

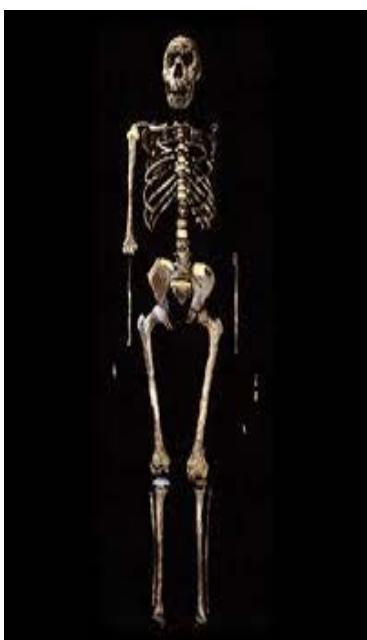
Primates, Fossils and Dating

Handwritten Notes: 1.5+1.6+1.8(a)+1.2

by

Narayan Amit(AIR 70 CSE 2021)

166+140=306(Highest)



My thoughts on Primates, Fossils & Dating

Getting 306 in Anthropology is the 'single reason' for me getting this rank. In that Primates, Fossils & Dating have played a very prominent role. I tried to attempt maximum questions from Archaeology, Primates, Fossils, Dating and Theory as it is possible to score 12/15 in such questions. In 2021, ~180 marks I attempted from these areas. Please focus on these areas. You can refer to these notes as your only source as they are perfect. Now about the topic in hand:

1. In primate questions always do the following to score more marks: Give Mivart Definition(can be summarized in short also); Draw Primate Tree Diagram(Pg6); Give both biological & behavioral features; Similarities as well as differences; Top to Bottom of primate all things to be covered; Draw Primate Bone/Locomotion Diagram; Give Taxonomy diagram & explanation, body/organ diagrams, etc. It will distinguish answer.
2. Please rote learn primate taxonomy by heart else you will have difficulty in interconnecting/differentiating various species/superfamilies.
3. In Fossil chapter, the terminology used is very confusing so be clear with it. Be clear about different bones/organs of body else you will find it hard to remember specific features of species. Please mug up entire life taxonomy from Chordates to Sapiens. Remember which species comes in which time period. Know difference between specie, genus, tribe, etc. Always draw phylogeny diagram whether they ask or not. Diagrams of skull/body parts need not be accurate, they must be representative(remotely) then nobody will question you. Correct way to write homo sapiens is "H. sapiens/Homo sapiens". The way name of lifeform is written gives info about it:

Ex: Dryopithecinae is sub-family whose members are called Dryopithecines. In it there are 3 Genus: Dryopithecus, Sivapithecus & Gigantopithecus. In each Genus there are several species.

4. In Fossil questions always mention the following: Name → Meaning → Founder → Find → Timespan → Species → Geo-location(Draw Map) → Skull/Organ Diagrams → Phylogenetic Position (include diagram) → Biological and Cultural/Env features (Top-Bottom including tool diagrams) → Unique things(including debates/scholarly points) → Conclusion. My answers on all species are world-class you need not waste any time in researching. I have done all value addition required even for Dragon Man/Homo naledi. Simply use my answers.

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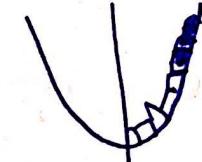
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1.5 Definition & Characteristics: Primates

Mivart (1873)'s definition appears in Buettner Janusch's classic book "Origins of Man", 1966.

Acc. to this definition, Primates are:

1. ✓ Ungiculate (Nails) { Not claws } → ~~6th mammalian order in all primates~~
2. ✓ Clavicolate (collar bone) → ~~Typical primate~~
↳ helps torso rotatability. (more evolutionary)
3. ✽ Placental Mammals, with orbits encircled by bone ✓
4. ✽ 3 kinds of teeth in at least 1 stage of life.
5. ✓ Brain with a posterior lobe & calcilune fissure ✽
6. ✓ Innermost digit of at least 1 pair of extremities opposable.
7. ✓ Hallux with flat nail or none. ↳ implied we were originally herbivores.
8. ✽ Well dev caecum (for digestion of cellulose)
9. ✓ Penis pendulous
10. ✽ Testes scrotal
11. ✓ Always 2 functional pectoral mammae near shoulders (Prosimian Daubentonia has 2 additional abdominal mammae but these are vestigial)
↳ non-functional



All these features are present in man. therefore Man is a Primate.

