

② Natality: Till 28 days after birth.

- (Neo-Natal)
- Boys 2cm longer & 100g heavier than girls on average. $\frac{\text{Avg} = 3.4 \text{ kg}}{\text{wt}}$ - $\frac{\text{HT} = 51 \text{ cm}}{\text{ht}}$
 - 4th finger > 2nd finger in boys and opposite in case of girls.
 - Height Spurt if uterus constrained is also discussed.
 - Growth differential: Brain > Up Face > Lo Face > Body.
- ★ Brain 25% of total at birth itself [0yr]

③ Infancy: Till 1yr,
From 28 day -

(Post Neo-Natal)

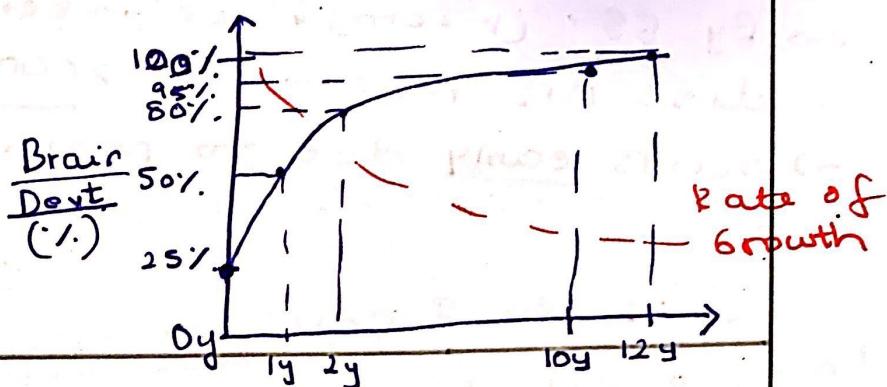
(50%)

- ★ Brain doubles in size,
- ★ Thymus achieves 40% of total, (1yr)
in immune system it helps.
- Teeth Milk/deciduous \Rightarrow 6m.
- Cultural Dev
- \rightarrow 2m: social smile
 - \rightarrow 3m: Mother recognised
 - \rightarrow 6m: Anxiety shown
 - \rightarrow 9m: Monosyllable
 - \rightarrow 10m: speech; & responds to the stimuli with sounds.

(4)

Childhood (Juvenile)

- Brain reaches 80%; by 2 years.
- Permanent teeth \Rightarrow 6 years (LI) first
- There is juvenile spurt.
- Boys have longer childhood.

Adolescence (Puberty)

(5)

- Growth of legs stops;
- Sign in boys \rightarrow Change in voice ;
Sign in girls \rightarrow Appearance of breast bud (the larch)
- Public hair, testes, penis, scrotum growth is accelerated. Same for breast, uterus & vagina.
- Boys shoulder-width (\uparrow) ; whereas hip width (\uparrow) in case of girls.
- After 2 years of dev of genitalia, spermatogenesis & oogenesis occur.
- Blood Alkali Level Higher in Boys to better contract effect of Lactic Acid buildup. \rightarrow Both weight & height
- Spurt:

⑥ Maturity (Adulthood)

- Growth continues upto 30-35 years even though total increment only 2cm.
- Cognitive Decision making capacity reaches peak at 30y.
- By 55; $(1-2\text{cm}) \downarrow$ as intervertebral disc oil lost \rightarrow compaction.
- occurs early due to malnutrition.

**⑦ Senescence (Ageing)
(Soit off)**

- Only universal observation is loss in elasticity of skin (wrinkling). Now as per UN: old age starts at 70.
- Brain can keep developing & become complex.
- Even Islets of Langerhans which produce Insulin in pancreas can regenerate themselves.
- Aging Gene identified.
- By 2050; 32.4 cr > 60 years.
 - Retirement age (\uparrow)
 - Geriatric Health & Insurance Policies
 - Labor Issues

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- Humans have longest senescence period.
- David Gutmann: We attain our humanity through the very existence of elders & significance of post-parental role.
- Nathan Shock: 1 organ f^n → Not much affected;
Many organs f^n → More affected

Case Studies

"Hazda of Tanzania sleep Biology (2017)"

- ① "Hazda of Tanzania sleep Biology (2017)" - David Simpson Et Al
- 33 individuals fit-bitted & 220 hours of sleep only 18 min where no one was awake. At any time $\approx \frac{1}{3}$ rd were awake. Grandparents slept less to wake up early so that others could rest while they watched for predators. It thus ensured survival of the group.

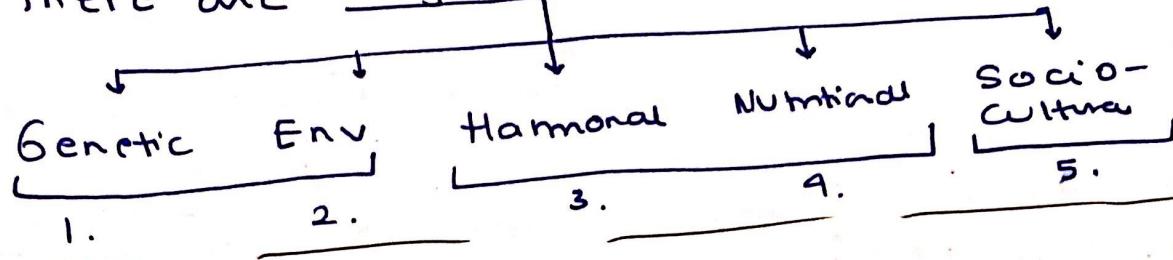
"Evidence for limit to human Life span (2016)"

- Xiao Dong in Nature Et Al
- 115 years; less than $\frac{1}{10}$ chance till 125.
- Since 1990 max limit has not increased.
- Criticised heavily; Said that by 2070 this limit will become 125.

Q3.

Factors affecting Human Growth [20 M] (and Development)

There are 5 factors



1. Genetic: Based on genotype;

Ex: sex; sex-related growth patterns are genetically controlled.

Ex: Skeletal Maturity : Twins very similar

* Dental Eruptions [Most tightly controlled]

* Bio-Rhythms (Menarche) → Mother & daughter have similar

→ Twins ~2 months

Non-Twins ~10 months

Some say girls better protected against stress as XX > XY.

2. Environmental:

→ Bergman's Rule | → Home environment (**Tanner (1972)**)

→ Aller's Rule | → Intelligence & personality of parents provides emotional support.

→ Altitude | → Habits of sleep & exercise.

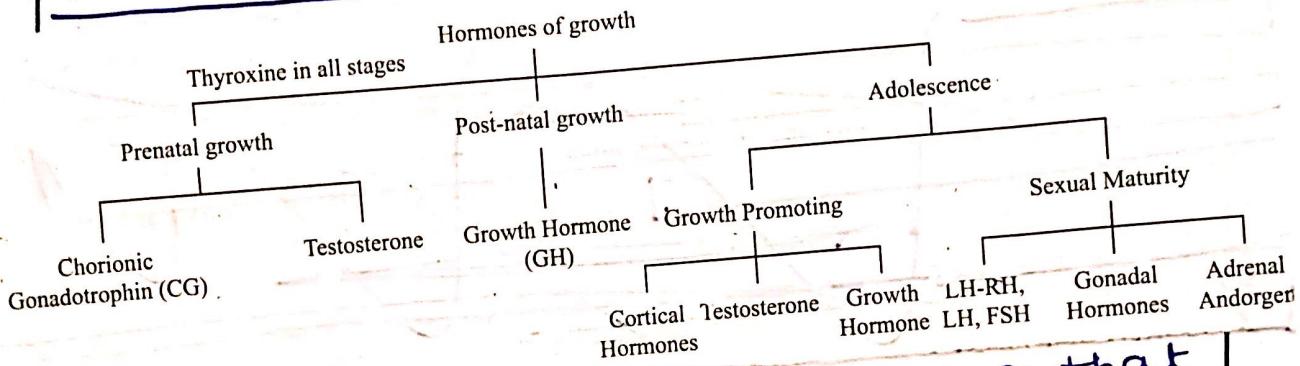
→ Migration: Japanese in Hawaii Case Study (**Troenick 1970**)

→ Season: More in Spring; for height
More in Autumn; for weight

→ Psychological: Stress can affect spurts as GH release affected.

Ex: **Widdowson (1948)** found correlation of Growth & behaviour of sister-in-charge. ²⁰⁵

3. Hormonal [Biochemical much wider]



Thyroxine

- (↑) permeability of cell membrane so that uptake of substances is increased.
- Increasing size & number of the mitochondria.
- Activation of DNA for RNA synthesis.

Chorionic Gonadotrophin (CG) – It reaches its peak in the 12th week of postmenstrual age. appearance and stimulation of Leydig cells in testes to secrete testosterone.

Growth Promoting Hormones – Other hormones combine with Growth Hormone to produce the adolescent spurt. Testosterone is the major cause of the increase in size and strength of male muscles, as also number of RBCs. Cortical hormones are secreted by cortex of the adrenal gland. They regulate mineral-metabolism, protein synthesis and level of blood glucose.

Growth Hormone (also known as Somatotropin) – It is a polypeptide secreted by pituitary. It is present in foetus itself, but not necessary for foetal growth. From birth onwards however, it is essential for normal growth to occur. It causes growth by stimulating an increase in cartilage-generating cells and by making them secrete hormone Somatomedin C.

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4. Nutritional

- If mother underweight \Rightarrow 30% (↑) risk of child being underweight.
- Tribal
CMR \Rightarrow 55 Carg = 42

First 5 years are when he/she is at maximum risk from malnutrition. It is biggest cause of U-5 mortality due to susceptibility to infections and slow recovery from illness.

Ex: Age of Menarche delayed as 17% body fat needed. So in Kenya vs USA \rightarrow 1.5-2 years difference.

5. Socio-cultural factors

Tanner (1972) : 2-5cm Δ in height b/w children of managerial classes & unskilled labourers.

Ex : If mother smokes, 100g (+) and 1cm smaller which cannot be recovered at anytime.

Case Study: Mayan village in Mexico by Inca - Yaucla - Salvia in a webinar (2020) concluded that the speakers of Native Language are less obese.

Q.7 Describe different methods of studying human growth.

(15M)

"As per Malina growth refers to the quantitative changes in size of the body and its parts. There are two broad ways to study growth -

Cross Sectional Method

A large sample is taken and divided into different age categories. All are assessed at once. The average is taken and graphs are plotted to study growth patterns.

Merits

1. Useful for estimating population mean at successive age level
2. Saves a lot of time, energy and resources
3. Training young researchers.

