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प्रश्न संख्या
(Question No.)

Small → Mainline
Capital → Triradius
Number → Regions

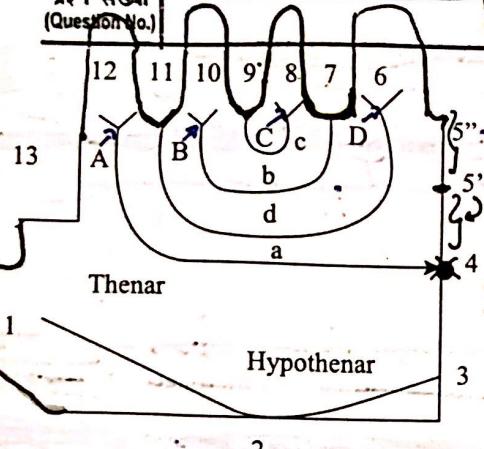


Fig. 2 : Palm Dermatoglyphics

→ One triradius on each finger
A, B, C, D.

→ Palm is divided into 13 regions.

→ Ridges starting from mainline are called A, b, c, d.

(a) Arches

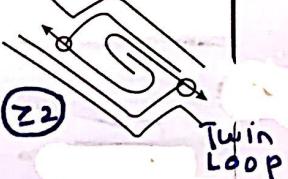
(b) Loop

(c) Whorl



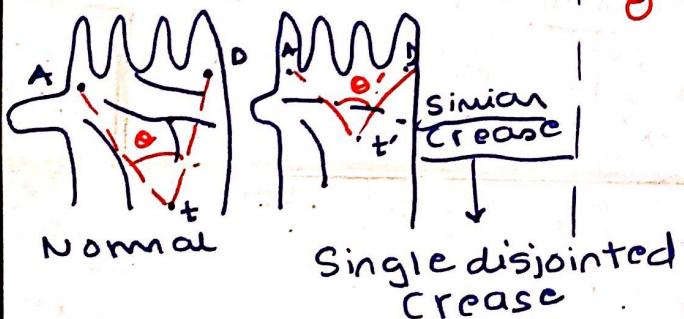
Finger Dermatoglyphics
(Finger Ball Patterns)

(d) Composite



But UNESCO said variations of the dermatoglyphics within popn of race are much more than between races.
Thus pure-races don't exist.
↳ Even Multivariate Analysis fails.

→ Case study of Down syndrome:



$0' > \theta$ by $\sim 30'$.

Why such differences?

Adaptation to env

- Differences between alleles may be quantitative & not qualitative.
- Popn living in diff geo conditions can have same allele frequencies. But it doesn't mean that they are same races.

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Balibar & Wallerstein wrote a book called "Race, Nation & Class: Ambiguous Identities" (1989) wherein they said Race:

- ①繁殖地：cheap labor, etc. (Some Marxist approach found)
- ②Promotes Nationalism
- ③They are like 'folk Taxonomies'. In simple society it is binary — 'us vs them'.

Racial Constructivism: Race is due to

④ social interactions & not rooted in biology.

They say we need race for our affirmative policies to work.

But 'Sally Haslanger' was following 'Eliminativist constructivist' but said we should not preserve the institution of Race. But she does agree that race is a social construct.

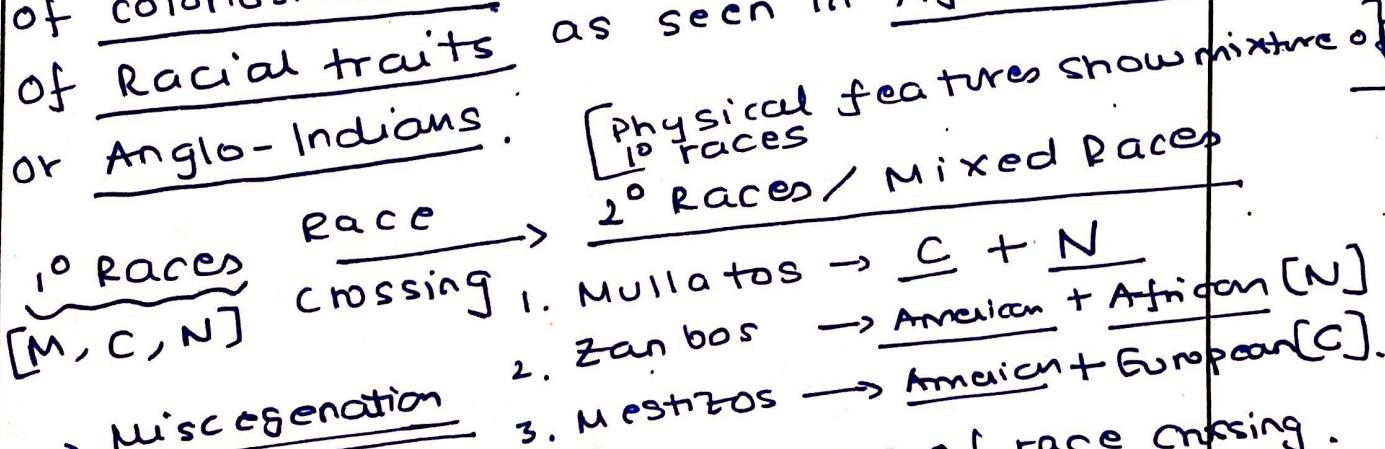
Gunnar Myrdal in American Dilemma (1944),

told about theory of cumulative causation which leads to a self-fulfilled prediction about Negroes in USA.

Race Crossing

Refers to interbreeding between different human races to produce new offsprings.

Diff races had sep. geographically & acquired race-specific characters. But man is a social animal he didn't remain isolated like this. Initially as the popn(↑) he migrated in search of new foods. He came into contact with other populations & interbreeding took place. This process was greatly accelerated especially in 15th century due to start of colonisation. This led to admixing of Racial traits as seen in Afr- Americans or Anglo- Indians.



→ Draw simple flowchart on causes of race crossing.

Today there is no group that is racially pure w/o interbreeding.

Ex: Jewish Race → Spain: Dolicocephalic.
also heterogeneous. → Russia: Brachycephalic.

→ Colonial powers: Boas, Huxley & Haddon → Harmless were against it: Dobzhansky → Not harmful sometimes favourable

→ UNESCO Statement (1951): No pure races; No harmful effects.

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Relevance

- Promotes \odot^{al} exchange
- formation of new races with new traits.
- Proves that Racism is myth & Unscientific.
- Evolutionary significance found.

In India; Race crossing has been occurring since start of inhabitation of the sub-continent. This has made India a 'meeting pot of races'. [DN Majumdar]

Q. Do pure races exist?

- 1st Introduction — History + UNESCO
- Definition of Race → Genetic, Morphological, Phenotypic
- Criteria → Genetic, Morpho
- Conditions for racial classification (Ryob) ← follows principle of Tolkaar Distinct
 - Stable
 - Early
- Morpho out
- Genetic fit → ABO etc.
- Conclusion → Human Genome project 1st report 2001, Feb 11 → 99.99% same
 - less inherent and not longer used, instead MP or some other prof is used

9.6Genetic Markers

DNA Sequences whose order & location on chromosomes; is known. [As per Crawford (1973):

- ① They are genetic entities segregating independently.
- ② Used to classify populations by their presence, absence or diff in f among pop's.

Types of Genetic Markers

- Blood Groups
- Haemoglobin variants
- Serum Proteins
- Enzymes
- GM ; HLA.

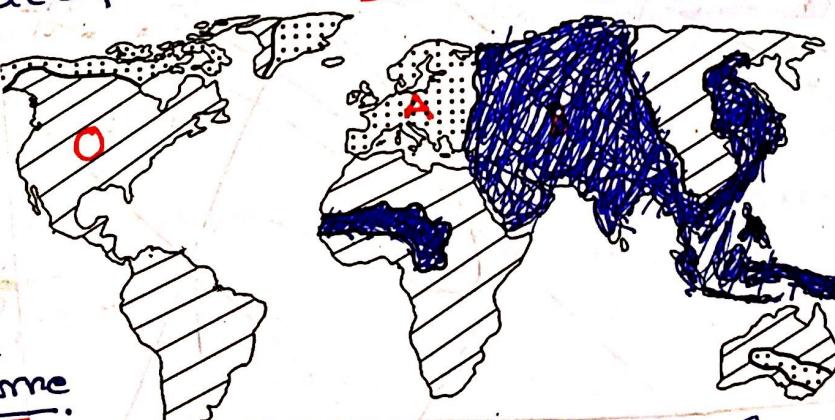
Why Blood groups? → Least affected by age, sex, env. as Genetic Markers → Have high & variable frequencies in diff popns.

Thus highly reliable markers.

① ABO System: 1901 by Landsteiner.
Inheritance deciphered in 1924 by Bernstein.

McArthur & Penrose did extensive studies (1951)

Single gene on 9th chromosome.



formed in
8th month
of the
pregnancy.

Allele frequencies: $O \rightarrow 0.62$; $A \rightarrow 0.21$; $B \rightarrow 0.17$; Phenotype: $O \rightarrow 0.39$; $A \rightarrow 0.31$; $B \rightarrow 0.23$; $AB \rightarrow 0.07$

useful for paternity testing & genetic lineage

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Latest studies have shed further light:

→ O: { > 80% in most of new world especially South America. Ex: Eskimo }

{ Pockets in Europeans: Scandinavians etc.
(western) Basques }
Duodenal cancer risk (\uparrow)

Generally provides immunity to diseases

→ B: { To some extent opposite of O.
location Not in New world or Australia }
→ Provides reduced disease risk in many cases.

{ 40% of Africa }
{ 40% of Asia }

→ A: { High in Europe
location Moderate in N.A but not in C/S America (n 25%)
Also in Australia }
Diabetes, Pancreatic & ovarian cancer risk (\uparrow).
Stomach cancer

Seymour & Smith

→ A-B: Popⁿ with high bacterial load, recent ethnic groups
→ O: Popⁿ with high virus load, old ethnic groups

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→ Different frequencies in different popn's.
 → Mother - foetus incompatibility & Child-Disease Association.
 → ~13 mya; even present in Apes.
 Does NS operate? That is why don't ignore the ever angle.
Swallow
Wrist
had studied
extensively.
on ABO?

QUESTION NO.	Evo /	In this part
♀	Is NS acting on humans?	<ul style="list-style-type: none"> ① Site Frequency Spectrum Method ② Allele Frequency Distribution in diff env conditions ③ Linkage - Disequilibrium Method <p>Being in <u>Hardy-Weinberg Law</u>.</p>

Genetic Markers

- Trace Genealogy
- Genetic Disorders Inheritance
- Gene Mapping

vary on parameters such as Age, sex & popn.

Physiology: Scientific study of functions & mechanisms of living organisms. It is thus the science of life and an integral part of biology.

→ 1st Genetic Survey of ABO blood groups done by Morand in 1930.

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Saline : Dextrose Saline;

$$\begin{array}{l}
 \text{1L} \\
 \text{Distilled water} \rightarrow \frac{\text{5g of Glucose added}}{\text{for energy}} \rightarrow \frac{0.9g \text{ of NaCl}}{\text{for PH}} \rightarrow \checkmark \\
 \text{PH = 7.3/7.4} \\
 \text{of blood}
 \end{array}$$

Serum : Non-living part of blood ; } non-living part

⇒ Plasma - Coagulating Part
thrombin & Fibrinogen [blood clotting factor]
Converts dissolved fibrinogen into long strands of fibrin that radiate from clumped platelets & form a net.

Actually

Bombay Blood Group

- 1952 by YM Bhende.
 - 350 in India; and around same in the rest of the world.
 - $\frac{1}{10,000}$ in India; $\frac{1}{50K} \Rightarrow$ in world level.

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Rh - System

By Karl Landsteiner & A.S. Weiner in 1940.