However note that these features are not exclusive to Primates? Other Mammals can also have them.

In addition; the list given by Mivart though comprehensive is by no means exhaustive. Thus other characteristics of Primates are:

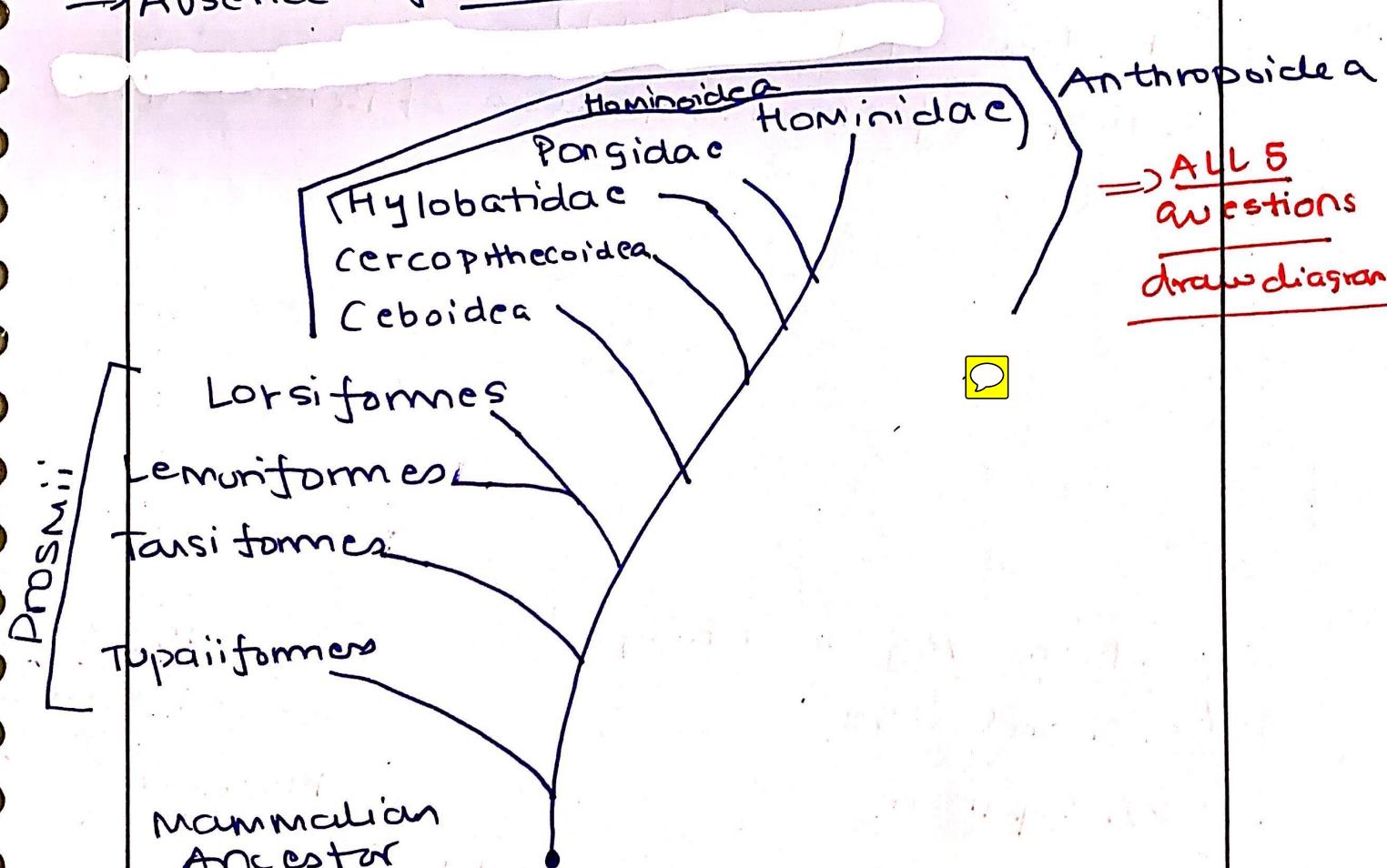
- Primates are Diphyodont; replacement of milk teeth by adult teeth.
- Warm blooded & suckle their young ones.
- Extended dependency on parents.
- Omnivorous; Pre-Molars & Molars are unspecialized whereas incisors & canines are specialized.
- Larger brain rel. to body size,
- Higher degree of learned behaviour
- Reduced olfaction \Rightarrow Snout (\downarrow); Vision (\uparrow) \Rightarrow Tunnel vision / depth (stereoscopic)
- Bodies generally covered with hair/fur.
- Opposable hands \Rightarrow Pre-hensility (grasping objects)
- Rotating fore-arm; Radius & Ulna.
- Simple stomach; can sit straight on hips.
- Femur never has 3rd trochanter.
- Lumbar curve in vertebral column & forward position of vertebral column.

