explores the biological basis of social ~~evolution~~ behaviour, in terms of evolution.

- Introduced by Edward Wilson.
- He argued that social behaviours have an evolutionary basis and are influenced by genetic factors.

Scope

- ① Understand various social behaviours like cooperation, mating pattern etc.
- ② Integrates principles of biology, anthropology and psychology.
- ③ Examine both human and animal behaviours to draw parallels and understand underlying biological mechanism.



Q.5 (b)

Tempo of Growth

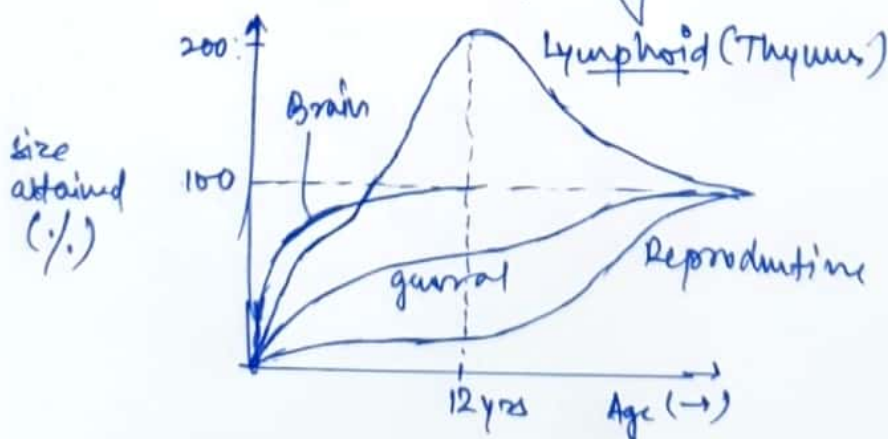
As per Malina, growth refers to the quantitative changes in size of the body and its parts.

Tempo of Growth → refers to the rate and pattern at which an individual grows and develops over time.

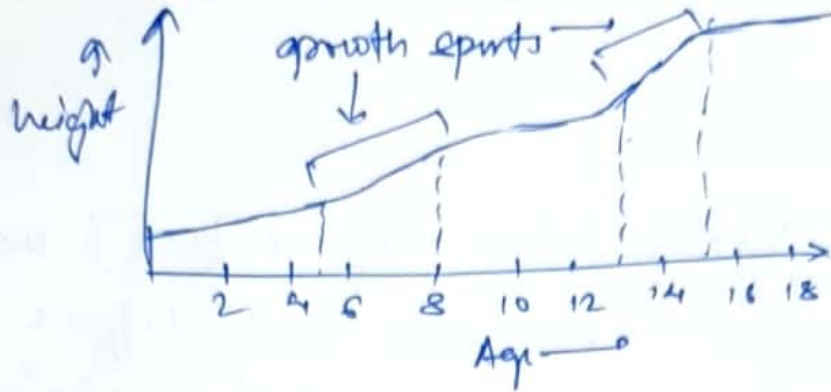
→ It encompasses the timing and speed of physical, cognitive and physiological changes.

Examples

① Growth rate of organs.

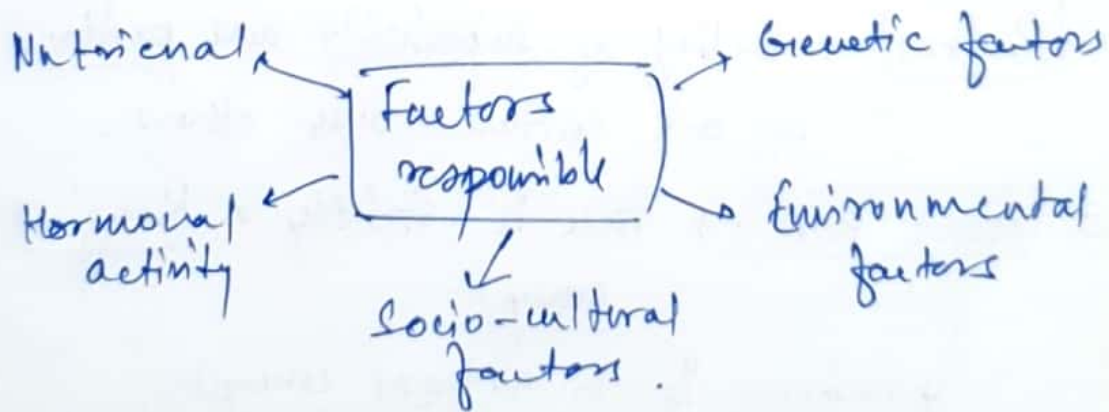
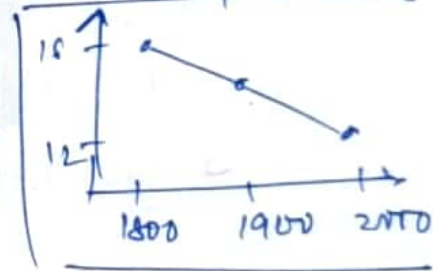


② Growth spurt
→ juvenile & adolescent.