Demerits

1. Inaccurate as it is a one-time study not recommended for research
2. Non-uniformity due to absence of international standards in dividing age categories
3. Masks individual differences as it looks at group averages [2 children cannot have same age]
4. Many-a-times, individual age category does not have statistically significant numbers (at least 30)
5. Subjects do not remember their date of birth.

Longitudinal Method

(n 10)

It studies a small sample from birth to maturity. The same people are studied repeatedly after regular intervals (6 months or 1 year). Then the average is taken and graphs plotted.

Merits

1. Highly accurate as involves long-term observation
2. Highly sensitive to individual difference

Demerits → Not reliable Method

1. Difficult to study children at regular intervals when they start their schooling.
2. Needs a lot of energy, time and resources
3. As it is long term, there are lots of problems like researcher's health, professional commitments etc.

4. Hawthorne Effect: The subjects become aware of study and change their diet & env.

Semi-Longitudinal Method

Most common method to study human growth. It is middle path; a statistically significant sample is studied for 3-5 years at regular intervals (6m-1yr). Each age category has ~30 members. It thus removes limitations of cross-sectional method while retaining advantages of longitudinal method.

↳ Practical, reliable & accurate.

Conclusion : Ultimate Objective is to plot graphs such as velocity graph / distance graph. These can be used as general health indicators

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Q. Discuss Ageing & Senescence.
Give Social and Biological Theories of Ageing [20M]

Ageing: Process of getting older along with its associated changes regardless of when they occur in the lifespan.

Senescence: Acc. to Strehler (1962)

Sir Peter Meadowcroft also agreed.

* Inescapable, gradual & continuous and common to all species.

Characteristics → Senescence is in a way deleterious. It is also cumulative and death is ultimate result of these changes.

* Usually Ageing precedes senescence.

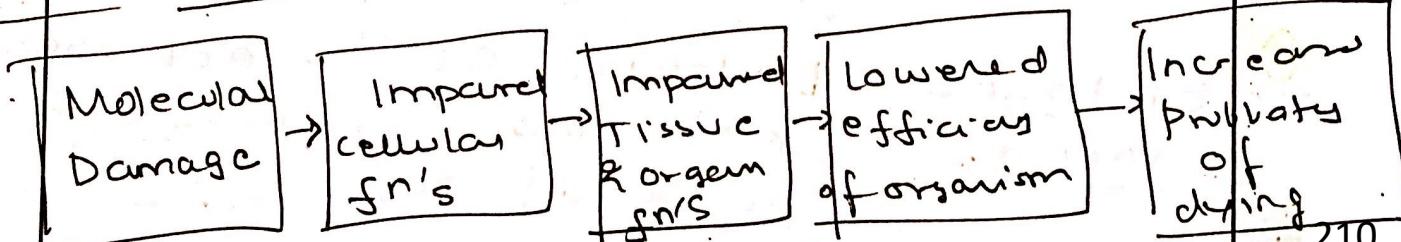


Fig: 1

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Ex: Onset of puberty \Rightarrow Ageing but not senescence.

Various Theories are given to explain Ageing [& senescence].

\downarrow A	Inconclusive & conflicting	Not unv applicable	\downarrow B
Biological Theories			Social Theories

'OPEN QUESTION'

(A) i) Programmed Theories: Ageing follows a biological timetable (A. Wiesmann)

① Death gene Theory: Become active latter in life. So human - lifespan is an inherited trait. Abnatharia of Georgia

Ex: Some families like Hunza of Pakistan have very long lives Vilcabamba of Ecuador

Ex: MZ Twins live similar time of death.

Criticism: Mechanism not understood.

② Immunological Theory: Burnet & Watson, programmed to decline over time.

③ Endocrine Theory: Biological clocks act through hormones to control the pace of ageing.

④ Rate of living $\propto \frac{1}{\text{Senescence}}$

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2) Damage/Error Theory: Inability to better combat natural deteriorative process.

① → Free Radical Theory: Denham Harman (1950)

Ex: Rodents fed anti-oxidants lived longer lives.

Criticism: Not all free radicals cause damage. Many participate in signalling pathways and kill harmful bacteria also.

② Iclomeric Theory

③ → Wean & Tear Theory: By A. Weissman (1962) of cells & tissues.

④ → Cross-Linking Theory: Accumulation of cross-linked proteins causes it.

By Bjorksten (1942)

3) "Life span: Why we age & why we don't have to" Prof. David Sinclair, prof of Genetics Harvard

→ Loss of epigenetic information like methylation markers.

→ If we stress body then protective mechanisms are done better.

→ Horvath Clock of life,

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- B**
- Disengagement theory** – It was formulated by Cumming and Henry in the book Growing Old (1961). It says that individuals start to withdraw and isolate from prior social interactions due to age. This is due to the expectation of death; decline in activity levels; and diminishing responsibilities.
 - Criticism** – The last decades have seen an increase in the general health and activity level of elderly people. Thus, the theory is not universally applicable.
 - Activity theory** – It was developed by Robert J. Havighurst in early 1960s, as a response to disengagement theory. It proposes that successful ageing occurs when elderly stay active and maintain social interactions. E.g. engaging in volunteering activity post-retirement → Shift in roles of people
Criticism - It overlooks inequalities in health and economy that hinders the ability for elderly to engage in activities. Also, some do not desire to engage in new roles.
 - Continuity Theory** – It was developed by Robert Atchley in 1971. It states that elder adults will try to maintain the continuity of their lifestyle by adapting strategies connected to their past experiences. E.g. an avid reader using spectacles to continue to read books
Criticism – It neglects adults with chronic illnesses, along with the role of social institutions.

→ Dependent on type of society we live in.

Evolutionary Theory

- ① Programmed Death Theory : A. Weissman
- ② Mutation Accumulation Theory of Peter Medawar
- ③ Antagonistic Pleiotropy Gene Theory by George Williams
↳ Sp. case: "Disposable Soma Theory", by Tom Kirkwood & Rubin Holliday

Chronical & Biological Age

- Actual time human has been alive
- How old human seems.

They may not match. As b.a is affected both by genetics & env. The b.a. considered as true measure of age. The disparity between c.a & b.a is said to be increasing.

- ① → Skeletal Maturity : x-ray of person compared with atlas of primary & secondary centres of ossification where there is high calcium content. b.a. is then determined by number of ossification centres & their developmental stage.
 - ② → Behavioural surveys : of people of similar chronological age.
 - ③ → Glycan Age Test : IgG Glycan structures compared with atlas.
 - ④ → Dental Maturity to match calcification of Jaw
- Ex: Bald Person
Ex: Early Menopause

Somatotype

white
male
4000
16-20 yrs

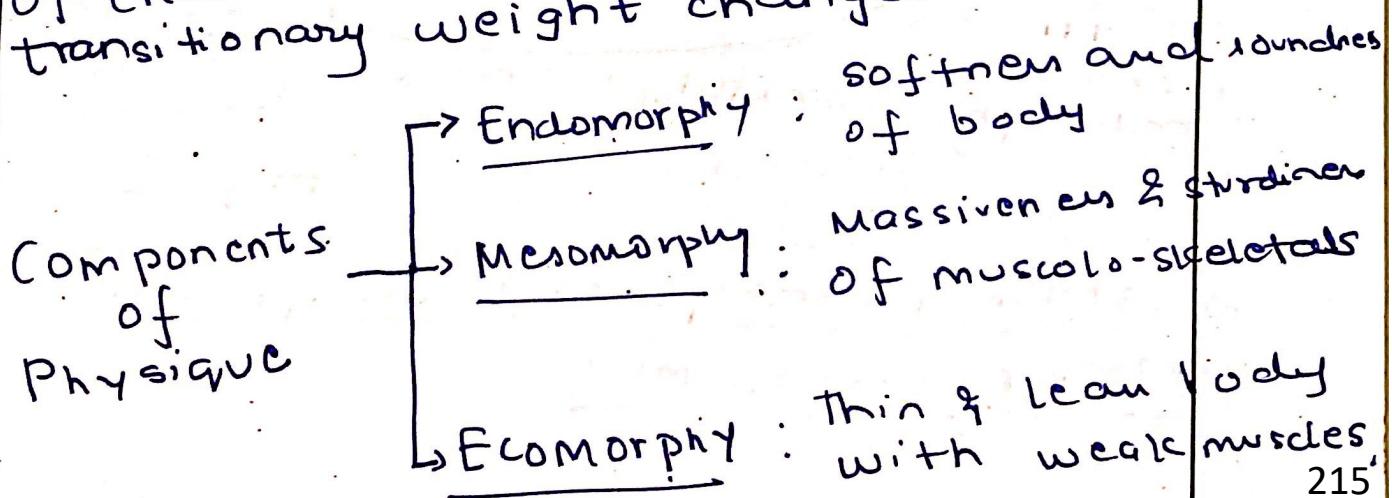
By William H. Sheldon in his "Atlas of Men, 1940". He got data from "Ivy League Nude Posture Photos". He said "Physique equals destiny".

Defⁿ : Morpho-phenotypic ranges along constantly recognisable characteristics; they are the functional endproducts of whole genetic & developmental complex.

Aim : Analysis & Quantification of the Human Body form.

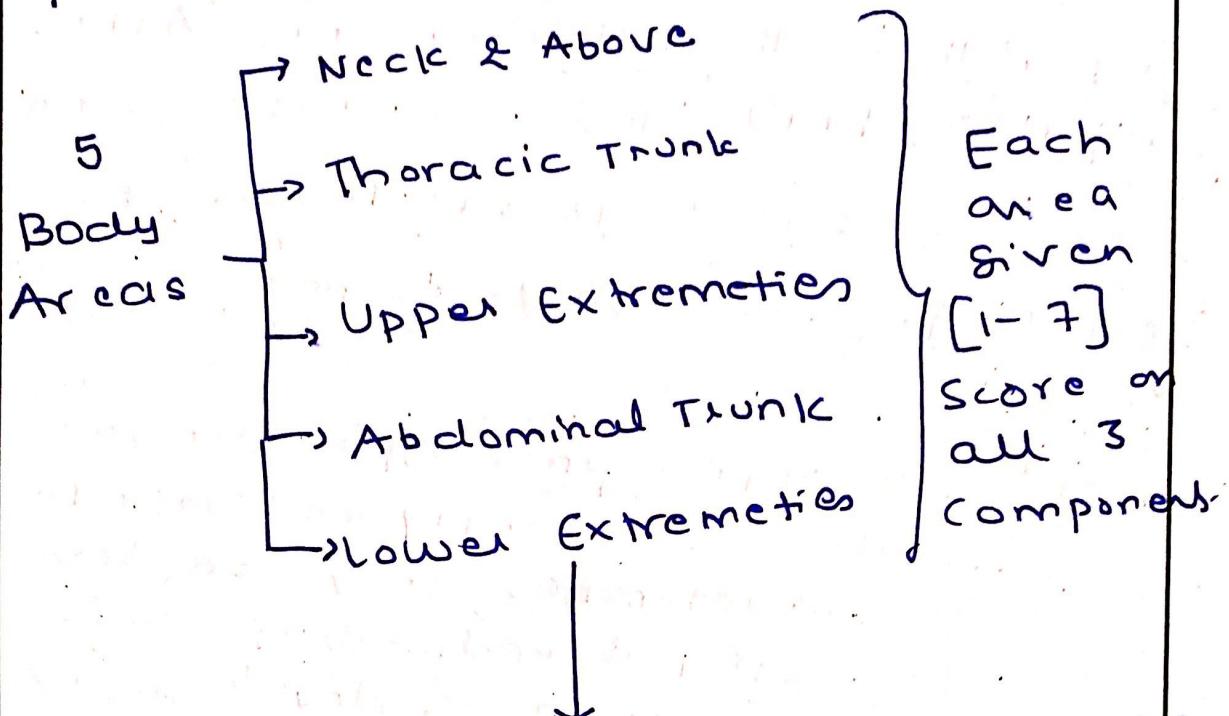
① Sheldon's Method : [1st scientific & systematic one] (1940)

Sheldon believed components were inborn & genetic; unwavering determinants of character regardless of the transitional weight change.