When Rhesus Monkey cells \rightarrow Put into 6st - Antisera
(Macaca Mulatta) Rabbit

In 1947, Fischer said
there are variations in the

R/Y it self \Rightarrow Decided by 3 pairs of alleles at 3 closeby locus on Chromosome 1.
If any concerned about Cc/Dd/e e R/Y

Agglutinated
only some Human cells

RH(+) (DD/Dd) RH(-) (dd)

Fischer Weiner 8 haplotypes found

CDE | R2 \rightarrow Rare; few Australian Tribes

CDe | R1 \rightarrow Mediterranean; but rare in Mergoloid

CdE | Y \rightarrow 10% of Africans

Cdc | Y'

CDE | R2 \rightarrow American Indian

CDe | Ro \rightarrow 70% of Africans;

CdE | Y'' \rightarrow Rare; Ex: Ainu of N. Japan

Cde | Y $\left\{ \begin{array}{l} \text{It has been found to be} \\ \text{low in India \& Far east} \end{array} \right.$

Z
1
Y
2
0
"

\rightarrow Cw found in Lapps, Fins & Latvians. $P = 0.75$
 $r = 0.25$

\Rightarrow More variation than ABO.

RR	rr	Y'
0.56	0.37	0.07

Haplotype, Group of Alleles inherited together from single parent because of [has 3-4 meanings] genetic linkage.

Linked with Glycogen storage disease & blood transfusions.

Paternity Disputes

- Relate with Mendelism; Study phenotype & find whether it is possible with combination of parents.
- ABO;
- [Rh, Kell, P, Kidd], Red cell & Serum Proteins.
- Dermatoglyphics: Finger ridge count & palmar ridge count
- DNA fingerprinting: Gel electrophoresis

MNS Blood Group:

Landsteiner & Levine in 1927: M & N : they have no natural antibodies. So no effect on blood transfusion.

Sanders & Race in 1947: S;

M: (1) from Aus → Europe → America } used to classify into races.
(20%) (50%) (90%)
Ex: American Indian

S: Highest in India & Middle East: ~40%.

Decreases as we move away.

Lowest in East Asia [5-20%], Eu: 30-35%.

N: Australia [No MS/1]; Sort of reverse of M.
Pacific Region.

④ U-; In Africa

M & N are both dominant; they occur at same locus on ^{co-} 4th chromosome.

S/s are at another locus on 4th chromosome.

Genotypes	Phenotype
M S M S M s	M S Ms
N S N S N s	N S Ns
M S I M S M s	M N S M N S

Duffy (Fy^a, Fy^b, Fy)

Most Australians and Polynesians and 90% of Asian populations. Duffy positive (Fy^a) 90% in India, 85% to 90% in American Indians, 65% in England and America, 27% in American blacks. Fy^a very low in Africa, but Fy gene is very common to about 80%.

Diego (Di^a, Di^b)

Diego-positive (Di^a) limited to American Indians, 2%, to 20%, and Asians. Diego-positive is absent in Europe and Africa, and much of the Pacific and among Eskimos.

Kidd (Jk^a, Jk^b)

Jk^a, Kidd-positive, is most common in West Africa and among American blacks, 90%. Also found in American Indians, 70% to 90%, Europeans, about 70%, and is least common among Chinese, 50% to 55%.

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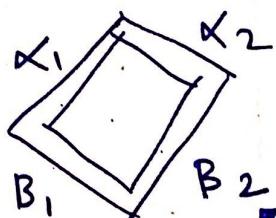
Most don't satisfy
I.V. for D.P.

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Haemoglobin : >130 variants known now.
→ Protein Molecule

Chains of Protein : α ; β ; γ ; δ .
(141) (146) [10Δ in
 β chain]

Structure : Generally protein chains are found with each having a heme group (Fe) \Rightarrow 1 O₂/Pr chain.



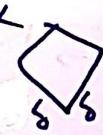
Each RBC has around 150M Hb on it.

Types : HbA : Normal; & rest all are called Abnormal.

1. HbA : (~95%)

α α found in most people.

2. HbA₂ : (2-3%)



Even India | Total

3.

HbF

: By age $\frac{1}{2}$; all gone

(1-2%)



1st abnormal to be discovered (1910)

HbS : Due to SNP in β -chain resistance, (5-30%) → rare in New world.

4.

HbEm

: Embryonic; 3rd month all over.

5.

HbC

: Limited area of North Bengal, Upper Volta, West Africa due to anomaly in β chain - (10-15%)

6.

HbE

: SE Asia;

→ correlated to spread of Aghri.

→ ALSO HbA/HbE : Malaria Resistance
HbE/HbE : Reduced fertility.

7.

→ Not in Bengal or Australia.

Rare

8. { Hb-D :

NW India

Hb-K :

West & North Africa

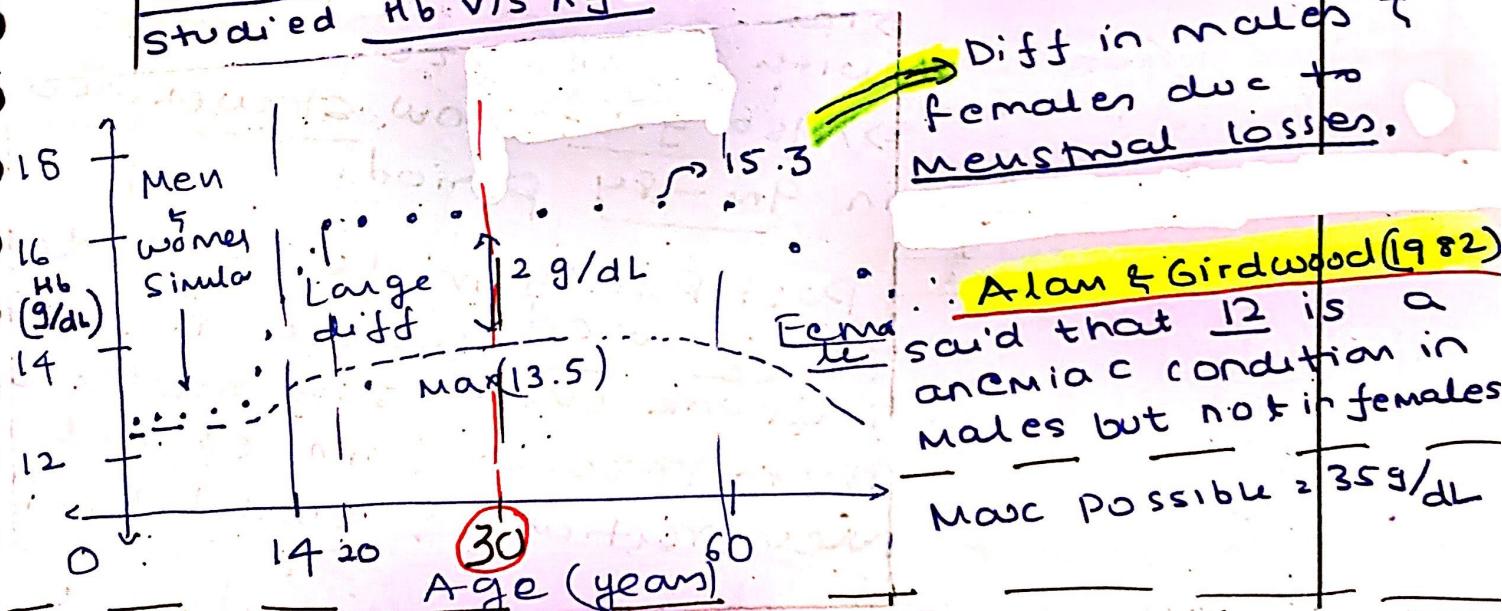
9. { Hb-O :

Celebes Island, Indonesia

Characteristics

- Most groups found to gradually (↑) till age 30.
Also in Americans; constant value kept & falls after age 60.
- All societies have noticed (↑) in Hb since primitive times. Hb \propto Activity Level.
 $Hb \propto 1/\text{menstrual loss}$
- Heavy variation due to Nutrition which depends on ©.
- Chiotectomy & Circumcision also responsible for anemia of infants & women.

Case Study: Owners & Pearson Et Al (1977)
studied Hb vs Age in Quebec, Canada.



Case Study: Venna (1977) studied Andamanese & found both males & females anaemic.

Again Chattopadhyay (1992) found 50% female, st. chd & 62% chd anaemic.

If Q:

Haemoglobinopathies

→ case studies

→ variants

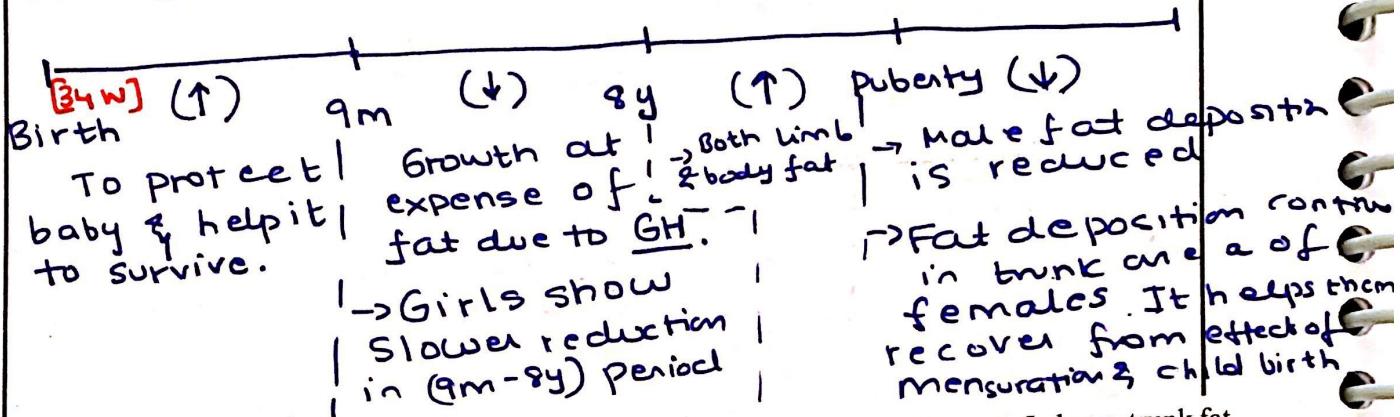
→ Thalassemia

→ Sickle cell

→ Anemia

Sex variations
with ageBody Fat

Especially the subcutaneous fat varies over the body a lot. Fat % around bones & muscles (\downarrow) with (\uparrow) in body size.



At adolescence, limb fat in boys decreases and is not gained back until the age of about 20 years. In boys, trunk fat, if decreases, does so at small levels. There is only a temporary halt to the gradual increase. In girls, slight halting of the increase in limb fat is seen, but there is no loss as such. The trunk fat shows a steady rise until the age of discretion (18 years) is reached.

Genetical and Environmental Variations

Study on Bushman and Hottentots found a significant amount of fat in their thighs and buttocks. In many other ethnic groups living in similar environments, such fat deposits are not found. This shows that genetics not only determines number of fat cells but also its distribution over the body.

Environment also plays a vital role. The nutrition level and level of activity directly influence fat level. Food supplies and climatic variations are also determinants. For instance, in regions of extreme environmental fluctuations (e.g. deserts of Rajasthan), populations are blessed with plenty of adipose tissue for fat deposition to be used in periods of scarcity.

Overall indication that Main factor is genetics followed by the env.

- # and distribution of fat cells decided by Genetics but filling of those cells decided by env & nutritional factors.
- Ex: Gangetic Plain → No need to store fat → less filling of fat cells.
- RJ Desert → Extreme (heat) → More need to fill cells & store fat.
- women has more accumulation of fat, especially thighs, upper arms & buttocks.
- Men → Abdomen

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Gm Groups [10M]; much lesser usually

Gm Factor is a serologically detectable variation of certain antibody proteins [immunoglobulins] of the serum.

Gm Specificities [n20] are due to variation in H-chain (heavy) of IgG only.

4 subclasses
of IgG
Heavy chains

- gG₁ : Many ; [1, 2, 3, 17]
- gG₂ : 2 Gm specificities.
- gG₃ : Many ; [5, 13-14, 21]
- gG₄ → NO associated Gm specificity.

Gm(I) Inheritance : Gm(I)⁺ & Gm(I)⁻ are codominant.

But if we test for several diff factors we find some are transmitted together as groups 'n' to an factor.

Europe : Gm(1, 17, 21) } common & inherited
 Gm(1, 2, 17, 21) } as units.

 ↓ Gm(3, 5, 13, 14) Rare elsewhere apart from places where recent European admixture happened (Caucasoid)

Africa : Bushman : Deviant pattern from Rest of Africa

Gm(1, 5, 17) nowhere else in Africa
 Gm(1, 13, 17) ↓ similar to Eastern Asiatic people.