There are over 500 species in primate order.

∴ Primates are called "the most unspecialized mammals".

Campbell's features:

- * → Usually birth of 1 child / fewer children at one time. & longer life-span.
- * → 5 fingers on extremities.
- * → Absence of wet-rhinium.



The science of classification \Rightarrow Taxonomy

- * How to make scoring this chapter
 - Diagram
 - Taxonomy
 - Top-bottom
 - Bio & behavioural
 - Sim & Differences

- Q) Is man an Anthropoid?
A)) Same \rightarrow

Since typical primate features are more evolved in man; man is an Anthropoid.

U.P.S.C.

Jane - Goodall: Britisher; Ethologist

Gombe Stream NP, Tanzania

Behaviour of Free-Ranging Chimpanzees (1965)

Shadow of Man (1971)

Chimps of Gombe: Patterns of Behavior (1986)

→ Non-veg in Chimps

→ Tool Use

→ Adoption

→ Effect of Mother in Child

→ Affiliation & Altruism

Ex: Grooming, etc.

Her child
confidante
in Adelocercus
↗

Flo: Good
mother

Passion, Bad
Mother

Child
scared.

U.P.S.C.

Evo^r of Primates

Paleocene: Archaic Primates called as Plesiadapiforms. Ex: Plesiadapis (65 mya). → Claws; eyes on side; smell prominent, snout present; squirrel like; etc.

Eocene: True Primates emerged including the common ancestor. Ex: Carpolestes Simpsoni (56 mya)

Believed that 1st limbs (hands/feet) → Mouse sized arboreal from Wyoming; it had nails, grasping hands & feet & stereoscopic vision was not dev yet. dev and then vision became better.

Why primates emerged?

(1912)

①

Arboreal Theory: G. Elliot Smith

Le Gros Clark

(Insectivores)

As mammals took to the Trees. Also in the trees vision was more helpful than smell.

Criticism: Matt Cartmill said Squirrel was exemption as it was a mammal that was arboreal but unlike other primates.

Insectivore }
is also a }
mammal }
order }

(1980)

②

Visual Predation Theory: Matt Cartmill

Vision was finally adaptive so it (↑) which resulted in decreased space for smell.

U.P.S.C.

प्रश्न संख्या
(Question No.)

Ate insects
acc. to
him.
इस पाठ में कुछ
न लिखें
(Don't write anything
in this part)

Hunting in the undergrowth of forests would have required good vision.

Criticism: Many primates eat veg / stationary things so was vision so needed?

③ → Friedrich Szalay's Dietary Shift Theory (1968)

The cause of the mammalian divergence was due to change in diet to fruits, plants and leaves. [Didn't eat insects anymore]

The synthesis of above thoughts was brought by RW Suzman (1991):

① Said earliest primates were Nocturnal hence Cantmill correctly emphasised role of vision.

② His own Angiosperm Radiation hypothesis was about fruit & plants' and not so much about the insects.

we can call it as the 'Nocturnal Angiosperm Radiation Theory' which is the best currently.

Old World Monkeys
(*Cercopithecidae*)New World Monkeys
(*Cebidae*)

- More closely related to humans than to new world monkeys.
- # of species less but live in more diverse habitats. → More varieties; broader feeding habits & locomotor adaptations.
- Same # of teeth as the apes & humans.
- Most are terrestrial. → Arboreal & thick forests.
Ex: Squirrel Monkey
- Africa & Asia → central & south America only.
- * Tail not prehensile → ✓
- * Narrow nose → Broad nose
- * Ear tube ✓ → X
- 2 pre-molars → 3
- * Opposable thumb → X
- * Cheek pouches → X
- Nostril gap less → More

Platyrrhines: Anthropoids that have nostrils outwards & broad flat bridged noses. Ex: NWM. Nosces separated by broad fleshy nasal septum.