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Each individual has varying degrees of development of the 3 components



Each area given
[1-7]

Score on
all 3
components

Take avg and represent 3 components:
as 3 digit score in proper order:

171 (Extreme mesomorph)

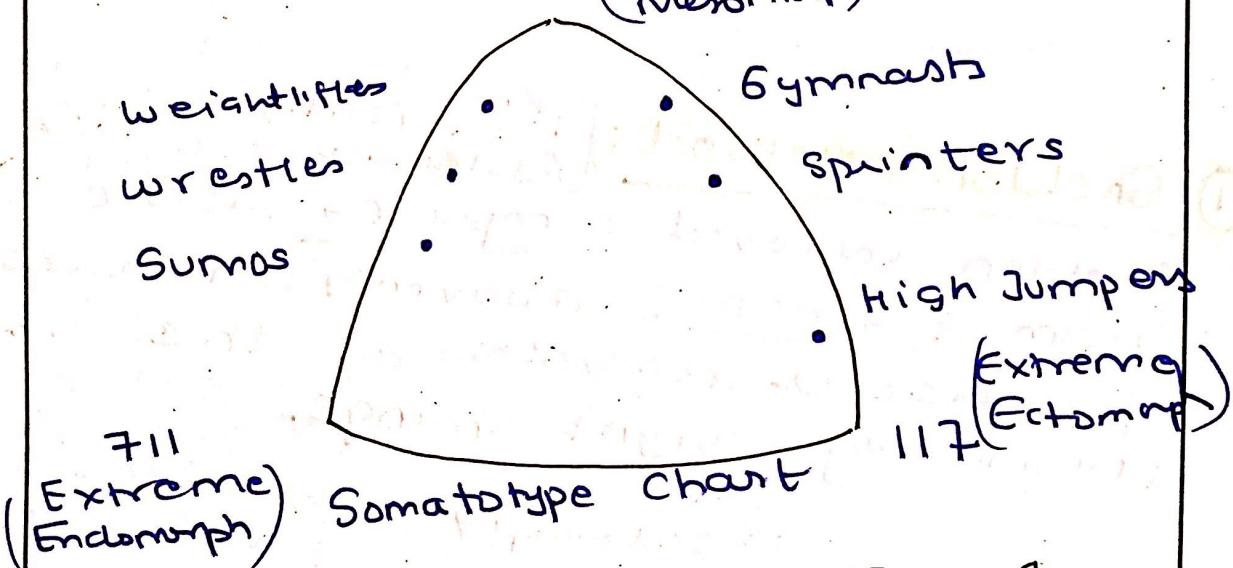


Fig : 1

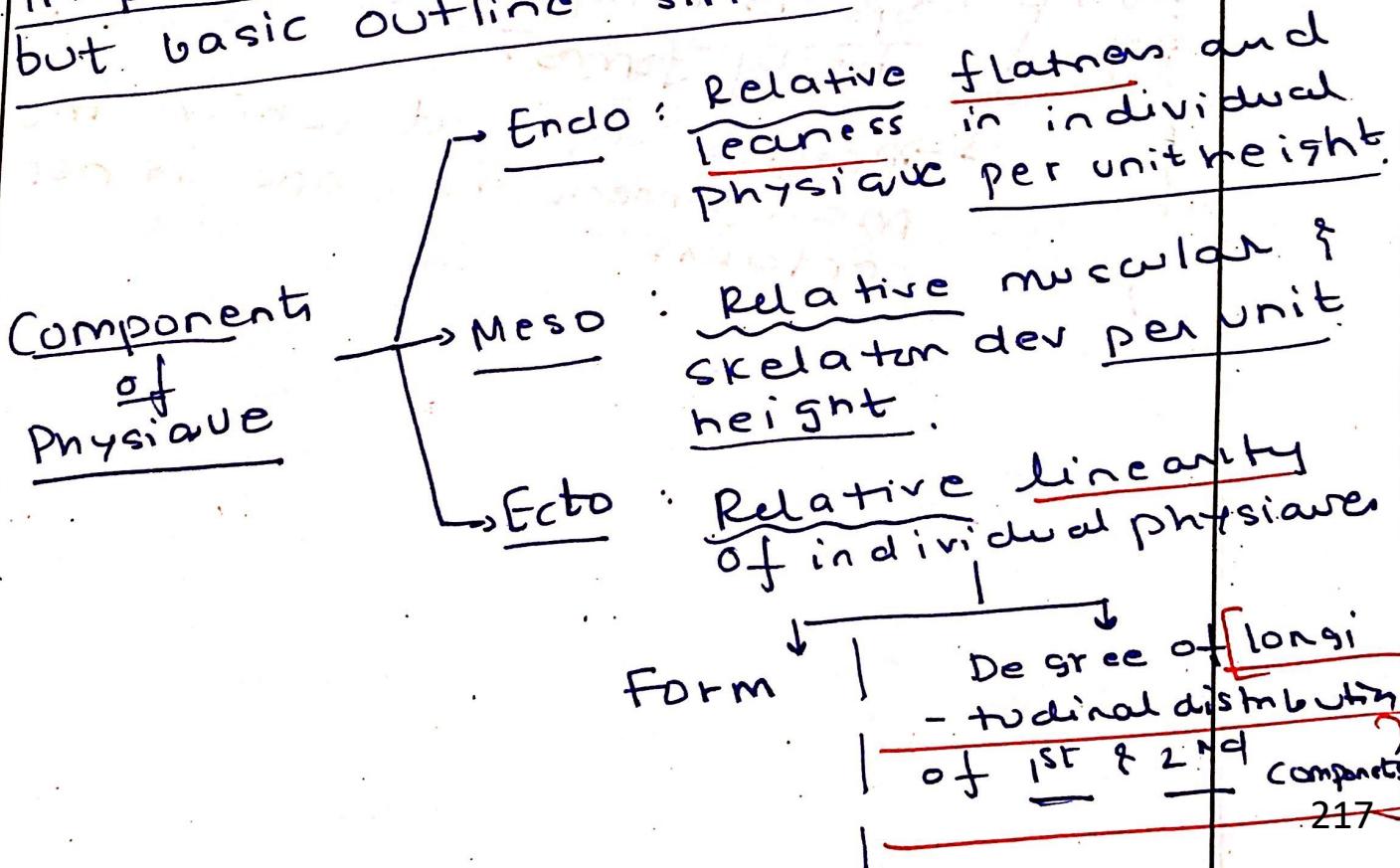
→ Used in Kinanthropometry, Equipment Design, Ergonomics

Criticism

- ① Subjective method as each evaluator will score photograph differently.
- ② Prior contact with rater not recommended. Only on white-males of limited age range. He ignored other ages, females and other ethnic groups.
- ③ How can human physique be static from birth to death; undoubtedly environment has a role to play.

2 Heath Carter Method (1967)

- In 1967; it is description of the present morphological conformation.
- Improvement on Sheldon's Method but basic outline similar.



femur
humens
diametre

The ratings of 3 components are based on 10 anthropometric wise measurements such as height, body weight, triceps, skin-fold, etc

Endomorphy $\rightarrow 1-15$; } 3-digit ranking
Mesomorphy $\rightarrow 1-12$; }
Ectomorphy $\rightarrow 0.5-9$; }

Analysis: \rightarrow Somatotype may change with time unlike Sheldon.

Sheldone
S.E.T.
3.F.M
H.C.M

→ Accuracy of Measurements taken is paramount. But lesser subjectivity than Sheldon.

→ Females also subjected; and can be used to explore the Spatio-temporal variation in body forms.

→ precise age at which the measurement is done is not certain.

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3

Viola's Method (Measurement & relative indexing)
(1921)

1. Long type : a) Long Limbs w.r.t trunk
b) Thorax massive than Abdomen
2. Brachitype : Opposite of Long type.
3. Normotype : In between Long type & Brachitype.
4. Mixed : Different body parts exhibit
above of traits.

4

Kretschmer's Method (Anthroposcopic inspection)
(1925)

1. Pyknic: Broad, Round & fat
2. Leptosome: Long, thin & linear
3. Athletic: Muscled, long shoulder
and narrow hips.

Both above methods no longer used as
they are fixed & discrete classes. They
don't capture all variation.

Physiotype : Form, Size & Dev of a
person's body.

Q. Secular Trends in Human Growth (Universal)

can be + / - / neutral? [20 M]

A. Due to difference in birth year
usually > 10 Y.

→ Mortality (\downarrow)

→ Height (\uparrow)

of weight

Relate with

\Rightarrow micro-Evolution

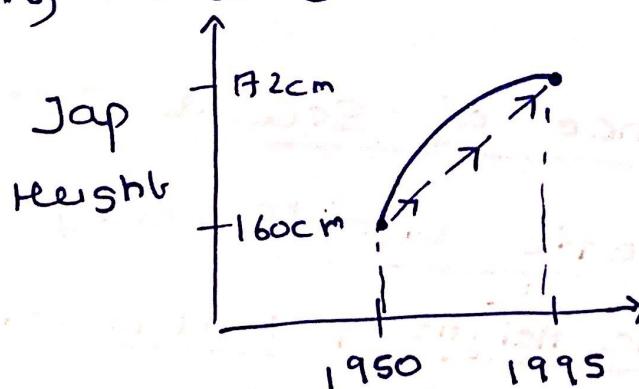
General

Obsr → Menarche (\downarrow)

Malina (2004) → wisdom Tooth (\downarrow) + Give S-C causes offsets Growth.