Gm(1, 13) used to chart Bushman-Hottentot Admixture among the South African Bantu.

↑ haplotypes contain high 'V' in African Negroes of p160's largely derived from them

Asia: Gm(1-5) found in many parts of Asia & even the world.

Studies indicate gene flow across the Torres Strait to Australia.

→ Ainu of Hokkaido, Japan → (2, 17, 21) unique; 30% Japanese admixture.
In Manus valley [PNG], Gm correlated with linguistic division between Melanesian & Non-Austronesian speaking tribes & this supports the view that former came from SE Asia.

Australia:

certain G's of N. Queensland have (1-5, 13-14) which is absent in tribes of the central & western deserts.

Steinberg did extensive work. He also estimated Caucasoid & Ichoisan [Bushmen-Hottentot] admixture in Sidamo Tribes of SW Ethiopia & found 40% & 12% respectively. Even Hokkaido Study by him.

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Histocompatibility, [HL-A] System

Tissue

IMMUNITY
(Against Pathogen)

→ Innate : Non-specific
[1st line of defense] Genetic

→ Physical
Physiological
→ Cell (WBC)
→ Cytokine
[Proteins called Interferon]

→ Acquired : Pathogen specific
Memory based
Spared cell & Antibodies

Active Passive
Natural Ex: IgA
Transplacental IgG
Artificial

→ Person's own cell produced ready made antibody
the antibody.
→ Long lasting
→ Memory is present

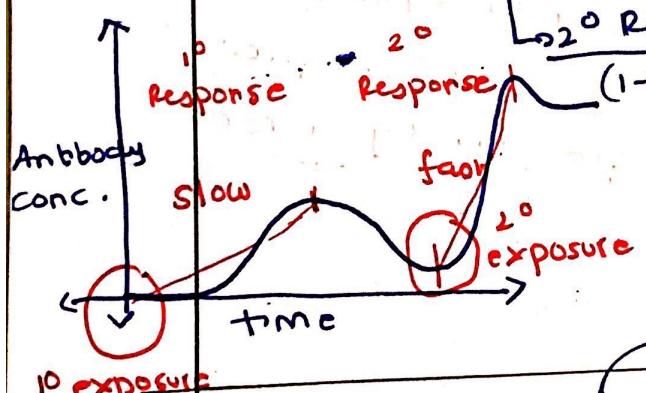
Colostrum
Short term
Injected.
No memory

Acquired immunity → Recognises ourself cell & pathogen
It can differentiate between them.

Immune Response

→ 1° Response : Initial contact
(7-10 days)
Longer time taken
Decline Rapidly
B-cells involved

→ 2° Response : Subsequent contacts
(1-2 days)
Slower response time
Last longer time
Involves Memory cells



HLA System refers to the gene complex encoding the Major Histocompatibility Complex (MHC) proteins in humans.
Tremendous role in organ transplantation.

Grafted Tissues attract an immune response.

Human Leucocyte Antigens are proteins that are detectable in most tissues but not on RBC's (WBC's)

The graft rejection is less severe if both are related. Usually ≥ 10 different types of markers are matched. [At least 6]
The differences in HL-A Antigens are

In humans, MHC is called as HL-A.
↳ So human form of MHC is HLA.

Chromosome 6.) HLA are cell surface Proteins.
Short arm [P] |
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inherited. They are determined by 2 diff loci but closely linked loci : LA & 4.

> 14 LA Locus Antigens} are known in
17 4 Locus Antigens Europeans

Thus HL-A antigens are also inherited in groups.
Similar to Rh & GM. ↓ Antigens such as
These thus form HL-A { I(LA) & 8(4) } Inherited
haplotypes in the same way we talk of GM Haplotypes, together in
The fact that these combinations have persisted suggests selective forces favour it. given popn.

Europe : Frequencies are fairly uniform. but Lapps, Sardinian & Basques show some deviations.

Australia & PNG : Considerable variation are found in the popn.

New World : 9 Antigen very common; especially Eskimos.

Asiatic : →

Fairly uniform; even more than Eu.

Africa : Fairly uniform; (Less Divergent)

1, 3, 7, 8, 12
Less common than in Europe.

Immune System uses these markers to identify which cells belong to "body" & which "don't".

Complex : Genetic Region consisting of many closely linked Loci.

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3 classes of MHC	<u>Class 1</u>	<u>Class 3</u>	<u>Class 2</u>
<ul style="list-style-type: none"> + Telomere A (Last) B C <p><u>CD 8</u> T suppressor cytotoxic-T Co-receptors → Expressed on all nucleated cells</p>	<p><u>Class 1</u></p>	<p><u>Class 3</u></p> <ul style="list-style-type: none"> Used in cell-cell signalling. → NO Antigen binding → cytolitic associated. → Poorly defined → complement proteins → Not expressed on the cell surface. 	<p><u>Class 2</u></p> <p>DP → centromere</p> <p>DR → Most imp</p> <p>DQ → 2, 3</p> <p>DR → 3, 4</p> <p><u>CD 4</u> (Co-receptors T-Helping cells) → Expressed on the Antigen presenting Cells.</p>

Some Autoimmune disorders are linked to

Specific HLA Alleles : Ex : Rheumatoid Arthritis → HLA-DR4

Multiple Sclerosis → HLA-DR2

Psoniasis → HLA-C

Ex : MHC in mice called → H2 ; Chromosome H. Complex

→ The antigens which are peptides are also recognised by the T-cells.

9.7

Ecological Anthropology : Graphs > Points

Ecology is study of interaction of living beings & env. It was coined by Ernst Haeckel in 1866. EA is a subfield of AP that studies interaction of biotic & abiotic components of env with humans. Thus every human responds to their env & tries to "adjust" with it. EA focusses on these mechanisms of human adjustability \Rightarrow "Capacity of humans to change themselves to fit their env."

(human ecology) \rightarrow our focus of \rightarrow study impact of env or man.

BiologicalAdaptation
(Permanent)Acclimatization
(Temporary)

This adjustment takes more time than ©al adjustment.

PT Baker is the father of Biological Ecology; he laid foundation in the

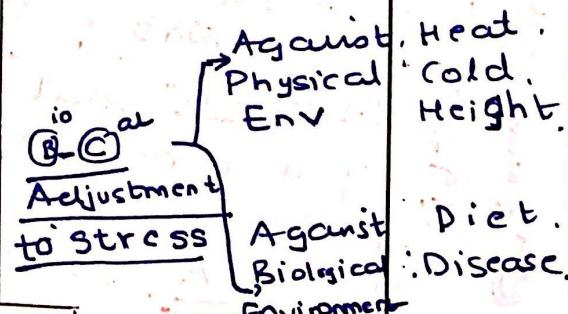
"Marin Anders (1976) Project". Thereafter he took up the "IBP Project" (1964-74). He spoke about species wide acc^{to} popⁿ specific gene adaptations, etc.

Sometimes difficult to classify an adjustment as Adap/Acc. Ex: Melanine.

Cultural Adjustments

Term coined by A.O. Howley in 1930 but was popularised by Julian Steward in "Theory of ©A (1955)".

He thus founded the concept of "©al Ecology".



E.A integrates both responses to study Human Adjustability 170

History of Ecology:

① Social Ecology; 1930; AO Howley. By studying animal behaviour we know about human behavior. Not true as Man is a Cal being.

↓ Led to Cultural Ecology.
It was a env "possibilism" by Julian Steward. Contrary to Env Determinism of Herskovitz.

② Ecology / Baker coined it
③ Human Adaptability: Biological Ecology; in contrast to Socio-Cultural Ecology. However scope of study of H.A. has expanded through study of CC by GW & COVID-19 that led to the lockdown in almost whole of the world bringing significant changes human genetics & also human behaviour.

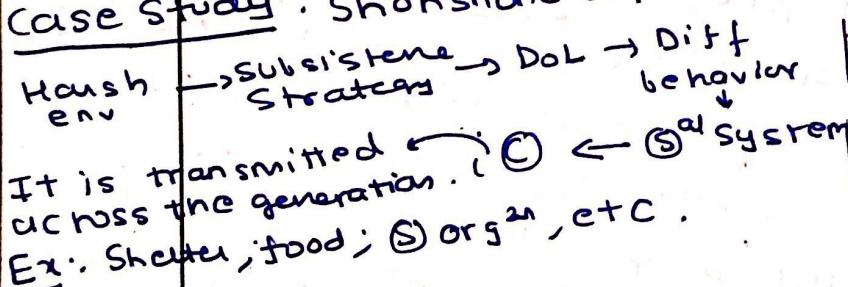
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Methods (Scholars' Views)

① Salzman & Atwood: "EA(1996); deals with complex relationships between humans & their environment or between nature & culture, over time & space. It investigates ways in which pop" shapes it env & may be shaped by its and the subsequent manners in which these relations form the populations S, E & P life.

③ Julian Steward: cultural ecology; he spoke of Man-Habitat Interaction. He said that ' $\odot^{\text{al }} \Delta$ ' occurred as a response to 'env Δ ' by adaptation. For him \odot was unit of analysis. Thus 1st $\odot^{\text{al }}$ must be examined: Tech & Env;

Case Study: Shoshone Expedition



EA rose as a response to Cultural Ecology in 1960's. It said humans as an Ecological Popn 'should be the unit of analysis. Culture should be means by which popn alters & adjusts to env.'

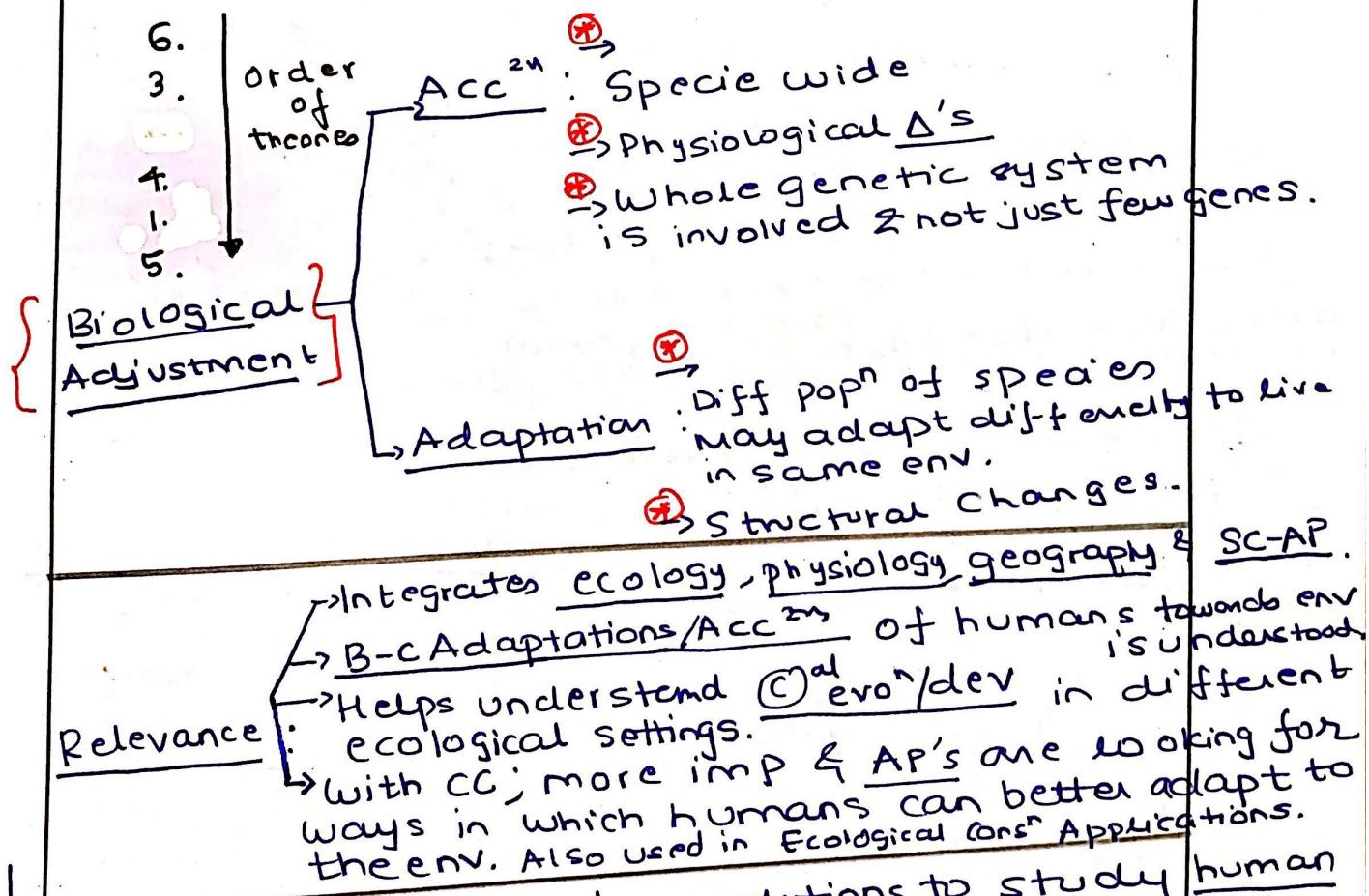
④ Roy A. Rappaport & Andrew P. Vayda (1968): Dev an "Ecosystem Approach" that treated human popn's as one of a number of interacting species and physical components and transformed 'CE' into 'EA'. It was thus an holistic approach. It was adopted from General Systems Theory. Their approach was called as "New Ecology" & tied culture into the emerging science of "Systems Ecology".