Catarrhines: Anthropoids with nostrils downwards & narrow noses. Ex: All else. Narrow nasal septum. Ischial callusities ✓

{
OWM
+
Apes
+
Mon}

Q

Prosimii v/s Anthropoidea [15 M]

Mivarts (Defn)

Primates (Order) as req

↓ Sub-order

Prosimii

→ Members.

Sub-order ↓

Anthropoid

→ Members.

[Wavy Diagram]
of Primates

Similarities:

① Biological: Gen mammalian features are equally dev in both (elaborate) so they are similarities.

Differences:

① Biological: Typical primate features are evolutionary in nature so more dev in anthropoidea.

→ Prosimii may have claw on 2nd/3rd finger for cleaning body whereas Anthropoids have nails in all fingers.

→ Prosimii lateral orbit wall is Muscular whereas in Anthropoids it is made of bone.

→ Brain and quar more dev in Anthropoids & progressively complex in them.

→ They can have
whiskers
also

U.P.S.C.

usually ~36 but
(upto 40 teeth)

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

- Dental Arcade 'V' shaped in Prosimii whereas it is 'U/Parabolic' in Anthropoids.
- Foramen Magnum: B v/s D / DGF.
(poor posterior lobe)
- 3133 in Prosimii & lower incisors & canines one fused together to form comb for grooming & cleaning body.
- 1st digit hand opposability is successively dev. in Anthropoids. Not so well dev in Prosimii.
- Eyes further in Prosimii; they have large moveable ears which can scan for sound. It is lacking in Anthropoids.

Behavioural Differences:

- | | |
|---------------------------------------|---|
| Prosimii → Arbooreal; Nocturnal | live in secluded places → W & Madagascar & occupy limited area/habitat. |
| Anthropoids → Arbooreal / Terrestrial | Diurnal, found in more widespread area |

All the advance features are found in Man also; ∴ Man is an Anthropoid.

Q

Monkey v/s Hominidae [15 M]

Mivart (Defn) ✓

Phylogenetic chart as req ✓ (from Primate)

Similarities

- Large & comparatively rounded cranium.
- Reduction of Prognathism & size of the nasal cavity.
- Eyes are nearer to each other.
- Fingers on hand & foot have nails;
- 3rd finger ≥ 4th finger.
- Lack of wet - thinarium in nasal cavity.
- Lacrimal canal opens into orbital cavity.
- Great capacity for bipedalism.
- Mobile upper lips detached from gums, resulting in facial expressions.
- Features of Anthropoidea are similarities

Differences① Biological:

- Foramen Magnum: D v/s D & F.
- Cranial capacity (↑) in Hominidae.
- 2123/2133/2132 in Monkey v/s 2123 in hominidae.
- Monkeys have buckle pouches in mouth to eat fast & bite later. Not in H.
- Monkeys have Ischial callosities on buttocks especially in OWM. These are called Sitting Pads & absent in Hominoids.

- Not much genetic similarities in DNA.
- Similar diseases are few in number.

② Behavioural Differences:

- Monkeys live in large groups and are mainly arboreal whereas apes can be arboreal or terrestrial & live in small groups.
- Only tool using (not making) tendency is found in Monkey.
- No Incest - Taboo found in monkeys.
- No erect - posture found in monkeys even though capable of it to an extent.
- Monkeys produce more than 10 offspring at a time whereas hominoids produce only one offspring at a time.
- Socialization is more involved in hominoid.
- Monkeys less widespread than hominoids on the globe.

All the advanced features are found in Man; ∴ Man is a hominoid.

U.P.S.C.

Q. Apes v/s Man [ISM]

O, G, C

→ Chart from [Primate - till Man], Don't include fossils.

Similarities

① Biological:

→ 96.5% → Orang }
97% → Gorilla } DNA Similarity
98% → Chimp }

→ Suffer COMMON diseases like
flu & Syphilis. → Pre-molars are
bi-cusped in humans.
→ No tail in both.
→ 2123 in both & X-5 cusped lower 3rd molar.

Features of Hominoidea are similarities.