① Positive Secular Trend

Hawpsie (1996) \rightarrow weight & height (\uparrow)



\Rightarrow Obesity also increasing.

\rightarrow Migration can be cause : Treloar (1970)

② Negative Secular Trend

- Age of Adolescent growth Spurt is being delayed (Aksglaede: 2008)
- Late wisdom teeth : Micro-Evolution
- Age of Menarche : AM Tripathi (1987)

③ Absence of secular Trend:

- Genetic Limits may be at play.
- Middle Height & Middle weight (\downarrow).

Affected by Endo/Exogamy; migration
gendered malnutrition, etc.

- Policy Implications
 - Relevance of growth studies
- ↓
- which type of GS to follow?

11Menarche

Significant bio-event of fertility in the women's life. A woman is said to be biologically fecund with the start of

Mensuration which is known as Menarche.

It prepares female reproductive system to receive sperm for fertilization.

→ Both Genetic & Env factors affect it.

<Characteristics> → Generally starts/onset in Adolescence but age very variable. ~ (12-15y)

→ Secretion of oestrogen by ovaries in response to the pituitary hormones.

→ Increase in fat density; 17% body fat *

→ Sufficient body mass.

→ Pubic Hair & Axillary hair.

→ Estrogen stimulates growth of uterus, breast, height, widening of plevis, endorectum, etc.

* → Whitish fluid secreted from BARTHOLIN'S gland; also hormonal overdrive occurs.

* → Labia Minoria & Majoria [clitoris] develop.

→ Strained inter-personal relations possible.

<Impact> → Delay/irregularity in Menarche can have effect on child bearing ability.

→ Genetic makeup; whether she was breastfed & if obesity affect onset of menarche. → substance abuse.

→ Smoking, Lack of Nutrition, Exercise affect it.

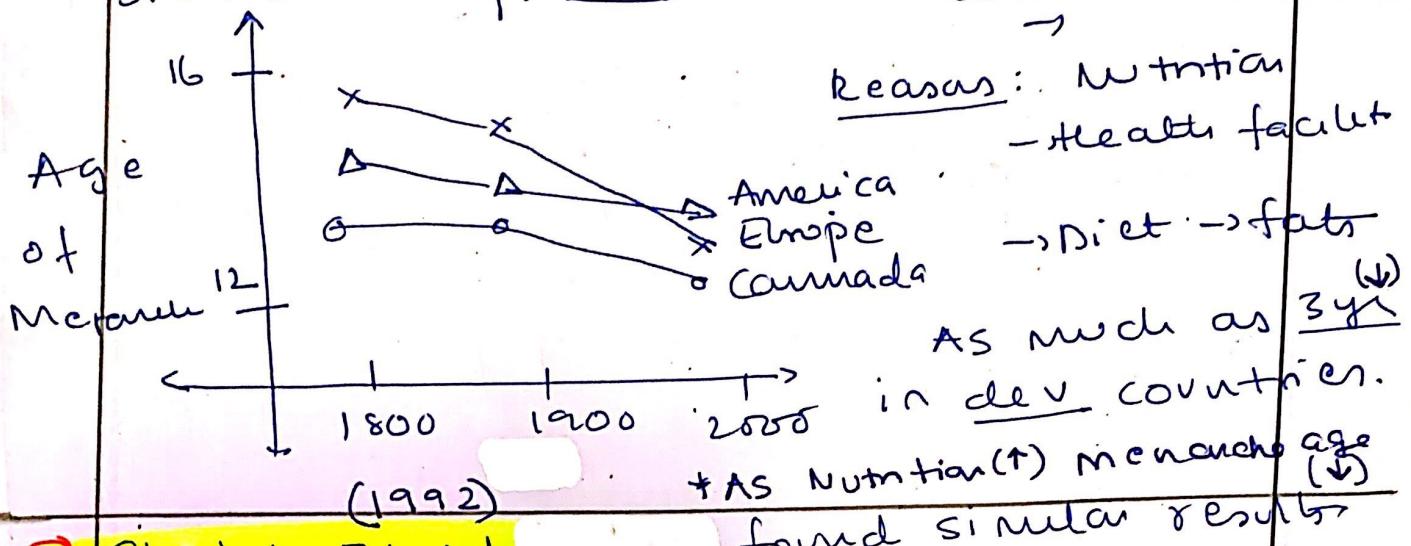
→ Attitudes of groups vary from 'pride' to pollution, menstrual, which refers to fear of menstrual blood. Many societies segregate the women.

Ex: Bauls of Bengal commemorate Menarche.

The blood is mixed with coconut milk & considered to be a regenerative substance. 223

* **(Case Study)** AM Tripathi (1987) found lowest age of Menarche in Delhi (11.2) followed by Calcutta (12.5) & UP (12.8). GJ has highest (14.8).

⇒ Urban Girls before Rural Girls
Similar thing: Dev before developing countries.



* **Shukla ET AL** found similar results as A M Tripathi (1987) in study of rural sports girls v/s urban sports girls.

- Peer pressure & teenage pregnancy are the other effects.
- * Ritu Kala Samskara in South India celebrates the girl's Liminality (rites de passage) after Menarche.
- Zomato: Holiday for women delivery partners during menstruation.
- Muslim Bugra ⇒ vitamin D (↑) ⇒ Menarche / Menopause affected
- Melanesia ① ⇒ Sleep with dead person ⇒ STD / unwanted pregnancy

These 2 case studies can be used anywhere

Menopause

Significant bio-event of fertility in the women's life. Stage in which menstrual periods stop permanently & capacity of women to bear children comes to an end. However if ovaries are removed earlier than automatically menopause takes place. The main reason however is decrease in hormonal prodⁿ by ovaries.

→ Both env & genetic factors affect it

Characteristics: → Cessation of Oestrogen secretion

- vaginal dryness; → No more ovulation. *
- usually occurs in 45 - 60;
- * In long run, oestrogen deficiency can cause Osteoporosis; where the bones become weak & skeletal strength is reduced
- * Hormonal imbalances can lead to the "Empty Nest Syndrome" & also cause mood swings, fatigue, anxiety, migraine, depression, etc
- Decreased Libido & difficulty in reaching of orgasm also found.

Impacts: → Early menopause can be devastating for the women; it can be caused by improper medication, malnutrition, surgery, substance abuse, smoking, hormonal imbalances, etc.

- family conflicts generally reduce.
- Women with diseases/disorders have erratic effect on it.

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Evolutionary Significance → Menopause seen as adaptation that allowed females to re-channel reproductive energy into nurturing existing offspring; thus contributing to human survival.

{ Ex: Identical Twin sister Menarche at avg of 2 months apart (Genetic) [10m for non-identical]

Menarche Ex: Study in western Kenya found that malnutrition led to delay of menarche by 1.5-2 years compared to a US reference popn [environmental].

Evolutionary Significance Animals have 'estrous cycle' to regulate fertility which is absent in humans. So instead we have menarche and menopause, for regulation of sex.

⇒ Avoids competition between mother and daughter.

Points for both events: The period between the two events is the reproductive span of a woman. It marks the ability of a woman to bear child; called Fecundity.

- Both events determine the demography of a country depending on TFR.
- Helps policy making regarding family planning & adolescent health.
- Helps for which groups to have family planning.
↳ Opposite in Nordic countries.
- Both affected by env.

Conclusion: The gynaecologists are too few in India to help with menarche & post menopause issues. More relevant as the literacy & life expectancy are increasing.

Puberty, Menarche and Menopause

Puberty refers to onset of adult sexual life.
Primordial follicles in ovary remain inactive during childhood due to lack of GnRH, LH and FSH hormones.

Between 9-12 Years, hypothalamus releases GnRH activating pituitary to release LH and FSH in right amounts.

✓ Puberty refers to hormonal changes leading to physical changes such as enlargement of gonads, pubic hair, secondary hair development. Body becomes ready for reproduction activity.

Puberty in female initiates in between 11 to 16 Years. However, successful ovulation takes time. Initial 6 to 11 granulosa follicles don't lead to ovulation due to non threshold levels of FSH.

Female Pregnancy

By 25th week of foetus all 1000 oocytes are arrested in Metaphase of Meosis II. They remain dormant till menarche. Thus # of eggs fixed at birth & n 400 of these undergo Meosis II & mature into ova during the female reproductive life.

Generally ovulation occurs 2 weeks after Menstruation [→ release of egg]. It's life span is only one day. If unfertilized it dies in the fallopian tube. If fertilized it attaches to inner wall of uterus. Finally if egg not fertilized then lining of uterus is shed which is called as Menses.

→ After egg embedded in uterus; then oestrogen & progesterone levels increased. These help support embryonic growth & prevent release of further eggs. The endometrium further thickens & this supports egg & next menstrual cycle avoided.

After 9 months; oxytocin induces contractions for delivery & prolactin starts lactation.

- Evoⁿ Discussion on Menarche/Menopause :
- ① Non-Adaption : we live long lives now hence we are now only experiencing menopause.
 - ② Fitness of Next Gen : As too many mutations in Ova are bad.

In addition to points of page after 2 sides

Adaptive Hypothesis → called as Mother/Grandmother hypothesis.

- Menarche has a elev. wt to preventing infectious diseases.
- keeping uterus ready for Ova/sperm is a very energy intensive process.
- Sexual competition between mother & daughter(↑)

Q

Fecundity & Fertility

Fecundity:

→ Thompson & Lewis: Physiological capacity to conceive & bear children

→ Barclay:

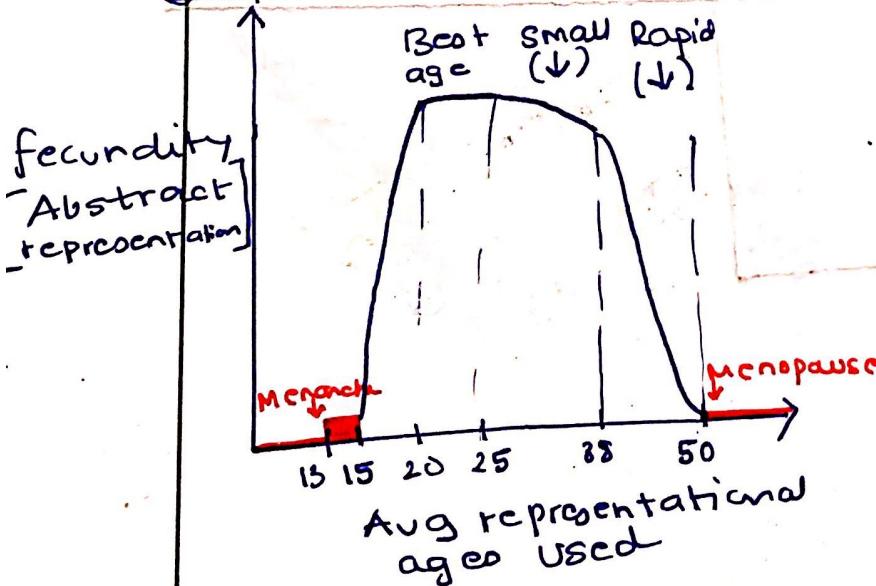
It sets maximum limit on the possible fertility level.