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⑤ Ethnoecology: Studies how groups of people living in different places understand the ecosystem around them & how they view their relationship with surrounding env. In 1955, Harold Conklin published one of the 1st Ethnoecological studies "Harunoo Color Categoricals". He was the one who had coined the term. Indigenous knowledge is one key aspect of it.

⑥ Env Determinism: By Melville J. Herskovitz, believes that env determines pattern of human culture & the societal dev. Criticised for devaluing human agency.

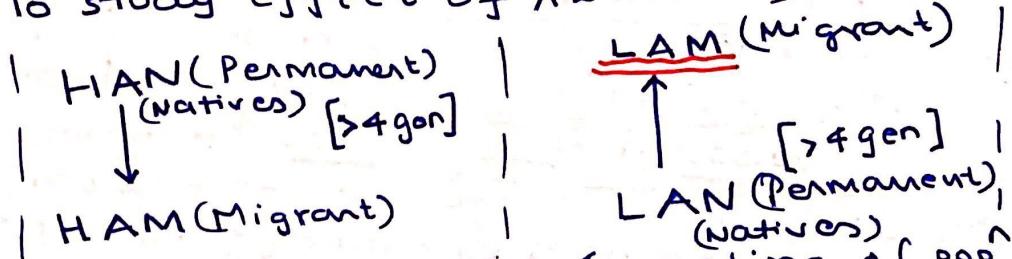


The approach & ideal conditions to study human adaptability given by Laurie & Weiner in "Biology of Human Adaptability (IBP-Pg)" (1971). They say that to study effect of env stresses on humans the heredity has to be kept constant. Thus genetically homogenous popn's are studied. But since ideal conditions are

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rarely found; cautiousness must bear in mind before making generalisations.

Ex: To study effect of Altitude;



Comparative study of these 4 sections of pop is needed. But we rarely find LAM. Therefore conclusions are only Tentative & never final.

All culture, process, objects
opart from attitude
must be same.

Man increased efficiency &
reduced wastage of energy.

WHILE majority of cultural ecological studies are concerned with pre-literate and traditional societies; the recent trend is of studying the effects of variations in environmental resources, population sizes and external intrusion of other societies on cultural evolution.

Approach

IN **EVOLUTIONARY Ecology**, an approach initiated in 1970s, it is the individual who is the unit of study and not a population. Here, the models previously validated on other animal species are applied to individual humans. Propponents of evolutionary ecology including Adam Smith believe that it can help to clarify human behaviour including (i) why people use specific behaviours for obtaining food; (ii) why they develop various mating practices; (iii) why they distribute themselves over space in different manners, and (iv) why they differ in such interrelated characteristics as population dynamics and community structure.

A NUMBER of hypotheses have been formulated by Winterhalder and other evolutionary ecologists for testing various models. However, the major emphasis has been on the behaviour related to acquisition of food.

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Cold

Anything that disturbs the homeostasis i.e. equilibrium of the body is called stress.

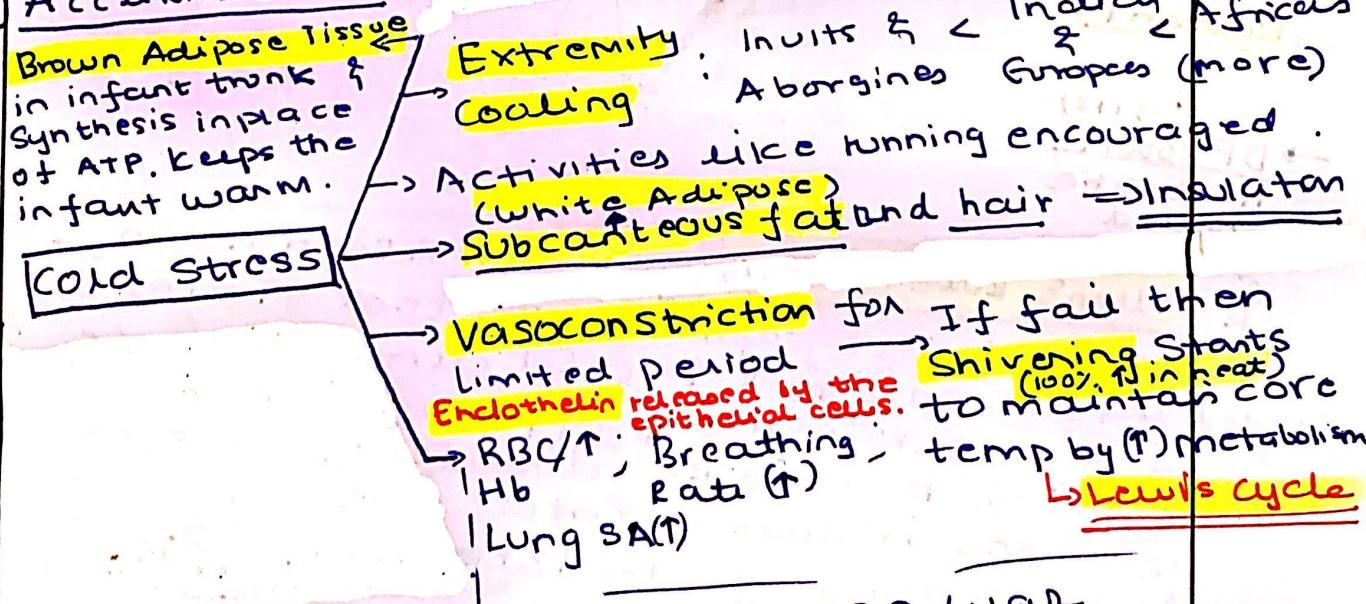
Our body uses biocultural adjustments to bring back the equilibrium.

⇒ 2 diagrams: Adjustment + Physical & Bio Env Stress

Humans due to their Savannah origin show Acc. poor tolerance to cold. Some say Eskimos have cold gene but results are tentative. The adjustments kick in when $T < 28^\circ\text{C}$. Both acc & adapt are causally imp.

1. Biological

a) Acclimatisation:



Ex: American & African soldiers during Korean War were easily frost-bitten

Case study: Cold Tolerance varies with Age; Hanna (1976)

Highland Indians, Peru ⇒ Children vulnerable as their skinfold thickness is low & neurological dev not complete.

b) Adaptations: Graphs MOST imp.

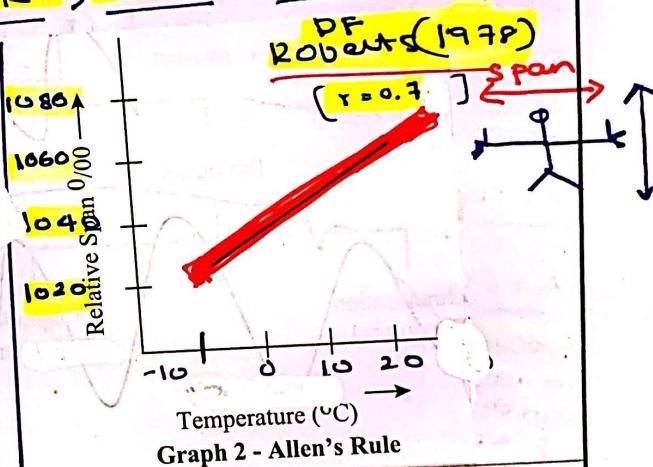
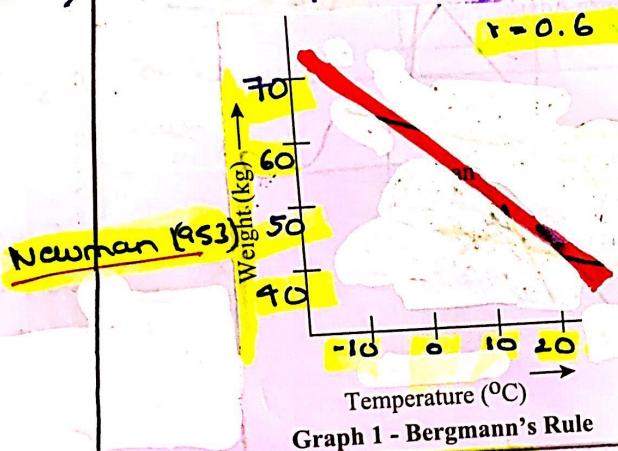
Bergmann's Rule (1847): By Carl Bergmann;

In warm blooded species; body size (T) as temp (\downarrow). As lower metabolism, hence lower heat production occurs. Ex: Polar Bear.

Case Study: Marshall T Newmann studied the tribes of N & S America (1953).

Ex: Masai of Kenya; Inuit, Mongoloid, Sami (T) of Norway & Sweden.

But exceptions are: Yuki, Andi & Eastern Eskimo.

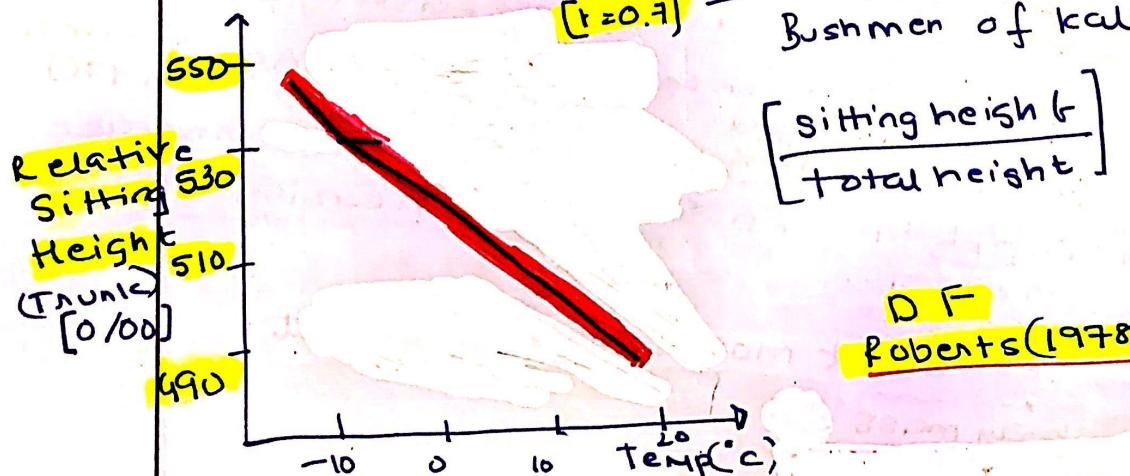


Allen's Rule (1877): By Joseph Asaph Allen; It is an ecogeographical rule that states that

blooded animals adapted to cold climates have shorter extremities & appendages than animals adapted to warmer climates. Body shape is linear in warm climates & round in cold. AS [SA/vol] dynamics dictate the heat loss.

Ex: Nilotic of Africa.

Bushmen of Kalahari.



2. Cultural Adjustments

* They have a larger role to play.