③ Catch up growth → increased velocity of growth following illness/stormation during which growth had slowed down, to reach genetically optimum level.

④ Secular Trends → recent study in "Nature" shows age of menarche is reducing in all countries.



Understanding the tempo of growth helps in monitoring and promoting healthy development and diagnose issues.

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Concept of "Race"

Race and Racism

Racism → belief of superiority and purity of one culture over others.

③

1 Basis of Race

- morphological (eg) head size, nose
- genetic (eg) blood groups.

Race - Not Biological Constant

- ① Genetic Homogeneity → Human Genome Project says all humans are genetically similar by 99.99%.
- ② Lack of distinct boundaries.
- ③ Inbreeding, Race crossing and gene flow.

Social construct

- ① Influences identities and experiences.
- ② leads to systemic discrimination.
eg. Apartheid system (South Africa)

However, UNESCO's Statement on Race (1951)

- mentions -
- ① pure race do not exist
 - ② Races do not differ significantly.

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

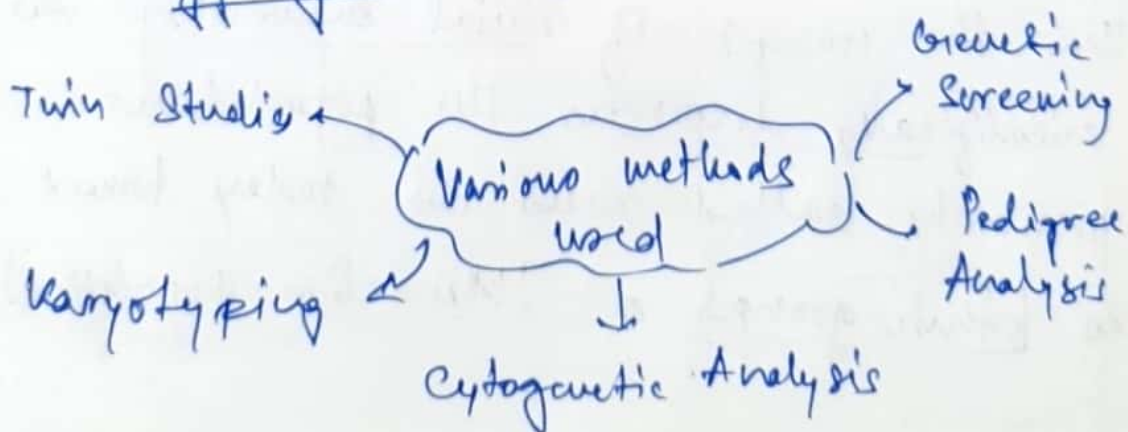
Q.5 (d)

Genetic epidemiology

Genetic epidemiology refers to the scientific discipline that examines the role of genetic factors in determining health & diseases in families & population.

Scope

- ① Identify the genetic basis of diseases.
- ② Understand how genetic & environmental factors interact to influence health.
- ③ Develop strategies for disease prevention, diagnosis & treatment.
- ④ Explore the heritability and familial aggregation of diseases.



Case study → Mary Claire King in 1990s
identified BRCA1 and BRCA2 genes,
mutations in which increased the
risk of breast & ovarian cancer.
→ this helps in "early detection".

Relevance

- ① Study the heritability of diseases.
- ② Genetic susceptibility can be
determined based on genetic
makeup.
- ③ Provides for insights to tailor made
personalised medicines. e.g. CAR-T cell
therapy.
- ④ Understand the spread of
epidemics and their prevention.

Thus, genetic epidemiology can help
us in achieving the goal of One
Health Approach and better disease
prevention in long run.

Q.5 (e)

Genetic Markers in Blood

Genetic markers are DNA sequences with known physical locations on chromosome. As per Crawford (1972), they are essentially genetic entities segregating independently, used to classify populations.

Genetic markers in blood

① Blood Antigens :-

① ABO blood group → based on presence of antigens (A and B) on red blood cells.