→ Alfred Sauvey: It is a biological concept. There is no direct measurement for it. It can be known only through certain biological tests. It is ~15 - 45 for women & much longer for men. Its absence is called sterility or infecundity. It may also be stopped for some period or may even reduce with age. Sterility may be voluntary or even involuntary.

1) Adolescent sterility - It refers to the interval between menarche and attainment of full biological maturity to bear children. Occurs because regular ovulatory cycles are not generally firmly established for the first two-three years after onset of menarche. It is observed between age of 13-18.

2) Post-partum sterility - After the birth of a child, the woman is generally sterile for some period, as the menstrual cycle is not resumed, or is un-ovulatory. During this period, the possibility of conception is very rare, and hence this period of temporary sterility is called post-partum sterility. → increased by breast-feeding.

3) Reproductive wastage - Abortions & still births.



Period betwⁿ the Menarche & menopause generally is fecund (Reproductive span)

Fertility: It is the actual reproductive performance of a woman.

↳ Thompson & Lewis

→ Responsible for replenishing the Society.

Ques
Basis
Topic
Date

Barclays: Fertility is limited by fecundity. → It's theoretical maximum ≈ 37 .

Alfred Sauvy: Fertility is result obtained in a group over a period of time. It is statistical concept with social relevance too.

Fertility Differentials:

- Ecological: Urban vs Rural ; Regional
- Socio-Economic factors
- Useful to understand factors which determine fertility levels among various sub-groups.

Case study: Religion & Fertility; Lorimer & Osborn (1945)

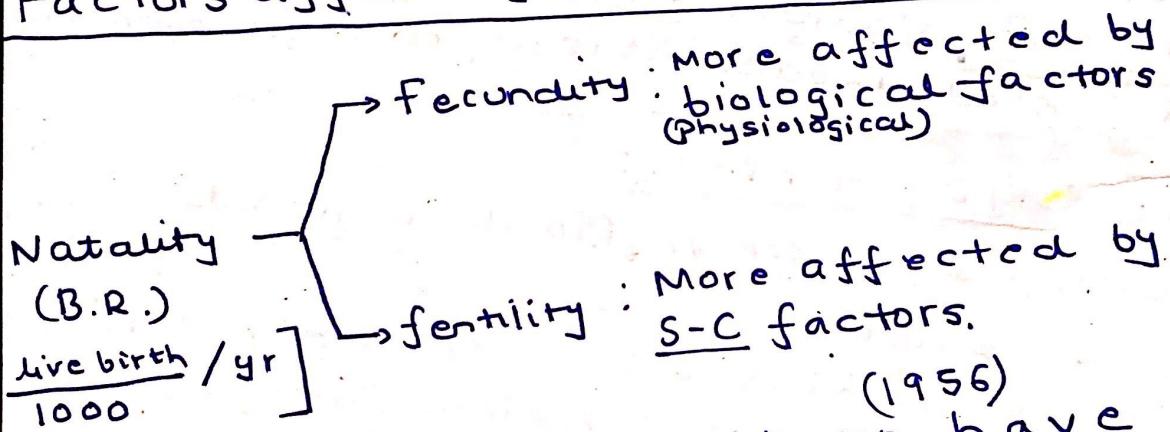
1. Pop' → Votes → Power structure; hence crucial topic.
2. they said all religion oppose obstruction to fertility but less in decentralised religions like Hinduism, Judaism & Protestant Christianity.

This is a relic of the times they were born in. Also note that minorities have higher fertility rates. Ex: Jews of USA; Parsis of India. The general trend narrowing among the various religions of dev countries.

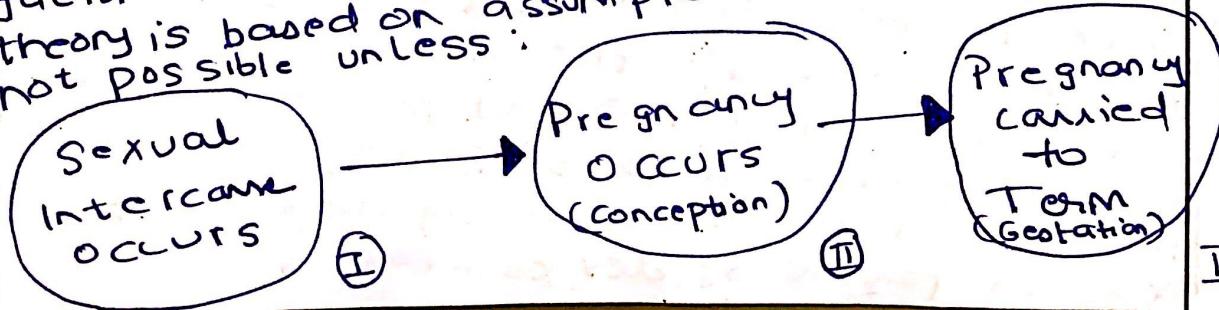
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Give Same answer — — — → [Natality] [Mortality]

Factors affecting Fertility & Fecundity



Kingsley Davis & Judith Blake have identified certain factors through which Natality is affected directly. They have called it as "Intermediate factors". Any other factor must influence them through these. Their theory is based on assumption that childbirth is not possible unless:



~~उपर्युक्त~~ There are **11** such intermediate factors:

- | | | |
|--|--|--|
| <ol style="list-style-type: none"> ① Age of entry to inter-coarse. ② Permanent celibacy. ③ Reproductive gap bet^{wn} pregnancies ④ Voluntary Abstinence ⑤ Involuntary Abstinence ⑥ frequency of inter-coarse | <ol style="list-style-type: none"> ⑦ Voluntary F/F ⑧ Involuntary F/F ⑨ Use/Non-use of contraception [Literacy & Superstition] | <ol style="list-style-type: none"> ⑩ Involuntary Fetal Mortality ⑪ Voluntary Fetal Mortality (abortion, infanticide) |
|--|--|--|

(I)

(II)

(III)

Other notables: Son-Meta preference.
 Stress, Lifestyle & smoking
 Lethal & Sub-lethal Genes
 Healthcare: vaccination & Gene Therapy.
 IR: Change of family from producer to consumer.
 Fatalistic attitude among traditional societies.



Ex: Kamayura of Brazilian Amazon kills twins
 of children of single mothers as they
 are considered inauspicious.

Ex: Chronic Malnutrition in Saharia of MP
 has led to early menopause & thus lower
 fertility.

Ex: Kerala has late marriage so significant
 years of fecundity period lost \Rightarrow low fertility

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John Bongaarts (1978) : Proximate Determinant Model

<u>Exposure</u>	<u>Deliberate Mortality</u>	<u>Natural Mortality</u>
1. Proportion Married	Fertility Control	Fertility
	2. Abortion	4. Lactational Infertility
	3. Contraceptive	5. Frequency of intercourse
		6. Sterility
		7. Spontaneous Mortality
		8. Duration of fertility period

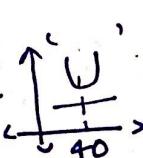
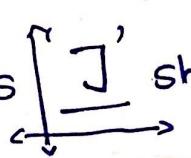
⇒ In fact '4' alone are mostly enough,

$$\text{TFR} = \text{cmCCCaCix} \times \text{[TF(15.3)]}$$

C.R. : Pop causes poverty.

Mortality: It is called Death Rate, WHO defines it as permanent disappearance of all evidence of life after birth has taken place.

A death cannot occur with live birth & Pre-birth deaths are known as foetal deaths.

① Age:  shaped v/s  shaped
 Less dev countries More dev countries, with Low IMR.

Endogenic: Related to foetal dev.

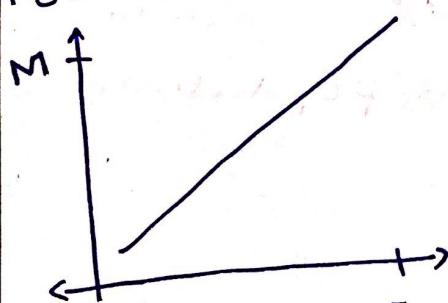
IMR → Exogenic: S-E & Other factors;
 Honor killing, FGM, etc.

< 28 days (28-365)

Neo-Natal Mortality in developing countries
 ↓ Most in developing countries.

- ② Sex: Male Mortality $>$ Female; comrad says it is due to lifestyle.

Fertility & Mortality: As a strategy,



Q. Fertility Differentials

- Urban vs Rural: (2.1)
- Regional Disparities
- Caste Classes
- Literacy
- Healthcare Access
- Occupation of Husband
- Race
- Family Structure

Q. Theories of Demographic Transition

Study of human collections/populations is called Demography.

Formal by Statistical Analysis

Population Studies Ex: Social Demography

- (Demo) It is linked to SC-AP via Popn Studies.
- ARRB said inseparable link between AP and demography.

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*① Malthus "An Essay on Population, 1798"

Better follow preventive checks rather than positive checks enforced by nature,
Ex: Cholanaikins of Kerala aware of herbs that helped in family planning.

*② Demographic Transition Theory

By Warren Thompson in 1929; but FW
Notestein led change in 1945.

Ex: India; Moderate BR } stage \Rightarrow 25 years
Low DR } more.

Also TFR in India = 2.3 now; so BR is not too high.

Peninsular India \rightarrow 2020's Peak

North India \rightarrow 2040's Peak

*③ Thomas Malthus: Destiny & Fecundity Principle.
In his 'Law of Pop (1830)' as a critique of Malthusian Theory.

Low pop: Lot of privacy & demand for labor there



High pop: Less privacy due to accommodation constraints

①

∴ Lower pop growth (↓)

Ind^{tr} has reduced demand for labour. [In addition the pop is interested in other intellectual pursuits.]

Criticism: His understanding of fertility and fecundity was incorrect. He named his theory wrongly.

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④ Theory of optimum Population [Edwin Cannan]

Grows till optimum; and further growth is harmful. Decided by 'Eco Dev' and exploitation of natural resources.

If low: then need for labor to utilise popn : the resources so popn (\uparrow).

⑤ Cyclical Theory of Corrado Gini

→ young people

Stage 1: Rapid Popn growth

→ stratified society with mechanisms in place.