- Well insulated houses : Igloo.
 - Houses have sloping roof so that snow doesn't accumulate and heat of sunlight captured.
 - Clothing of fur & wool: keeps frostbite away.
 - fire: Bushmen of Kalahari & H. neanderthalensis.
 - Diet rich in fat; exercise; tobacco; drink & fun; warm & hot meals.
- Ex: Melanesian Tribes : Smoke to get heat & drive mosquito away \Rightarrow Respiratory issues
- Siberians sleep in boxes \Rightarrow hypoxic conditions.
- Aborigines sleep between fires \Rightarrow Burns.
- North Atlantic Fisherman \Rightarrow fast response due to experiences.
- Rubbing of hands
 - Cuddling to (\downarrow) SA.

- C.R.
- At high altitude $\rightarrow O_2$ is factor \Rightarrow hypoxia.
 - At sea-level; eating more \rightarrow more heat generation.
 - cold along with wind is more dangerous.
 - Military Training: Siachen Glacier
 - Preparing Medical Equipments
 - Useful in sport preparation.

Thus a combination of biological & cultural adjustments help humans respond to the environmental stresses.

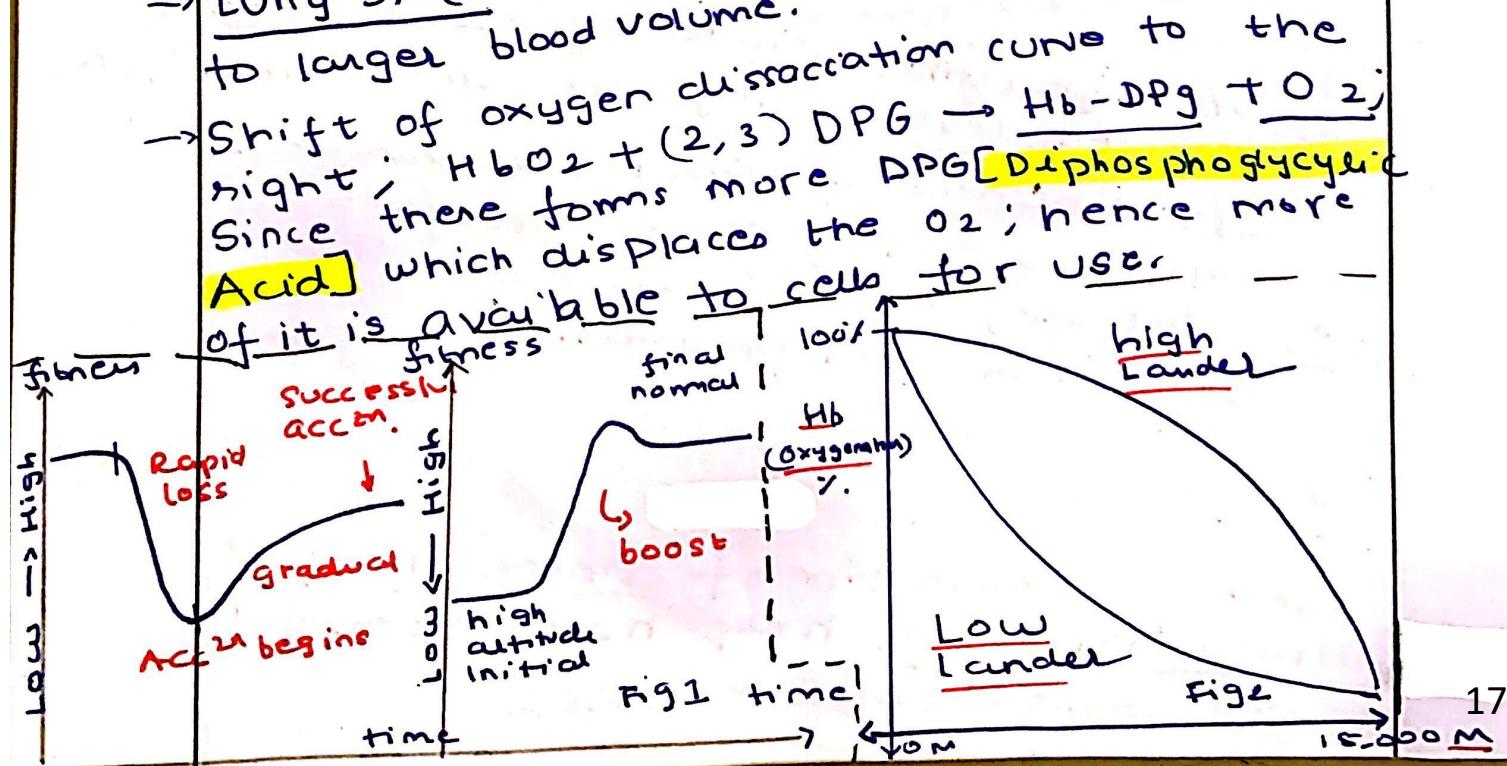
Altitude :

Generally Altitude & Cold stress occur together. When $\geq 2500\text{M}$ above sea-level, the most important stress factor is hypoxia. Oxygen is needed to produce the energy for survival. Nausea is one of the first reactions.

a) Biological Adjustments :

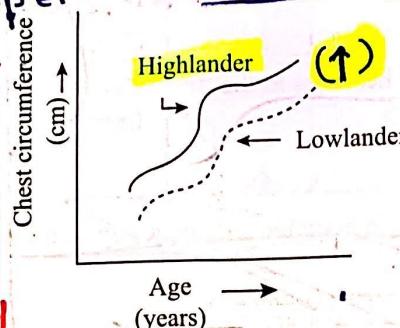
1. Acclimatisation: Hypothalamus initiates many of these processes.

- Cells (\uparrow) Mitochondria number \rightarrow more energy (f size)
- Breathing rate (\uparrow) by $\approx 70\%$; in extreme conditions upto $5\times$ possible. \rightarrow Try to consume less O_2 ; (Balke : 1969) in hypoxic conditions.
- Heart rate (\uparrow)
- Kidney secretes erythropoietin & $\text{Hb}(\uparrow)$ from $15\text{g/dL} \rightarrow 22\text{g/dL}$. Ex: Bushnik Et Al (1977) 27% (\uparrow) in White US Athletes.
- Blood Volume (\uparrow) by $20-30\%$; but this one takes 2-3 weeks.
- Lung SA (\uparrow) due to expanded capillaries due to larger blood volume.
- Shift of oxygen dissociation curve to the right; $\text{HbO}_2 + (2,3)\text{DPG} \rightarrow \text{Hb-DPG} + \text{O}_2$; Since there forms more DPG [Diphosphoglyceric Acid] which displaces the O_2 ; hence more of it is available to cells for use.

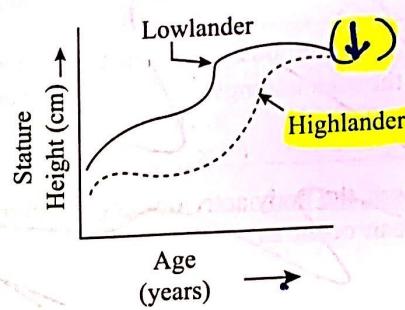


2. Adaptation

→ Longer chest size: To get high ventilation capacity to body mass. Similar does not happen in acc²ⁿ. Ex: Bodys of Ladakhis > Lowland Indians.



Graph 1 - Change in Chest Size with Altitude



Graph 2 - Change in Body Size with Altitude

→ Decrease in body size: Reduces body mass which can be better supported by lower O₂ uptake. However, Sherpa is exception [Ethiopian highlanders grow faster] (Pawson, 1974)

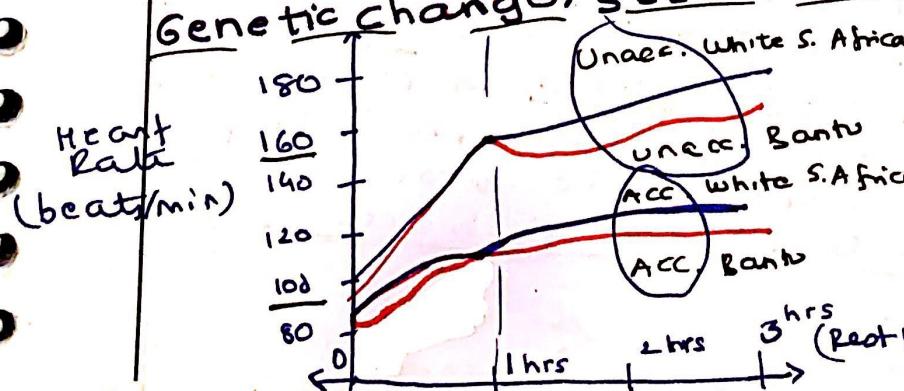
→ Size & weight of babies (↓): Nutrition also factor as less available in high altitude.

→ Heart: Right pumping side is enlarged.

→ Nose: Short & nasal passage reduced. nostrils are also directed.

→ Capacity of Hb: More in highlanders due to more Hb-F [XXYY]. Ex: HbO₂ → 40mmHg (Low tander) saturation → 100MMHg (high lander) [PO₂]

→ Unique Genetic Variation: Tibetans have unique variants of EGLN1 & EPAS1 genes which are crucial in oxygen homeostasis. Genetic changes seem to be imp.



Reasons for exceptions
not given
Conclusion: Even diff genes the acc & unacc have same response.

Even if genes same then diff betw acc & unacc.

b) Cultural Adjustments

- ④ Migration to lower altitudes during pregnancy.
Ex: Quechua Indians of Peru.
- ✳ Chew Betel Leaf \Rightarrow Hb(\uparrow)
- > Diets focussed on maximum utilization of Glucose & carb. Ex: Brazilian Highlanders chew herbal leaves for it.

Relevance: Training of sports person & army men to (\uparrow) their lung capacity & their performance.

Heat: Acc to Law of Thermodynamics....

Our body tries to maintain a temperature of around 37°C. A 4-5°C rise can even cause permanent damage. Usually heat adjustment is universal human capability.

① Biological Response:**a) Acclimatisation:**

- Hypothalamus receives cold & hot stimuli from all organs. It can induce sweating in hot areas & thermogenesis in cold areas. This is usually done for diuretic & emp changes. Minor changes are brought about by altering conductance of body to the radiation.

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- Nitric Oxide [NO] released by endothelial cells. This reaches the muscles & causes relaxation causing vasodilation [radiation of heat] [heart rate (↑)]
- Sweating: $\frac{47}{hr} \rightarrow \frac{2L}{hr} \rightarrow \frac{8L}{day}$ } young male in desert. when coming from outside area.
Thus electrolytic imbalance averted.
- Heat tolerance also depends on age. In infants sweat glands are not active till after 1 year. Humidity makes it worse

- $\frac{SA}{BM/V} = 0.3$ [0.6 in children hence high CMR] Need less size or else Little (1973) in deserts, too much sweat gen' occurs.
- Less hair, lower rectal temp & less pee/salt secretions
- Trunk is short

In low pressure areas: hot dry winds soft here 'smaller SA' preferred. Therefore here Trunk longer than extremities.

- b) Adaptations: Same as cold stress.

(American soldiers)
WW2 study showed fatter killed.

Sweat glands are

activated during childhood; thus if a child faced acute heat stress than more of his sweat glands get activated that results in better heat tolerance for him throughout his life.

hypothalamus activates them → so if "sweat glands not activated (1 yr)" they won't be.

2. Cultural Adjustments

- They dominate here too.
- More water in diet; Green leafy vegetables.
 - Nomadic Lifestyle (\downarrow) sick of drought.
 - Oasis Residence; less work during day.
 - Loose & Light clothing: Chaamba Arabs of Sahara wear special clothing that blocks heat gain from env; color of clothes.
 - Houses are made of high heat reflective materials & insulation beneath surface too.
Ex: Pueblo Indians houses.
 - AC & coolers.



Note: Dog sweat glands are Apoacine which also secretes proteins & fats.
we have acrine in man: electrolytes + water,
 \hookrightarrow less energy loss.



Env Stressors affecting human body [20M]

- H, C, A, Nutritional, Chronic Disease, etc.

Nutritional Stress

Teeth & Jaws reflect to great extent the diet of humans. Gradual reduction was observed due to mastery of cooking & use of tools. We now believe that humans were primarily herbivores who occasionally ate meat. Our intestinal tract is not particularly adapted for eating meat. Other studies show that hunting is not generally energetically favourable as the only source of nutrition.