② Rh factor → 8 haplotypes

③ HLA typing → encodes protein for immune system.

② Plasma proteins :-

① Immunoglobulins (Ig) → proteins produced by B cells that bind to specific antigens.

② Clotting factors → blood coagulation

③ Enzymes -

① G6PD → crucial for red blood cell functioning.

② Red cell acid phosphates.

③ 6-PGD.

Applications

① Medical diagnostics → for blood typing, organ transplantation, diagnosing autoimmune disorders etc.

② Forensic science → paternity dispute, identifying individuals, toxicology.

③ Genetic Research → to understand
| diversity and spread.
→ potential targets for drug development.

These genetic markers in blood are quite valuable in various aspects of advancing healthcare and solving complex biological & criminal cases.

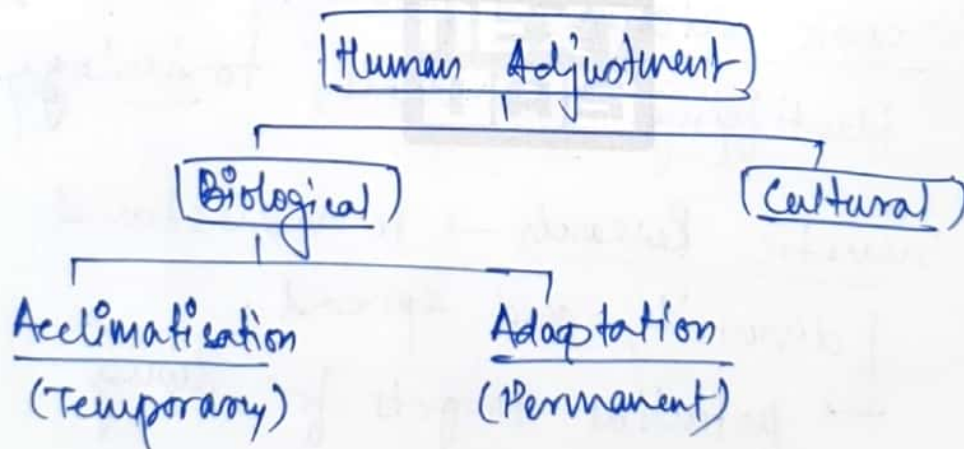
Q.6 (a)

"Humans have unique ability to adapt to varied environmental conditions due to the innate biological ability as well as through cultural means". Elaborate with examples.

20

Adaptation is the process to cope with environmental stresses to maintain homeostasis.

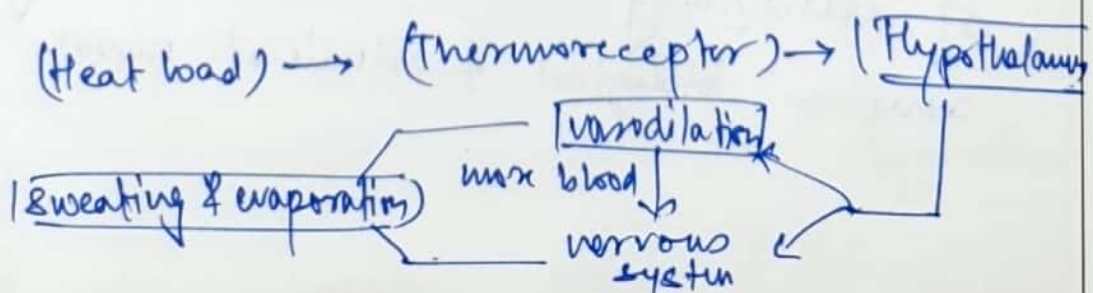
Humans exhibit the unique ability to adapt to varied environment due to the interplay of both biological and cultural factors.



Heat Stress

A Biological Response :-

① Acclimatisation



- $\uparrow$ rectal/core temperature
- Tanning.

② Adaptation

① Bergmann's Rule $\rightarrow$ individuals in warmer areas have lower body size.

eg. Pygmies of SE Asia.

② Allen's Rule $\rightarrow$ warmer areas have longer body appendages to dissipate heat.

eg. Nilotics of Africa.