Stage 2: Slow Popn growth

→ loss of energetic young people
→ prosperity (\uparrow); and rich people are not so fertile.

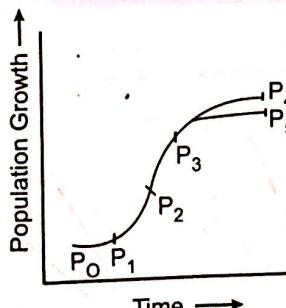
So similar to lifecycle
of an individual.

Food Fertility Nexus Related Theories

- 1. Theory of De Castro - It says that less consumption of proteins by females leads to fatty degeneration of liver, causing it to become weak. A weak liver is unable to neutralise excess oestrogen, which causes fertility to rise.
- 2. Theory of Thomas Doubleday - It says that vegetarian diet increases fertility and non-vegetarian diet decreases it. Further, leanness is favourable to fertility. Also, consumption of animal fat, and leading a sedentary life add to the fat levels, thereby interfering with the fertilisation process.
- 3. Theory of Herbert Spencer - Spencer argued that fertility decreases when the complexity of life increases. Lower forms of life have high genesis (reproductive energy) because there is lower individualisation (energy for self-development), whereas higher forms have low genesis due to higher individualisation. It doesn't give man any responsibility for controlling popn as nature does it from him.

Population Density Theories

- 1. Theory of Pearl and Reed - With certain contradictions, the theory proposes that as density grows, there is a fall in fertility and population finally reaches a plateau. The population experiences transition from lower density to high density, explained by the below S-curve.



$P_0 - P_1$ = Most backward society

$P_1 - P_2$ = Developing society (high growth rate)

$P_2 - P_3$ = Society starts showing concerns about population growth

$P_3 - P_4$ = Developed society with slight increase in population

$P_3 - P_5$ = Developed society with no rise in population

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⑧ David Ricardo's Economic Theory

$\text{Pop}^n (\uparrow/\downarrow)$ as per equilibrium of D/S in the wage market.

⑨ Karl Marx : Use communism to slow popⁿ growth to avoid a revolution.

Proletariat

Bourgeois

: Only asset labor so try to (\uparrow)
They don't want it ;
↓ to avoid division
of assets

CLASS STRUGGLE

↓
REVOLUTION & ASSET REDISTRIBUTION

So then popⁿ growth slowed

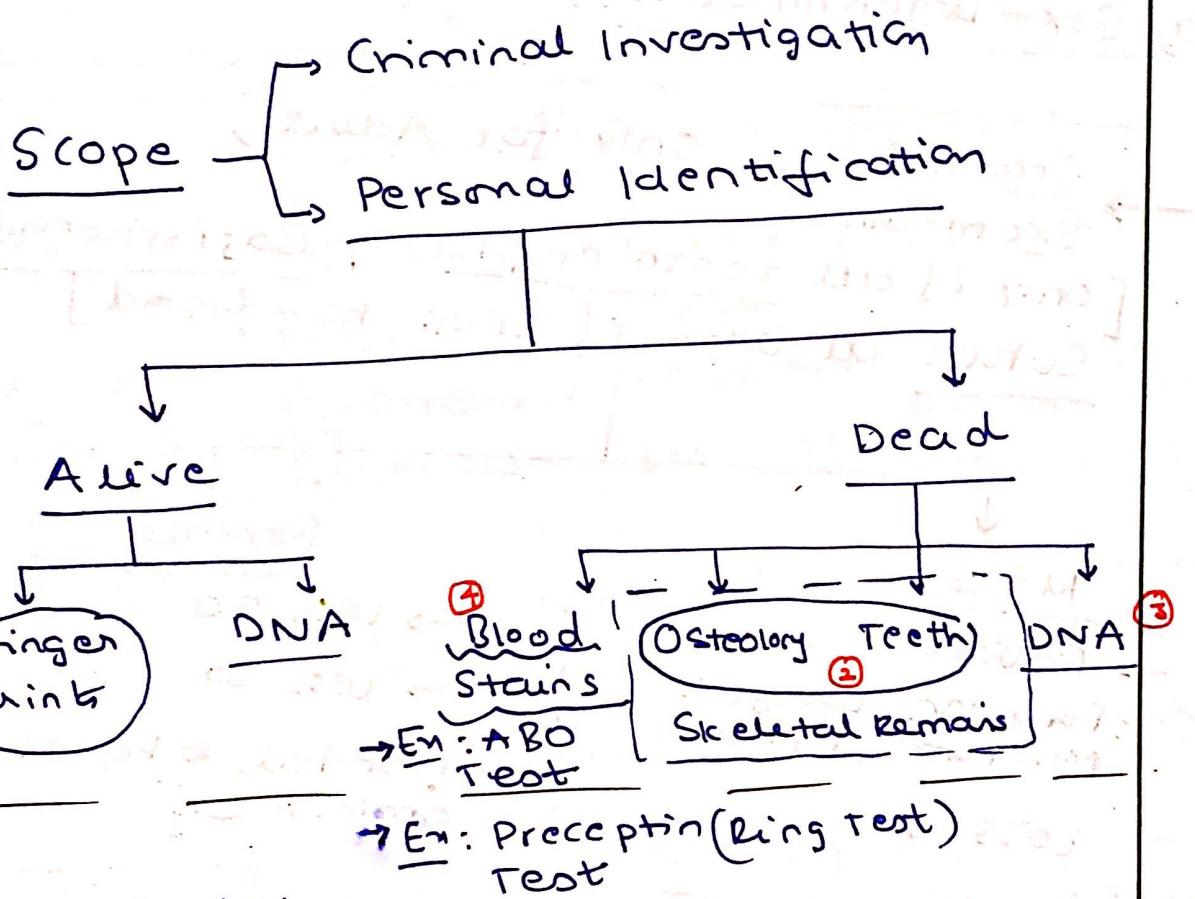
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Q.

Forensic AP [India Physical Identification]

Def'n by : Application of Phy-AP specialised knowledge [sex, age, race, etc] to the problems of medical jurisprudence.

CC Snow (1973)



1. Finger Prints:

Types

- Visible → due to sweating;
- Invisible/Latent → made visible by sprinkling fine grey powder.
- Plastic : Photographed by differential exposure to light; found on plastic.

All India Forensic Science Congress (1973)

said at least '8' ridge characteristics match are needed to establish an identity.

Add study from race also

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प्रश्न संख्या
(Question No.)

2. Skeletal Remains

→ Whether bones are human?

If so are they of same person.

a) Sex-Determination:

→ Cranial → Only for Adults;

→ Examination

[only if all teeth erupted & Basisphenoid
Suture at base of skull has fused]

Female

Male

Robust

→ less so

Foramen Magnum

Large & Broad

→ less so

Frontal & Parietal
elevations

Less so

→ Post-Cranial: For both; Examination

By Pelvis and sacral shape,

The sub-pubic angle and Sciatic Notch

In femur => Proof of Bipedalism

Angle of Torsion:

Male → Elbow X } During
Female → Elbow V Adolescence

Comparison of Male & female foot
by Vern Houston (2009)

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इस भाग में कुछ
न लिखें
(Don't write anything
in this part)

$$\text{Female} = ((\text{L of femur}) \times 2.47 + 54.1) \text{ cm}$$

(cm)

$$\text{Male} = ((\text{Lenth of femur}) \times 2.32 + 65.5) \text{ cm}$$

(cm)

b) Age-Determination : By Tooth & Bones

→ Tooth

- ① Attrition [Wearings down due to Mastication]
- ② Periodontitis [Loosening of Gums]
- ③ Root Transparency
- ④ Cementum Oppositum
- ⑤ Secondary Dentine [formed in root/pulp cavity]

Dr Ambrogi
of Calcutta

Used to prove
Hitlers suicide.

→ Bones

5 stages
of life

- Infant: Ossification centre at lower end of humerus bone found
- Children: Unification of Pubis & Ischium
- Adolescence: Angle of Torsion
→ All epiphyses are united.
- Adult: Fusion of clavicle bones
- Senescence:
 - 40: Xiphoid process & Sternum fuse
 - 60: Manubrium & Sternum fuse.

→ Wrist proximal/distal row
can be used to tell if he
is adult/adolescent.

c) DNA - Profiling

Relevance → Tandoor case (1995)
 → Bill (2018) in Parliament
 → Kathua Rape case
 → World Trade Centre victim
 → Paternity Disputes
 Accuracy: 1 per Million, so very good,

But in India → 1200 possible matches
 So probability innocent person is
 $\frac{1}{1200} \Rightarrow$ couple with other methods.

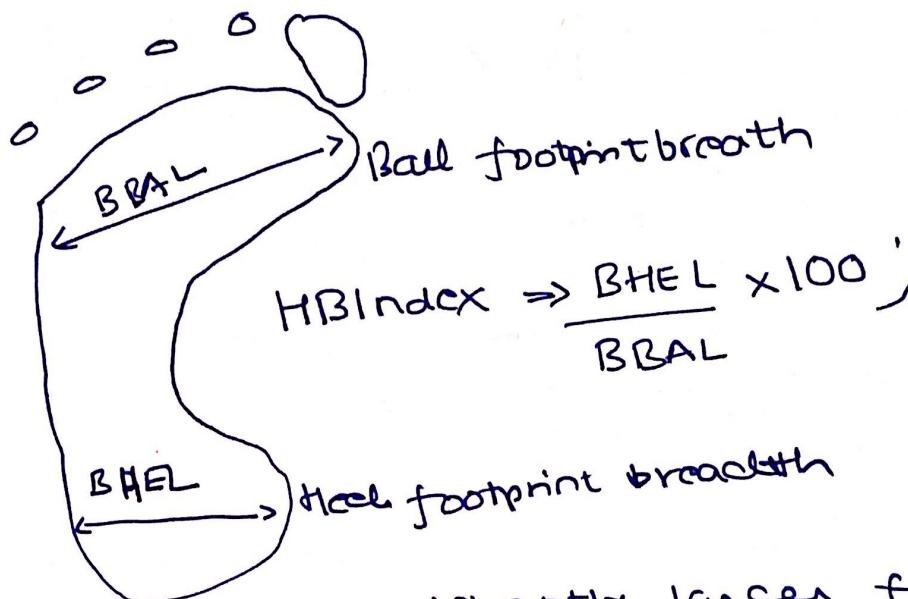
Amplification by PCR: Just 1 molecule enough

⇒ VNTR & minisatellites are hyper-variable
 so analyse by Electrophoresis, Southern Blotting and Hybridisation with DNA Probe.

New Age Personnel Identification Method

→ Gait Analysis can be used to identify a person. Ex: Bombay Police Inspector case.