Humans are generally very adept at adapting to Nutritional Stress \Rightarrow Cultural Adaptation

Basal Metabolism Rate

[rest energy req for the internal organs]

$36 \text{ kcal/hr} \Rightarrow \text{Child}$

$72 \text{ kcal/hr} \Rightarrow \text{Adult}$

$100 \text{ kcal/hr} \Rightarrow \text{Lactating Mother}$

BMR \propto body weight also ✓

Varies on Env, Age, Exercise, Sex

UN/FAO estimates based on British, USA popⁿ; an overestimation as they have large body size.

L, Leslie Et Al attempted rational estimate which is much below UN/FAO

4% protein enough for New Guineans

Prior Et Al (1981): Showed that different popⁿ's have adapted to varied environments

food gatherer have needs for protein day.

→ Polynesians: Vegetable fat of coconuts, Taro & chicken

→ Eskimo: Animal fat

→ South American: Burn limestone added to food for 'Ca'

→ Meso-American: Soak maize in lime; add nachos across world 'Ca' deficiency is rare

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Lee (1979): Studied !kung of Kalahari
Found their diet to be quite diverse & balanced. Generally H&FG have a nutritious diet & less affected by stresses.

2350
kcal/
day

→ Milk + Meat (+)
Pastoral ($\frac{1}{3}$)

25% Monogo + 40% Veggie
NUT

[15% higher than
oxford calorics]

3375
kcal/
day

Sinclair (1953): Eskimo

Low in fibres
Excessive in fat-soluble vitamins.

Many times disruption of traditional diets & introduction of new foods \Rightarrow stress.
also

① Ireland Potato famine.

② fortification of food.

Relevance: ③ N. S. also affecting the affluent nations; due to junk food & substance abuse & over-medication.

- High intake of Iron → Cirrhosis of Liver
Ex: Inuits.
- Balance of salts in body gets disturbed because of their regular excretion through urine & sweat; thus their regular intake is a must.
- Water: → Cooling agent; nutrient transport, etc.
→ 5%. dehydration can cause death also.
→ If water shortage ⇒ kidney stones due to accumulation of salts.
- Food: anything we can eat & digest. It is species specific.
- Diet: what we commonly eat. It is region & culture specific for man.
- Nutrients → Energy; Chemical Rxn; Regulation, etc.

Infectious Diseases

- Short term → Best way to avoid it is hygiene. But those w/o that knowledge like those living in slums; even a short term disease can cause permanent damage. Ex: Paralysis of organ loss of eyesight.
- Pandemic → Mutation;

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9.8

Epidemiological Anthropology

Epidemiology is the study of distribution, patterns & determinants of health & disease conditions. Over the years, there has been growing recognition on effect of human behaviour & its Social-Cultural determinants on the spread of diseases. This led to rise of Medical AP under B. David Pauk in the 1940's. But focus was still heavily on medical aspects; so in 1960's the rise of Ep. A took place. It is much wider than M.A.

Defn: Trustle Et Al (1996) defines Ep. A as:

"Study of health & disease and their relation with determinants like B^{ehavioural}, S^{cultural}, C^{ultural}, E^{cological}, etc."

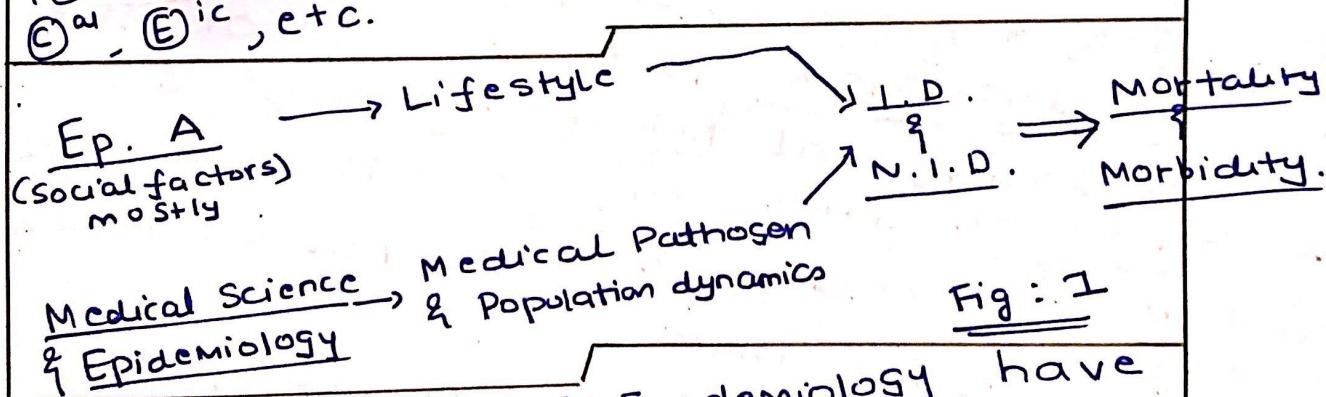


Fig: 1

Thus both Ep. A & Epidemiology have undergone parallel evol. Ep. A focusses mainly on biological & social factors now.

Approaches

① Ecological/Env Approach: a) Ecology & Spread
b) Urban & New age effects.

Ex: China's Hookworm Infection.

| ⊕ Same approach
for Medical AP'
— also —

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② Interpretative Approach: Looks at the way different cultures use symbolic meaning to describe & understand health & disease. Study how people of diff Θ^{res} label & describe illness & ritual trances. The 'system' of meaning elaborated.

Ex: Claude Levi Strauss studied how (1967) song sung by shaman among Kuna Indians of Pana helps a women during labor. It can also study effectiveness of symbols which can be related with the Placebo Effect. *

③ Critical Medical Approach: studies how S-E & P factors shape overall human health system. It throws light on the possibility that 'Modern Processes' of medicalization can actually be harmful. Thus 'prescribing a pill' is not a solution for every problem. Thus conflict of Personalistic Healers v/s Biomedical Healers comes to fore in E.A.

④ Evo" Approach: Defense v/s defect;

⑤ Sahariyo Θ \rightarrow 1st 3 days no breast feeding; after ritual bath only it is done.

Global
Media
&
Social
Inequality

⑤ Berlin (1996): Mayan Ethnomedicine though SN yet underlying basis is scientific.

प्रश्न संख्या
(Question No.)

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

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Case Studies : (2015)

- ① Nat Geo & WHO: Amy Maxmen & Paul Richards
Ebola bodies issue;
L> 70% of cases during the burying rituals. \Rightarrow Not merely a health issue but ④ all one.
- ② India ①: Snake catchers who produce 80% of India's Anti-Venom. Yet their tradition doesn't allow them to use it as a treatment if a snake bites them.
- ③ Kuru ① & Cannibalism: Neurological degenerative condition in New Guinea Tribes due to Slow virus. \Rightarrow Explain properly.
- ④ In 19th century, Danish Traveller carrying measles virus was responsible for spreading it to 6000 inhabitants of Faroe Islands.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Public Policy; Healthcare System; One-Health
- \rightarrow Study of Suicides
- \rightarrow find relative importance of factors within causal web of disease.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Role & impact of life style elucidated. Helps to avoid modern age diseases.
- \rightarrow Mother Education & female control over reproductive health.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Changing popn structure due to ageing & managing resulting ④ alterations & issues.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Occupational hazards & illness. Ex: Cotton factory \rightarrow lung issues.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Agrarian Distress & Suicides.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Role of Indigenous Knowledge & Ethnomedicine. Ex: Himalayan Yew by Bhotia of Nepal.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Use of P.O. leads us to the truth.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Accupuncture of China.

Relevance & Scope of Ep. A \Rightarrow Make modern medicine more effective

- \rightarrow Understand illness & disease 188 (both).

Lancet (2021): Indigenous people are more vulnerable to epidemics.

Ex: Navajo Indians per capita deaths are greater than NEW YORK.

Ex: Chicken Pox → 'Amav aur Ochindri';
→ 'Moto Hosi Hai'

Ex: Ojibwa Indians → Thinking of doing bad, causes illness

Ex: Anorexia Nervosa → Severe Starvation

Ex: Hikimori → Jap Adolescent Boys withdraw from Gfys due to societal pressure.

Gotai → No operation/piercings on the body. Beheading means never rebirth occurs. Also organ donation is greatly affected.

Ex: Vaccine Hesitancy in USA;

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Health:

Ability to function effectively in complete harmony with ones environment. It thus implies physical, mental & social well-being. It is usually measured in terms of variables like BP, sugar, etc.

Ex: Between OPP

Tribes: Balance & Equilibrium Theories of wet & dry

Hippocratic (Greek) : 4 humors

(Blood, Phlegm, BB, YB)

Disease: Abnormal condition which impairs the regular functioning of the body. It is thus any deviation from health. It may be an illness or latent. Illness is the subjective & social experience of the disease. A person may also have a disease for many years w/o being aware/much affected by it. Ex: Diabetes + Insulin → Not ill

(Disease) (Remedy)

cal. in nature
objective & unv
folk illness
@ specific perception

Disease
doesn't always lead to illness.

Types of Diseases:

- Acute: Begin & end abruptly ; Chronic: Begin gradually.
- Benign ; Malign
- Infectious: Caused by a pathogen;

Communicable: They can be spread from one person to another. If directly then it is called as Contagious & if indirectly by a vector it is called as Non-contagious.

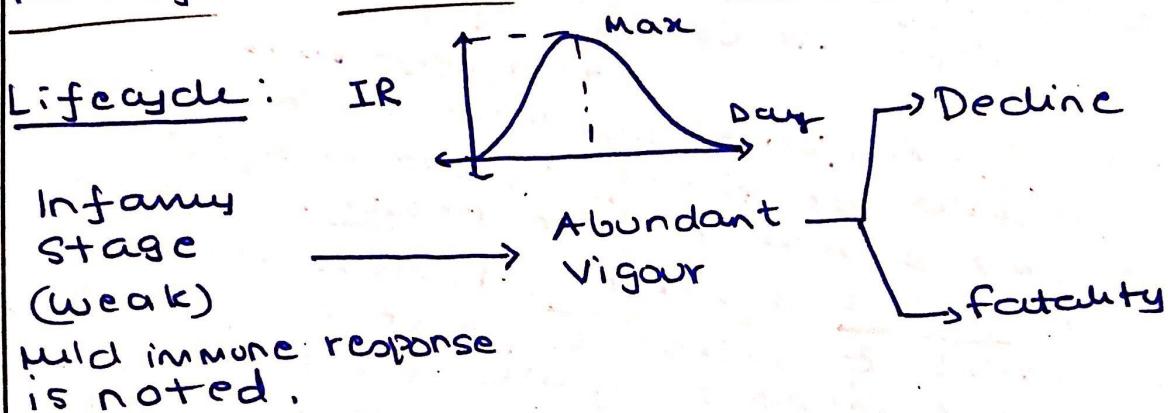
All communicable diseases are infectious but all infectious diseases need not be communicable. Ex: Tetanus.

→ One can be diseased but not ill & vice-versa.

Disease →

- Sign : Objective Manifestation that can be determined. Ex: Temp.
- symptom : Subjective evidence of disease reported by the patient. Ex: Pain.

Morbidity : Suffering from disease; it signifies rate of disease in the popⁿ.



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Infectious Diseases have profoundly affected humanity by acting as "agents of NS". They have affected our genes & culture.

Ex: Alland: How \odot enhances human health & hygiene.

→ Minimax cultural practices that minimise risk of disease & maximise health & welfare of group.

Ex: Namaste.

→ Some disease undergo selection & dev resistance to medicines like MDR/XDR-TB.

→ Famine Areas people have 'Thrifty Genes'. These are both adaptive & mal-adaptive.

Ex: As sedentarianism (\uparrow) \Rightarrow Malaria (\uparrow)

So as adaptation Hb S (\uparrow), acc to study by Livingstone.

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Case Studies

- ① "Reducing Lead Poisoning among Mexican American children" - Robert T. Ortt (1985)

Causes

- ① Paint
- ② Smelters (near homes)
- ③ Pottery glaze

In addition, traditional healing practice using Azarcón (contained lead) to treat Empacho (constipation)

US Public Health Service took his help to prevent it.