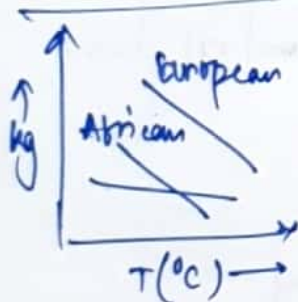


Fig. Bergmann's Rule

Reference
(Baker (1983))

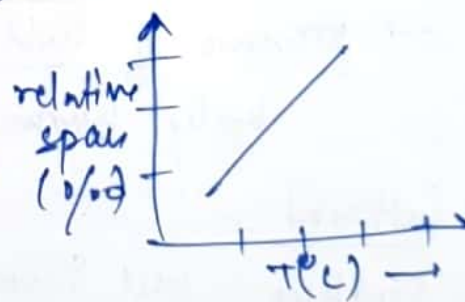


Fig. Allen's Rule

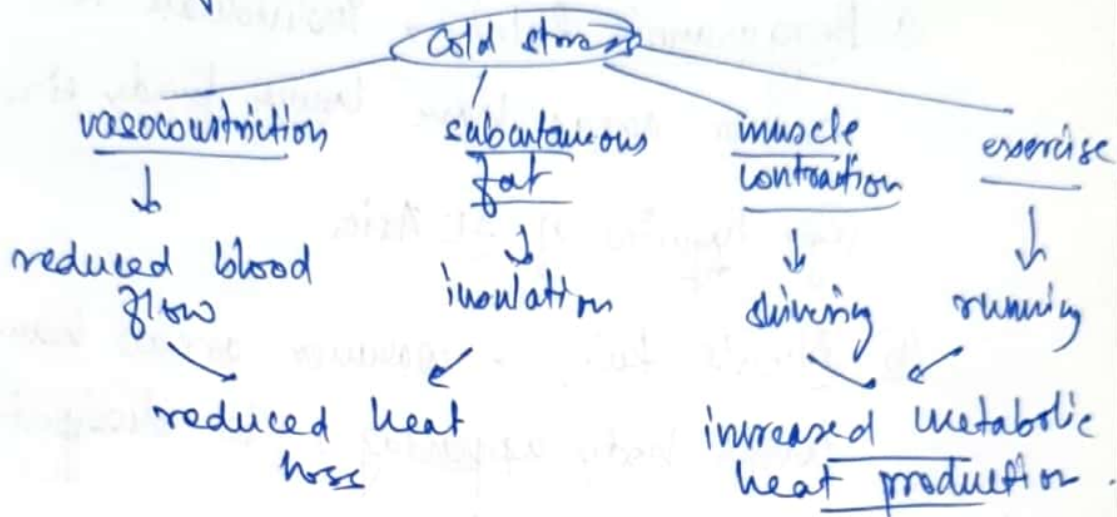
③ Cultural response:-

① Shelter $\rightarrow$ high reflective materials.
eg. Pueblo Indians.

② Diet $\rightarrow$ higher water + green leafy

③ Clothing $\rightarrow$ loose and light.

④ Technological $\rightarrow$ coolers & ACs.

Cold stress(A) Biological :- ① Acclimatisation② Adaptation — Allen & Bergmann rule

↳ presence of (cold genes) to control how body burns fat.

(B) Cultural :-① Shelters — well insulated housing② Igloos.③ clothing → insulated using animal skins.④ Inuits (| Jeane Briggs)⑤ Diet → high caloric diet like meat.⑥ Technological → use of heaters.

Altitude stress

(A) Biological: ① Acclimatisation

Import → Hypothalamus

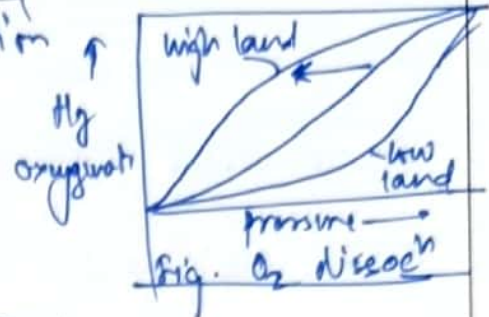
kidney
↑
erythropoietin
↓

↑ RBC and
haemoglobin

lung
↓
increased
respiratory
rate

Little &
Muirson (1990)

cells
↓
more mitochondria
number
↓
Increased energy



② Adaptation

↑ increased chest size (Monge, 1964)
↓ decreased body size
↑ unique genes:

Cynthia Beall - EPAS1 gene

in Tibetans for better oxygen utilisation.



(B) Cultural:-

- ① More glucose based diet.
- ② Migration to low altitudes in pregnancy.
e.g. Ancestral Indians (Hanna).

This knowledge helps in concluding that it is combination of biological & cultural responses behind human adjustments.

Q.6 (b)

"Study of primates have widened our understanding of human evolution". Elaborate.

15

According to Mivart (1873), primates are defined as ungulate, clavulate, placental mammals.