→ Heel-Ball Index: Footprint dimensions for determination of sex; - Kewal Krishnan (2014)



Males have significantly larger feet than females.

Kinanthropometry : Anthropometry of Sports

Defn: Study of physical structure of the individual in relation to gross motor functions.

Scope ① More than just measurement and also includes aspects of nutrition etc.
② Singh & Malhotra (1989) say help in selecting the best individuals.

Origin ① Started by Bill ROSS in 1972.
② Inaugured in Olympic Scientific Congress (1976)
for the Montreal Olympics of 1978.
③ International Society for Advancement of Kinanthropometry founded in 1986.

Classification of physique → Form, shape & size of the person's body.

By Morhouse & Rasch (1964) on basis of height and weight.

	Heavy	→ Wrestler	
Tall	Medium	→ Boxer	→ Lung capacity → Long legs
	Light	→ Jumper/Sprinter	→ Sudden energy
Medium	Heavy	→ Thrower	
	Medium	→ Swimming	Subcutaneous layer → buoyancy warmth endurance
	Light	→ Football, Cricket, Badminton	
Short	Heavy	→ weight lifter	
	Medium	→ Gymnast	
	Light	→ Skating	→ Low centre of gravity

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Ex: Long distance runner → Need High Blood Alkali level to keep lactic acid induced PH Low.

Applications

✳ 1. Role of Genes: Shukla ET AL (1992)

Even research at Australian Institute of Sports, published in American Journal of Human Genetics (2003) have found role of X-Actinin:

ACTN - 3 → (X-Actinin) → ACTN - 2

→ Short distance running | Long distance running
→ Protein to keep glucose near muscles and help contraction of muscles → Protein to keep lactic acid levels low.

2. Maturity: By ossification sites.

✳ 3. Swapna Barma → 20 yr old Heptathlon has 12 toes. Gold medalist

She had a customised anthropometric shoe.

✳ 4. Sachindra Narayan (1988) @ kids → Hockey stick for of Jharkhand.

Result: Jhlc won National Games of 1995.

① Smaller Archery instrument for Sonia Beharla of Jhlc

[20M] Somatotype [Ans 1]

Q: Somatotype ? +
Anthropology of Sports: Anthropology of sports

Sport needs not only muscle strength but coordinated body movements which are unique to the sport. \Rightarrow Individuals with certain anthropometric characters perform better than others.

↓ ↓

Choose better individual for the sport Curtails expenditure on individuals who are less fit

(1972)

Defn: Ross et al defined KM as application of body measurements, genetic methods, etc to study human size, shape, proportion, composition, maturity & gross function so as to understand human movt. in relation to growth, exercise, performance & nutrition.

Kinecin \Rightarrow Move }
 Anthropos \Rightarrow Man
 Metrein \Rightarrow Measure

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Anthropology in Design of Equipments

Defⁿ : Anthropometry is branch of Physical AP concerned with measurements of the human body.

Origin : Term 'anthropometry' coined by Queflet (1871).

Martin Rudolph published it in his book "Lehrbuch Der Anthropologie, 1928".

Prominent in WW 2,

Malik El All (1991) \Rightarrow Man - Machine Relationship

Efficiency
Safety
Comfort

Applications

1. Gun Turret : Needs to be small to (\downarrow) air resistance so designing is challenge.
2. Cockpit : To reduce fatigue and accommodate many diff sizes.
Mockups also made for testing.
3. Anthropomorphic Dummy : To study G-force effect
4. Ejection Seat : centre of gravity consideration

5. Flight Clothing : a) Partial Pressure Suit by J P Henry.
 b) Oxygen Mask : 7 faceforms are standard as per Anthropometrists.
 c) Helmets : four sizes fit population in 10 : 40 : 40 : 10 ratio

6. Apollo Space Chamber: During reentry

→ Designing a Chair : A scientific perspective
 - Shanti Lal Mank (1984)
 of UoD in "Indian Artist".

Other Applications

→ Class Rooms, keyboard spaces, etc.

Caution : In design anthropometry; there is no average man but percentiles of Normal Distribution Curve.

Reach → Bottom (1-5) percentile

Clearance → Top (95-99) percentile

Good for make-in-India; also Defense ²⁴⁹
Institute of Physiology and Applied Sciences, DRDO
 maintains anthropometry database of body dimensions of soldiers

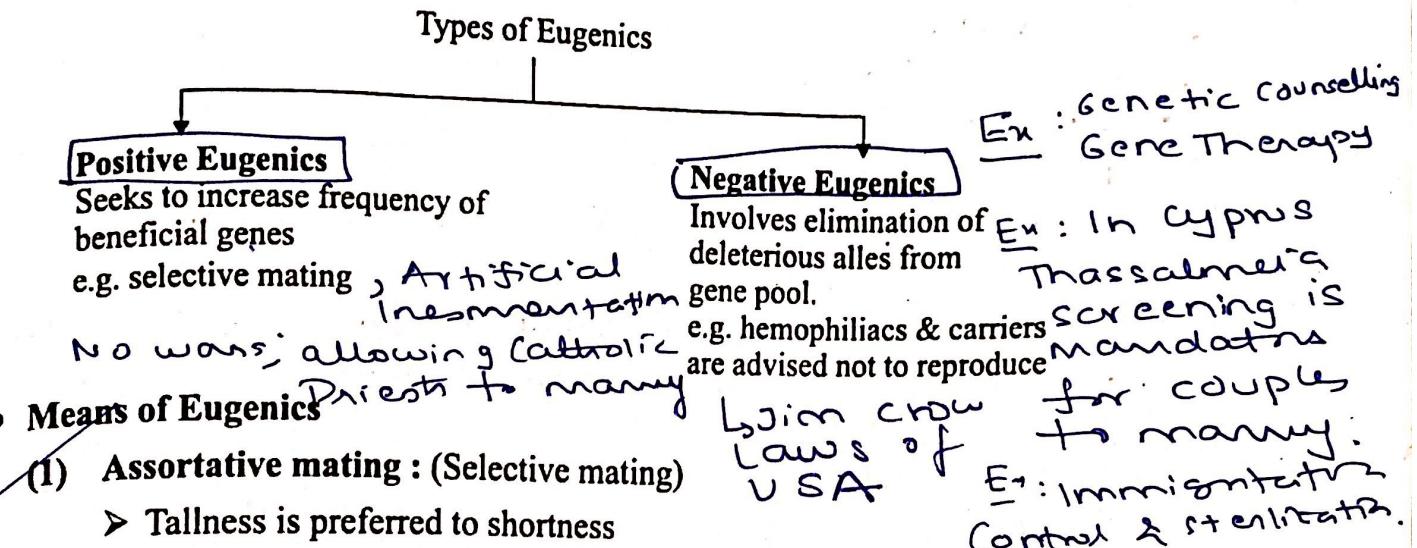
Eugenics: Francis Galton in 1885;
Heredity Genius

→ Took help of statistics of
Queflet

Ques. (8) Describe the terms Eugenics and Euthenics with suitable examples. (10/15 marks)

• Eugenics and Euthenics :

~~Eugenics~~ ~~can be achieved by improving the environmental conditions.~~ ~~and~~ ~~subjecting them to better nutrition, better unpolluted ecological condition, better education and sufficient amount of medical facilities. E.g. Navodaya school, IIT's & IIM's, sport training for athletes & players (coaching etc.) Ex: HbS/HbA can live rather than in Malaria regions~~ ~~The idea of Eugenics and Euthenics has been from time immemorial. Great philosopher Plato suggested that the best of both the sexes ought to be brought together as often as possible.~~



• Means of Eugenics

(1) Assortative mating : (Selective mating)

- Tallness is preferred to shortness
- White complexion is preferred to dark one

(2) Whole Animal Cloning : Means multiplication without formation of gamete (reproduce asexually). It can be done through somatic cell nuclear transfer.

(3) Gene Therapy : Missing gene is produced or defective gene is silenced. It can cure hereditary diseases but may lead to reduction in genetic diversity.

(4) Recombinant DNA technology : It means combining DNA from two different sources for various purposes. Thus Eugenics appears to be beneficial however it is full of negative consequences. Therefore the knowledge of genetics shall be used to keep in mind the short term & long term consequences.

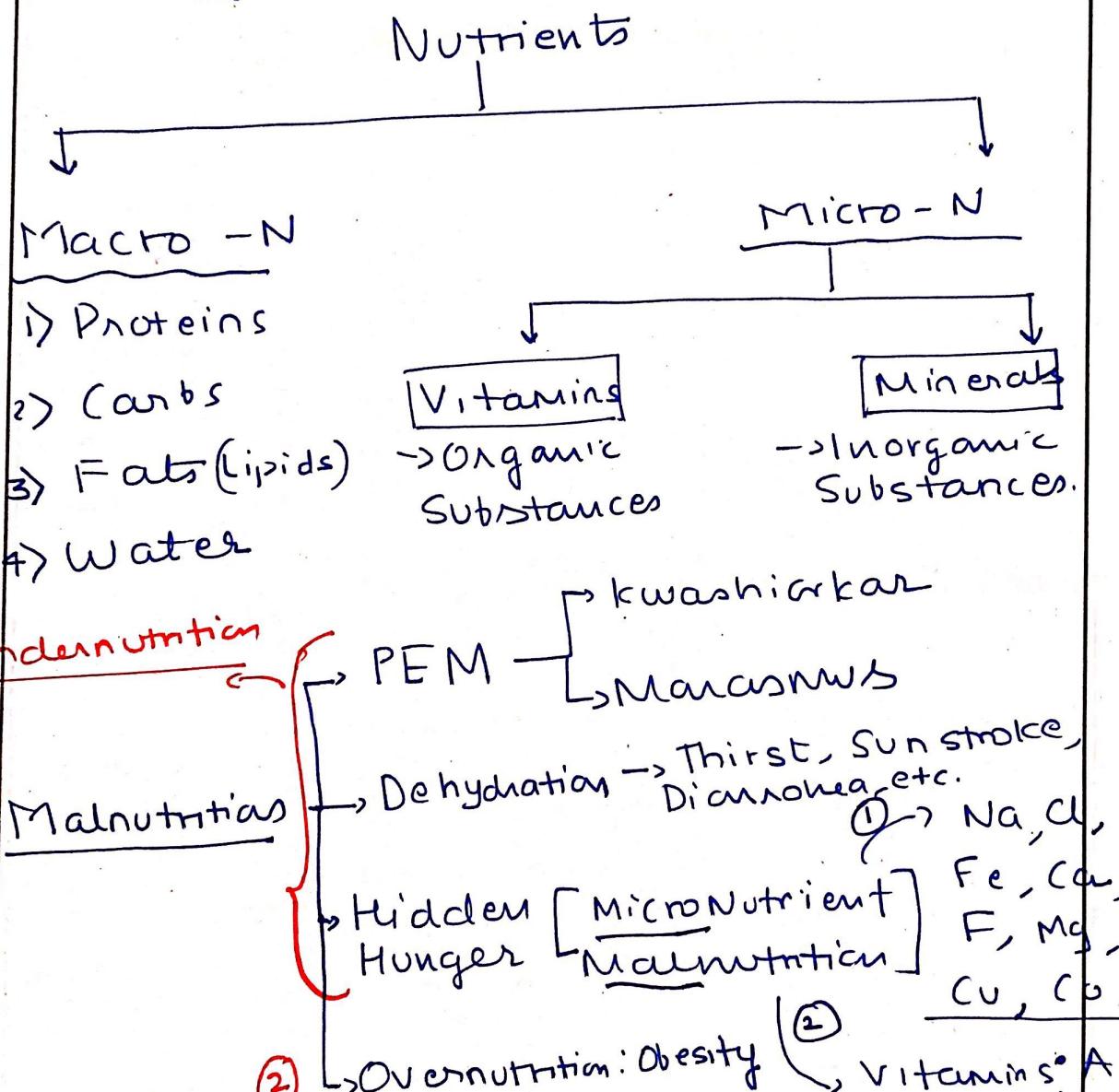
Charles "Heredity in rel" Devlopment to Eugenics, 1911 → Mendelian Int of Eugenics ⇒ Racism, Publicised to common person 250