Macro & Micronutrients

Malnutrition is the condition of prolonged deficiency or excess of total energy or specified nutrients. It thus includes undernutrition and overnutrition. The former is more significant of the two. As per UN FAO, more than 800 million people suffer from chronic undernutrition.

There are 2 kinds of nutrition required by body:

1) **Macronutrients:** ^{most imp} Water, Carbohydrates, Fats(Lipid) & Proteins.

Proteins & Carbohydrates

give 4.26kcal/g & Fats give 9kcal/g. Alcohol has 7kcal/g.

2) **Micronutrients:** They mainly function as co-factors of enzymes. Vitamins(Organic Molecules) & Minerals(Inorganic Substances). Water & Minerals give zero energy. Vitamins give almost zero.

Though dietary fibres(Carbohydrates) are recommended in balanced diet they are not absolutely essential. Same thing for carbohydrates. They are responsible for global obesity epidemic.

Vitamins

* Draw effect of malnutrition on Growth Diagram as in .

They are organic compounds. ¹³ needed by human body. ACDEK + 8 B vitamins like Thiamin, Riboflavin, Niacin, Pantothenic Acid, Biotin, Vitamin B- Pyridoxine Cobalamin. Vitamin B-12 & Folate(B9). Vitamin B(All 8) & C are water soluble. Vitamin A,D,E & K are fat soluble. Vitamin B12, D(Kidney, Liver & Skin) and K(Liver & Intestine) can be synthesized in body. Vitamin B & C get destroyed in Cooking.

Vitamin A(Retinol): Vision(Low light & Color), Skin, Immunity, Reproductive function, Dev. of embryo, Gene transcription, etc. Provitamin A **Beta Carotene** fights free radicals in body. Helps in generation of **Rhodopsin**. More deficiency leads to **Xerophthalmia**. It is severe form of conjunctivitis.

Vitamin B1(Thiamin): Causes Beri Beri. Person skeleton visible.

Vitamin B3(Niacin): Causes Pellagra(rashes). Mental retardation. ² Diamine

Vitamin B12(Methyl Cobalamin): Nerve Cell Maintenance, New Cell Synthesis, Breaking down fatty/amino acids. It may lead to anemia(also caused by lack in diet & by sickle cell disease also).

Vitamin C(Ascorbic Acid): Wound healing, anti-oxidant, iron absorption, etc. It is called Mariner's disease. Helps in Collagen Synthesis, Amino Acid metabolism. Also called Scorbutic Disease.

Vitamin D(Calciferol): Exposure to sun is required for synthesizing. Regulates calcium and phosphorus levels which are essential for bone development. It promotes bone mineralization.

Vitamin E(Tocopherol): Anti-oxidant, regulation of oxidation reactions, supports cell membrane stabilization.

Vitamin K: Synthesis of Blood Clotting Proteins, Regulates blood calcium. It is not same as Hemophilia.

Kwashiorkor: It is protein deficiency. Has bloated stomach. ^{→ diarrhoea, respiratory & skin infections.}

Marasmus: Not only protein but also carbohydrates deficiency. Very lean. ^[Almost no fat]

Sodium	Fluid and electrolyte balance, supports muscle contraction and nerve impulse transmissions	Zinc	Enzymes production of genetic material/proteins, vitamin A transport, wound healing, sperm production and the normal development of the fetus
Chloride	Maintains fluid and electrolyte balance, aids in digestion	Selenium	Antioxidant, works with vitamin E to protect body from oxidation
Potassium	Maintains fluid and electrolyte balance, cell integrity, muscle contractions and nerve impulse transmission	Iodine	Thyroid hormones regulate growth, development and metabolic rate
Calcium	Formation of bones and teeth, supports blood clotting	Copper	Absorption/utilization of iron, formation of hemoglobin, enzymes
Phosphorus	Formation of cells, bones and teeth, maintains acid-base balance	Manganese	Facilitates many cell processes
Magnesium	Supports bone mineralization, protein building, muscular contraction, nerve impulse transmission, immunity	Fluoride	Formation of bones and teeth, helps to make teeth resistant to decay
Iron	Part of the protein hemoglobin (carries oxygen throughout body's cells)	Chromium	Associated with insulin and is required for the release of energy from glucose
		Molybdenum	Facilitates many cell processes

No.	Disease (and key nutrient involved)	Symptoms	Foods rich in key nutrient
1	Xerophthalmia (vitamin A) Retinol	blindness from chronic eye infections, poor growth, dryness and keratinization of epithelial tissues	liver, fortified milk, sweet potatoes, spinach, greens, carrots, cantaloupe, apricots
2	Rickets (vitamin D) Calciferol	weakened bones, bowed legs, other bone deformities	fortified milk, fish oils, sun exposure
3	Beriberi (thiamin) B₁	nerve degeneration, altered muscle coordination, cardiovascular problems	pork, whole and enriched grains, dried beans, sunflower seeds
4	Pellagra (niacin) B₃	diarrhea, skin inflammation, dementia	mushrooms, bran, tuna, chicken, beef, peanuts, whole and enriched grains
5	Scurvy (vitamin C), Ascorbic Acid	delayed wound healing, internal bleeding, abnormal formation of bones and teeth	citrus fruits, strawberries, broccoli
6	Iron deficiency anemia (iron)	decreased work output, reduced growth, increased health risk in pregnancy	meat, spinach, seafood, broccoli, peas, bran, whole-grain and enriched breads
7	Goitre (iodine)	enlarged thyroid gland, poor growth in infancy and childhood, <u>possible</u> mental retardation, cretinism	iodized salt, saltwater fish

Social epidemiology of nutrition

E.g. Bolton studied Orang Asli tribe of Malaysia, and found that pregnant women could only eat small amounts that possessed so-called 'weak' spirits.

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10

Q1. Differentiate Growth & Dev [OM]

Acc. to Malina, growth is quantitative change in size of body or its parts.

Development is qualitative changes that lead to mature & specialised individuals.

Note: Growth → $(\uparrow)/(\downarrow)$ in number, vol or size; in biology it is cells.

→ Positive/Negative v/s Permanent,
Ex: Thalmus is max \oplus Irreversible,
at adolescence One-way
→ Later → Decay may
occur earlier

Differences → Timing of Growth spurt v/s More fixed
varies

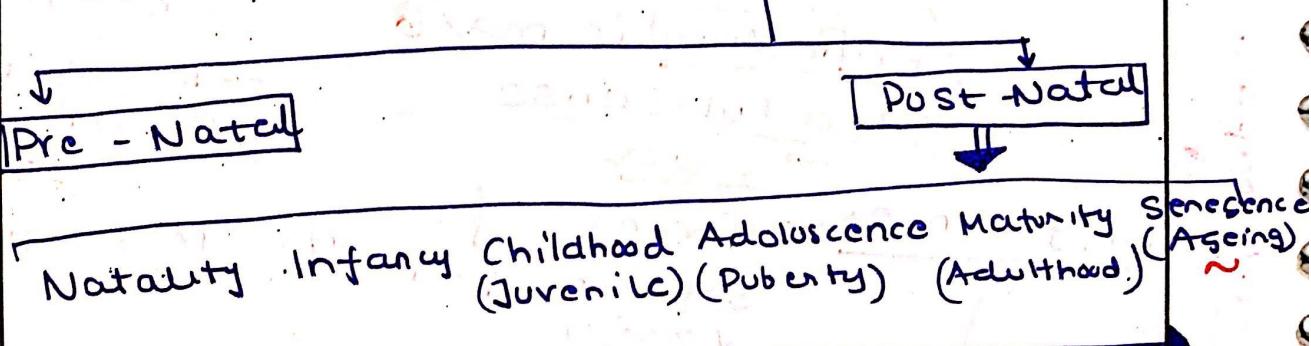
→ Longer duration of time it occurs
→ Almost lifelong from 12th week.

v/s much less
① Pre-Natal: organ dev
→ 5th day - 12 weeks
② Post-Natal: from
Adolescence - Till maturity

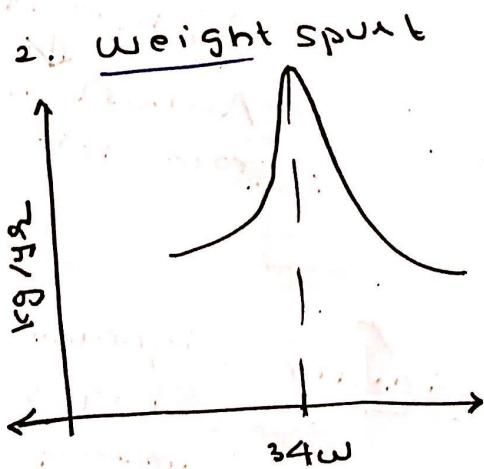
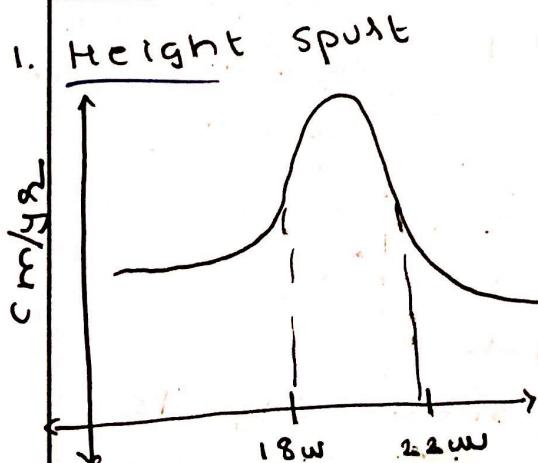
Similarities: Dynamic aspects of life
Stages similar
Impacted by similar effects

Q2.