Study of primates

→ in Anthropology began in early 20th century as researchers sought to understand the evolutionary roots of human beings and behaviour.

→ Traced back to -

① Robert Yerkes - studying primate behaviour.

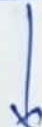
② Low's Leakey - to gain insights into behaviour of early human ancestors.

→ supported studies by Jane Goodall

Dian Fossey.

Widened our understanding

① Behavioural insights



→ Tool usage: as seen in chimpanzee and orangutan.

eg → Jane Goodall - complex primate tool usage by chimpanzee.

→ Social structure: studying their social hierarchies can give insights on early humans.

eg Diane Fossey's study of Gorilla social structure.

② Genetic insights

→ very high genetic similarity → 96.5% (Orang)
→ 97% (gorilla)
→ 98% (chimp)

→ gene function: FOXP2 gene in vocalisation → light on evolution of speech.

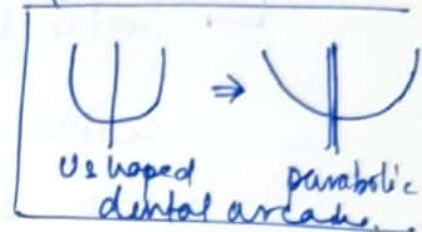
→ suffer from common diseases like flu and sypthitus.

③ Anatomical insights

→ Locomotion: understanding the evolution of bipedalism.

③ Lovejoy on Lucy fossil (A. afarensis)
provides evidence of bipedalism.

Diet and dentition: helps reconstruct
the dietary habits



④ Cognitive insights

→ problem solving & communication → evolution
of human intelligence.

eg → studies show chimps have better
short term memory.

→ social cognition and emotions: show
empathy and cooperation.

→ shift from "power grip" to "precision grip".

These studies have helped us in
setting the right evolutionary context,
better understand the human origins
and the various adaptations.

Q.6 (c)

The transition of humans from quadrupedal to bipedal locomotion had wide scale implications on biological and cultural evolution of man. Discuss. 15

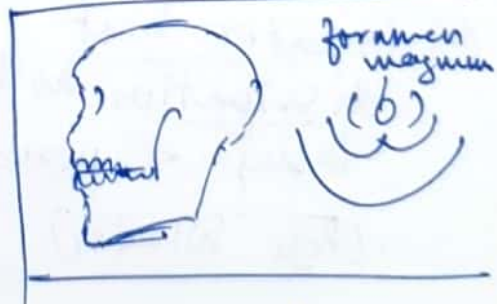
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About 16 million years ago, the first major development in human evolution took place - erect posture with bipedal locomotion. It was thus the process of hominisation.

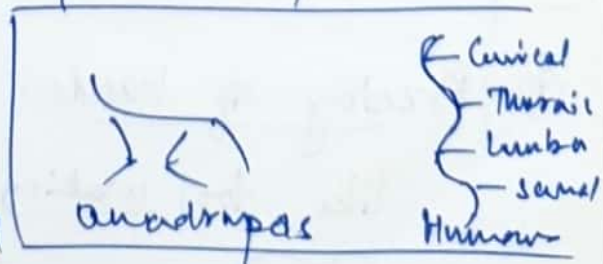
Implication on Biological evolution

① Gradual shift in gait from just bipedalism to erect posture

② Skull → shift of foramen magnum under the skull, → less robust neck muscle required.

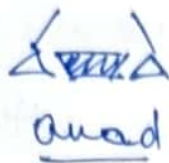


③ Spine → 2 distinct curves, bringing centre of gravity directly above the feet.



④ Pelvis → basin to support internal

organs, stabilising weight



⑤ Foot → double arch and non opposable hallux.



Positive

① more efficient in walking than knuckle.
(Rodman & Mittern)

② Greater heat dissipation as lower body exposed
(Pete Wheeler)

Negative

① Painful birthing process due to narrow birth canal

② Lower back problems as more weight

Implications on cultural evolution

① Freeing of hands for other purposes like tool making.



Abbevillian Handaxe

- ② Enhanced social bonding for support during birth process. (eg. marriage)
- ③ Started living in social groups for cooperation in hunting.
- ④ Speech development - due to hyoid bone and increased cognition.
enhanced communication.
- ⑤ Social institutions → with Neolithic age and domestication of plants & animals.

Most of these changes emerged in Australopithecus (Pliocene epoch), gradually evolving in Homo erectus (Pleistocene epoch) and finally in Homo sapiens (Holocene epoch). Highlighting the wide scale implications due to bipedal locomotion.