Euphenics

Study of delaying phenotypic expression of Lethal or sub-lethal genes by personalised or medical care. It cannot prevent a genetic disease itself, but can stop effects of genetic diseases so that people can live as if they don't have it.

< Nutritional Anthropology >

Malnutrition: When a person's diet doesn't provide right balance of nutrients for optimal health.



Case Study: POSHAN Abhiyan → ✓
: BPKK → MOWCP ✓

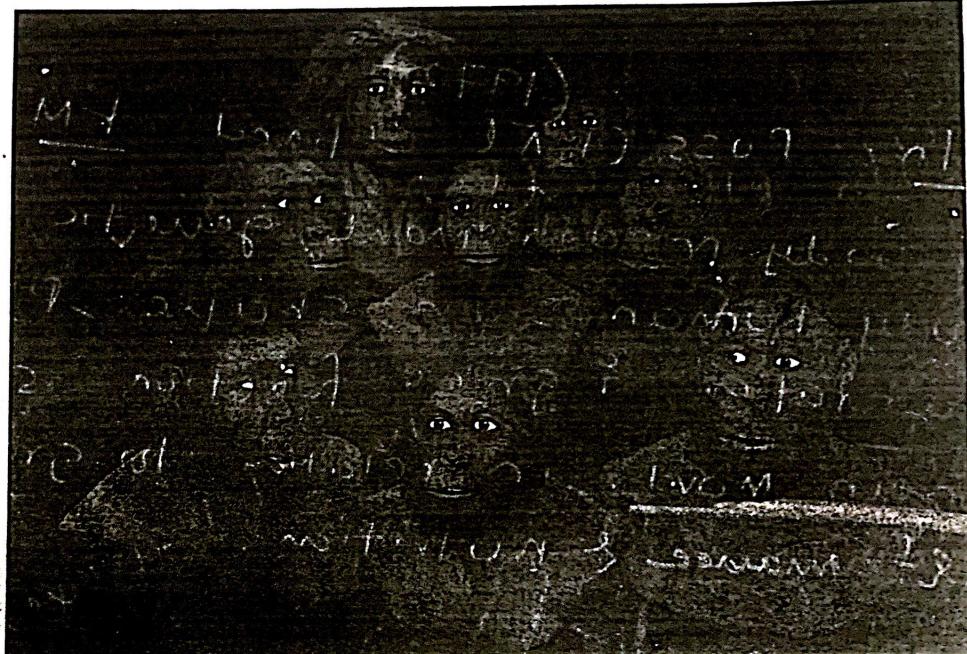
Applied Anthropology

Facial Reconstruction

Have you ever wondered how we know what early humans looked like? The answer lies in the field of forensic anthropology and more particularly in the field of facial reconstruction.

Facial reconstruction is based on knowledge of skull musculature and the thickness of soft tissue, determined over many years (the first such analysis was done in 1895) from cadavers and, more recently, magnetic resonance images of living people. From these measurements, forensic anthropologists have established a standard set of 21 to 34 locations on the skull where the average soft tissue thicknesses are known. The first step in facial reconstruction is to mark these locations on a cast of the skull to be reconstructed, using pegs that are the same length as the thickness of muscle and soft tissue at that location. Clay is then used to cover the skull cast to the depth of these pegs (the musculature of the face is first modeled in more sophisticated reconstructions; then clay is used to represent the soft tissues, up to the depth of the pegs).

The size and shape of the nose are reconstructed based on the size and shape of the nasal opening. The size and shape of lips and ears are more difficult to determine, and the skull itself can tell the forensic anthropologist almost nothing about hair or eye color, whether the person had facial hair, or how the person's hair was cut. Those aspects of facial reconstruction require some artistic intuition, and it is helpful



Reconstructions of ancient hominins.

to know something about the person, such as sex, age, and ethnicity.

But what about ancient humans? The standard measurements used to reconstruct faces from modern human skulls cannot be assumed to work for ancient skulls. For those, the forensic anthropologists have to go back to the basis of facial reconstruction—muscle and soft tissue. When reconstructing the faces of ancient humans, forensic anthropologists begin with a careful reconstruction of skull musculature, often aided by the comparative anatomy of modern great apes. Once the muscles are in place, glands, fatty

tissue, and skin are added, and the face begins to take shape.

Though based on study of the likely muscular anatomy in fossils and the comparative anatomy of modern humans and great apes, it is important to realize that the reconstruction of ancient faces is in part an artistic exercise. This is why reconstructions vary in the ways they depict ancient humans. We need to keep in mind when we look at reconstructions that they are educated, perhaps biased, guesses, and not necessarily true depictions of ancient people.

Sources: Prag and Neave 1997; Moser 1998; DeGreef and Willems 2005.

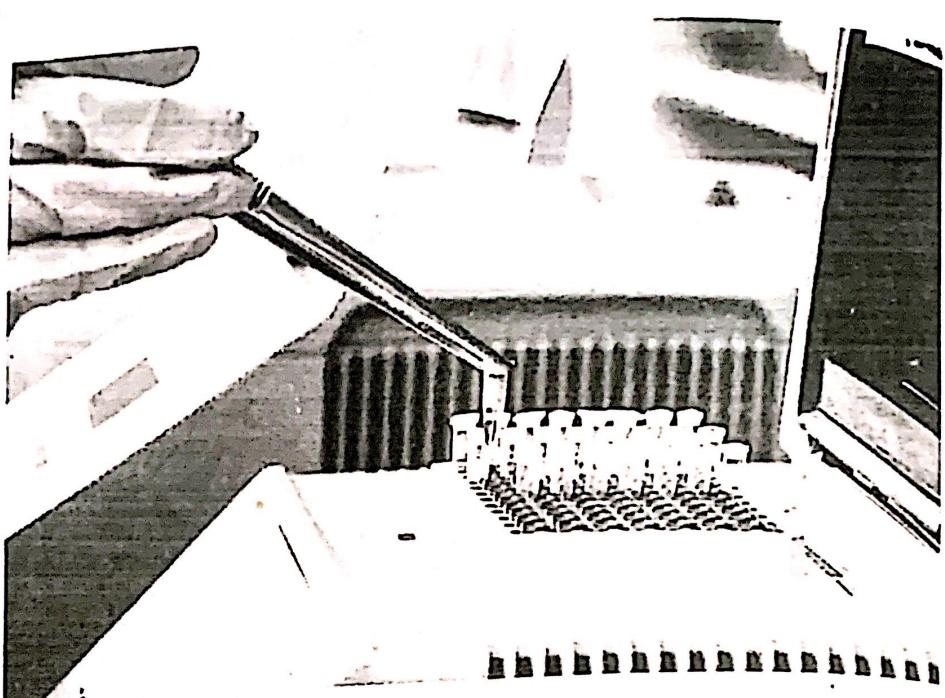
Molecular Anthropology

Physical anthropologists and archaeologists are increasingly relying on genetic data to help them understand the relationships between modern humans and other species, to explore the ancestry of modern human populations, and to examine human variation. This study of modern and ancient DNA to explore the human variation and the human past is typically referred to as molecular anthropology, and many see it as the most exciting area of current research in anthropology. But how does molecular anthropology work?

Genetic mutations are the focus of molecular anthropology. As DNA replicates during meiosis, the process that creates sperm and egg cells, there are frequently errors, or mutations. Since these mutations occur in the process of creating sperm and eggs, they can be passed on to descendants. A single mutation, particularly one that confers an adaptive advantage to carriers, can be transferred through many generations and provide a way to identify related populations and trace their common ancestry back through time.

Two basic types of mutations are commonly studied by molecular anthropologists. One is called a single nucleotide polymorphism or SNP. These occur when a single base in a string of DNA changes. The other is called a short tandem repeat or STR. For reasons that are not fully understood, multiple copies of short segments of DNA are sometimes created, and STRs refer to these repeated segments.

Until recently, molecular anthropologists typically restricted their work to either mitochondrial DNA or the Y chromosome. There are two reasons



Researcher preparing DNA samples for PCR.

for this. First, there is no mixing of DNA from an individual's mother and father, as mitochondrial DNA is inherited directly from one's mother and the Y chromosome directly from a man's father. Second, both sets of DNA are relatively small and thus can be more easily searched for SNPs and STRs. Recent developments in computing and statistical analysis now allow molecular anthropologists to work with cellular DNA as well.

Three technical advances have led to the recent burgeoning of molecular anthropology. The first was the development in the late 1980s of the polymerase chain reaction or PCR, a process that uses a chemical chain reaction to make thousands of copies of a given specimen of DNA—copies required to provide enough DNA to analyze for SNPs and STRs. The second was the development since the 1990s

of various "high throughput" methods of DNA sequencing that allow for rapid "reading" of large DNA samples. Finally, because DNA breaks apart into shorter and shorter strands very quickly after death, it was almost impossible to piece these strands back together until very recently. In the past decade molecular anthropologists have developed several very successful ways to do so.

All the discussions of genetic relationships between populations, the movement of ancient populations, the genetic differences between humans and other species, the genetic fallacy of race, genes that cause or prevent illness, and the like that you may read in this and other books are based on the fascinating work of molecular anthropologists.

Sources: Harris 2008; Jobling, Hurles, and Tyler-Smith 2004; Stone and Lurquin 2007.