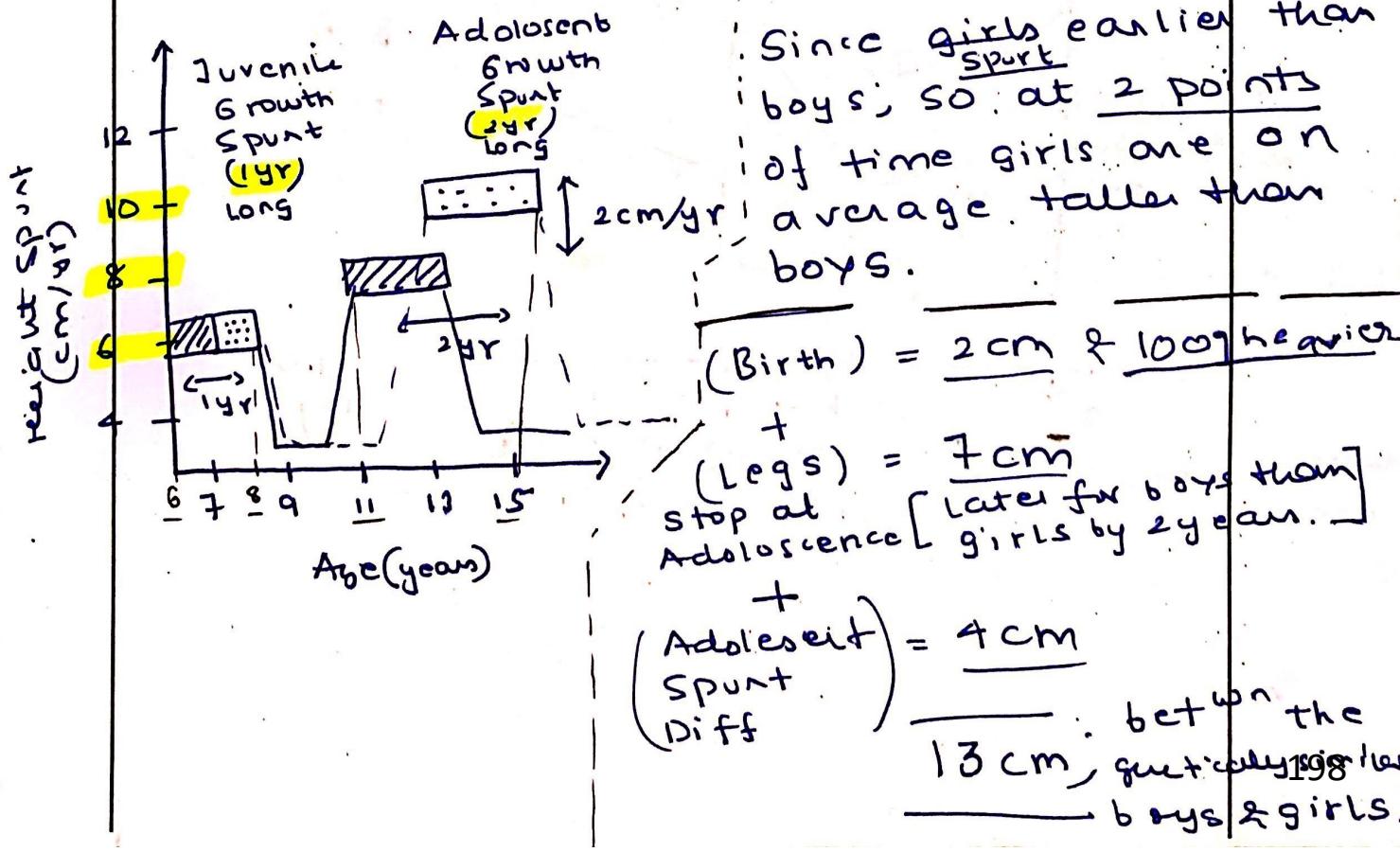
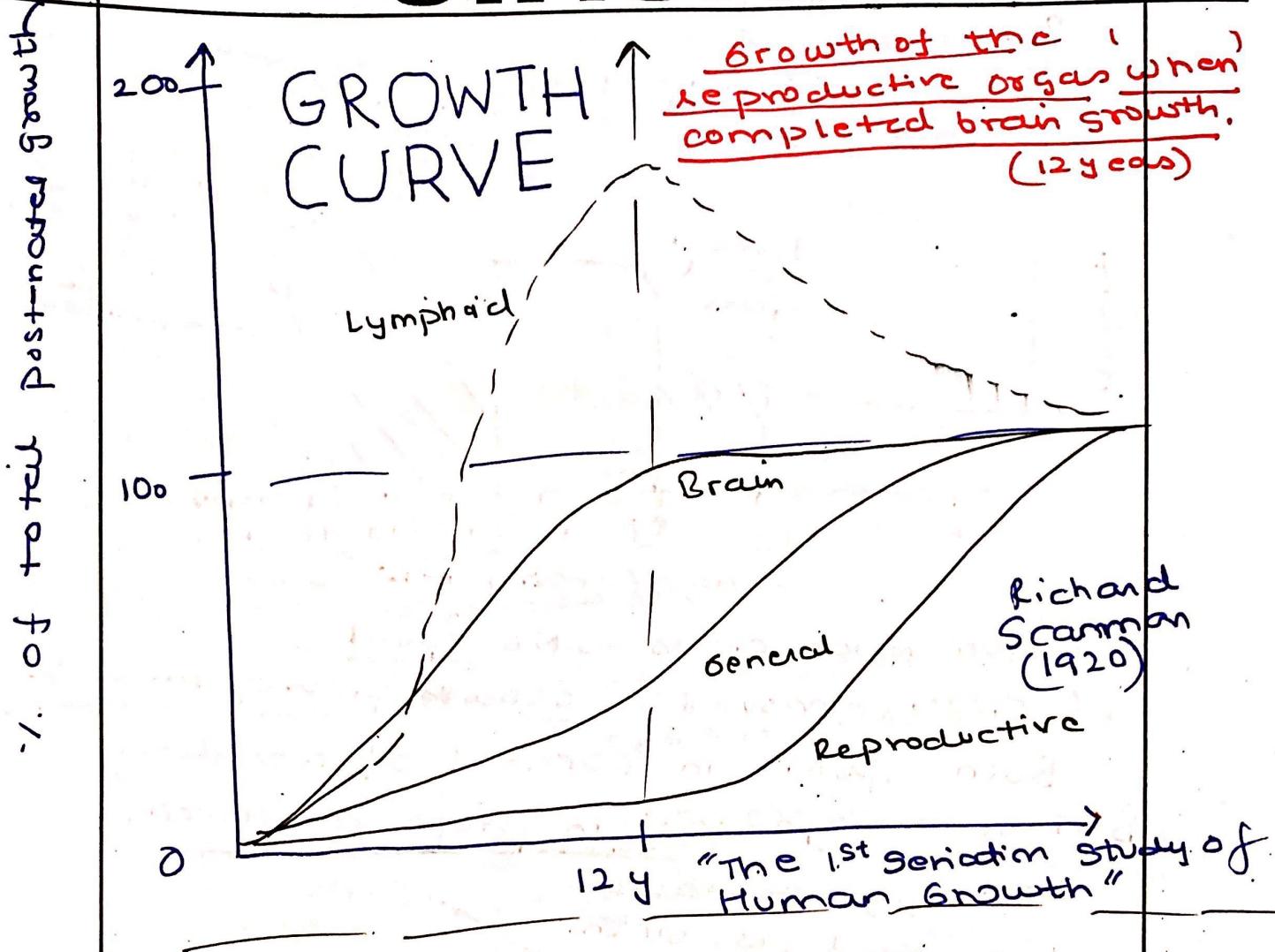
Different stages of Growth [20 M]

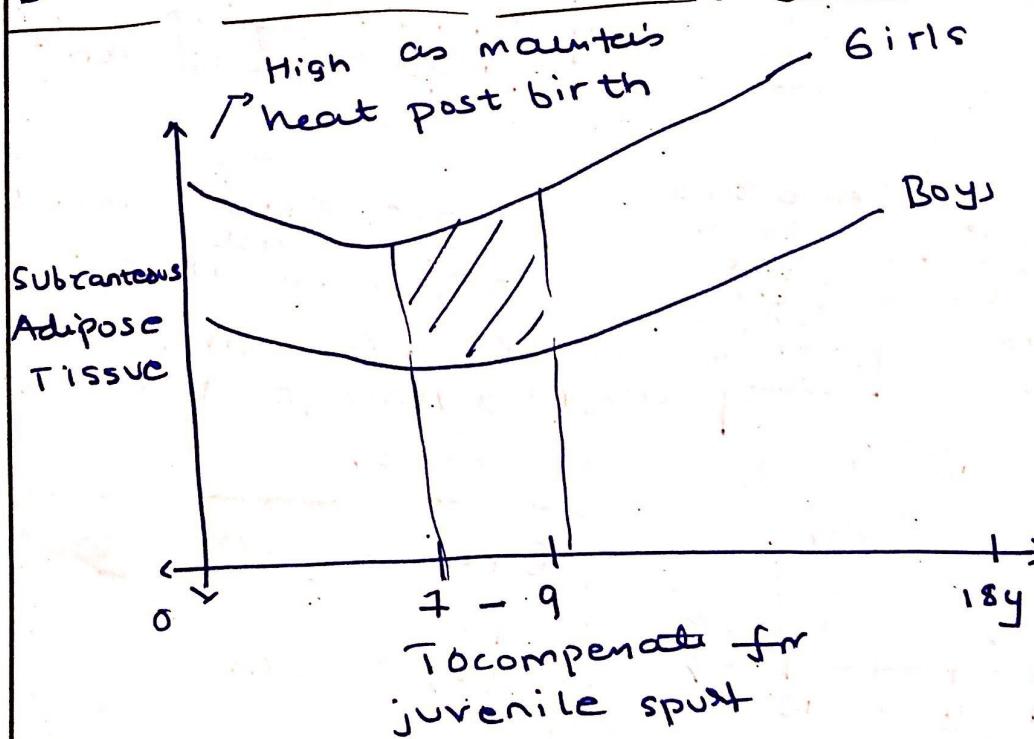
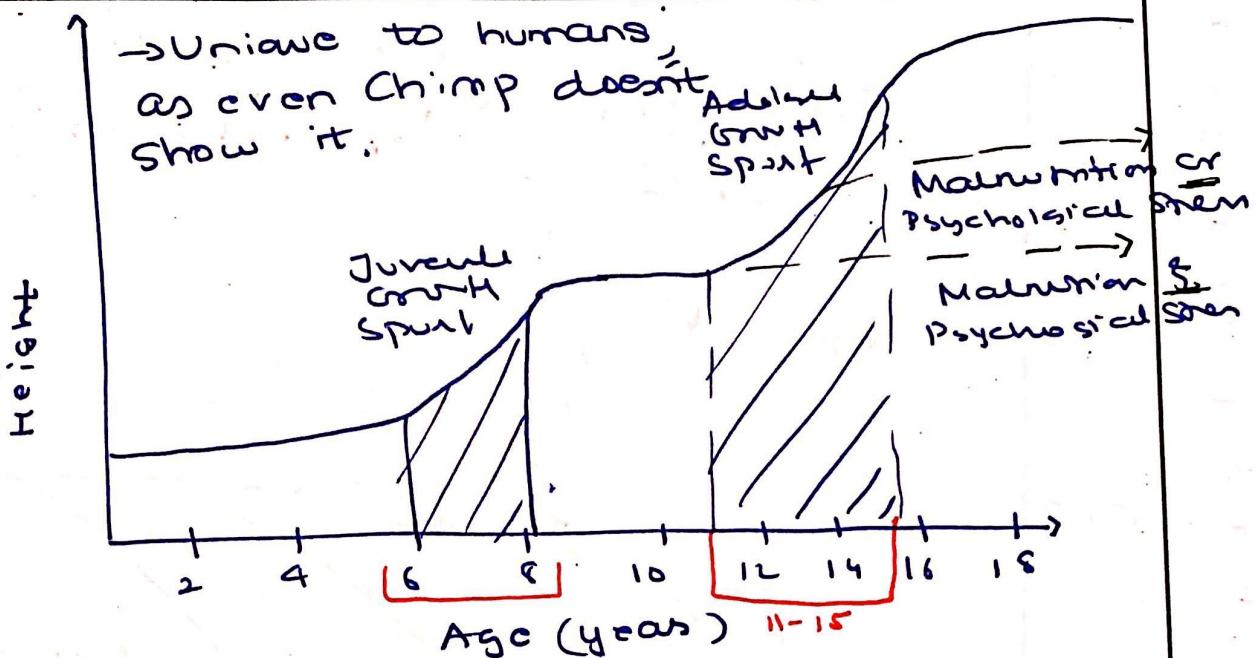


Graphs



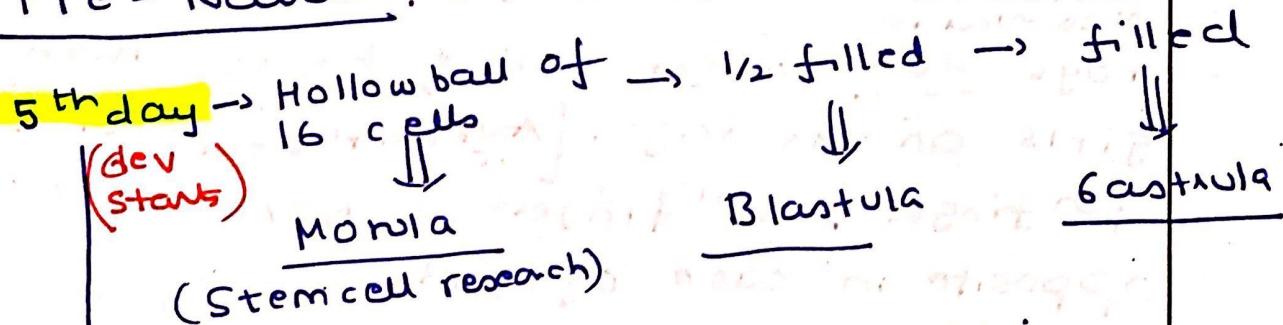
U.P.S.C.





U.P.S.C.

① Pre-Natal: Last - Mensa till Birth [40 weeks]



4th week : Above process complete

Organ differentiation starts (Histogenesis & Morphogenesis)

6th week : Heartbeat noticed

9th week : Male genitalia developed

11th week : Female genitalia developed

12th week : Organ differentiation complete

[Dev stops & growth begins]

18th week → Height spurt

- 22nd week → Weight spurt

34th week → Weight spurt

36th week [Body stops growth]

40th week : Birth

No impact of GM in fetus.

Size of uterus = 500X if mother genetically short; then another spurt occurs after baby is born.

Just before birth position and change in head takes place to align.