② Behavioural:

→ IT ✓ → Both live in small groups
→ Tool Making ✓ → 1 child birth at time is rule.
→ Good Communicators → Extensive sⁿ of child.

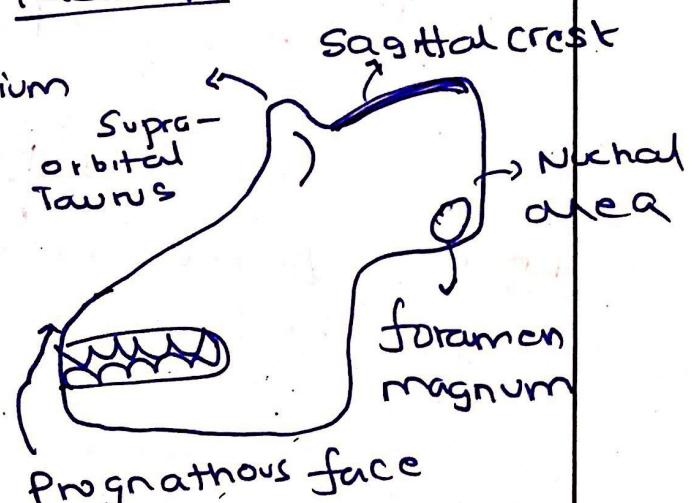
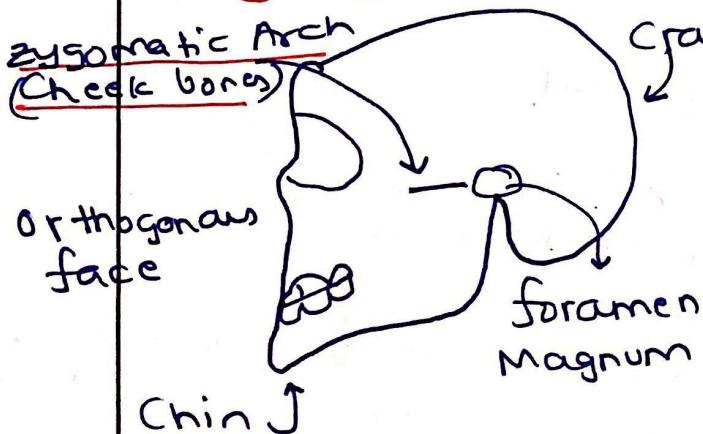
Differences ① Biological

- (O&C) → Cranial capacity ($400-660$) / ($1300-1450$) → sexual dimorphism more in apes.
- foramen MAGNUM → Apes fertile only few months of the year.
- Dental Arcade 'U v/s Parabolic'.
- Canine size & Diastema → Protruding nose in man
- Chin
- Vertebral column curves (2 v/s 4)
- Opposability of toe.
- Man has Patella but not ape. | Apes have instant memory while man has long-term memory.

Skull: Nuchal crest less dev in man as neck is slender for rotation & skull is well balanced in man.

Sagittal crest not much dev in man, it serves to attach heavy jaw muscles in apes.

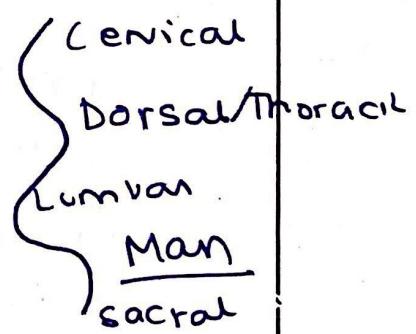
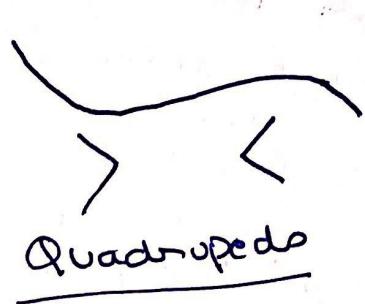
Cranial Part > Facial Part in man. *



Teeth: Rotatory motion of teeth is less. Thus chewing motion is up & down.

[Diagram easy] * Apes have simian shelf but not man. (C)
Spiral cord: Apes → Quadrupedalism → Brachiation. Man → True Biped & erect. Palm & fist walking (O)

→ elongated "double-s" shaped → 4 curves.
→ vertebrae show progressive increase in size.



These curves in man bring body's centre of gravity directly above the feet.

Hands: Both have opposable thumbs but not opposable toes in man.

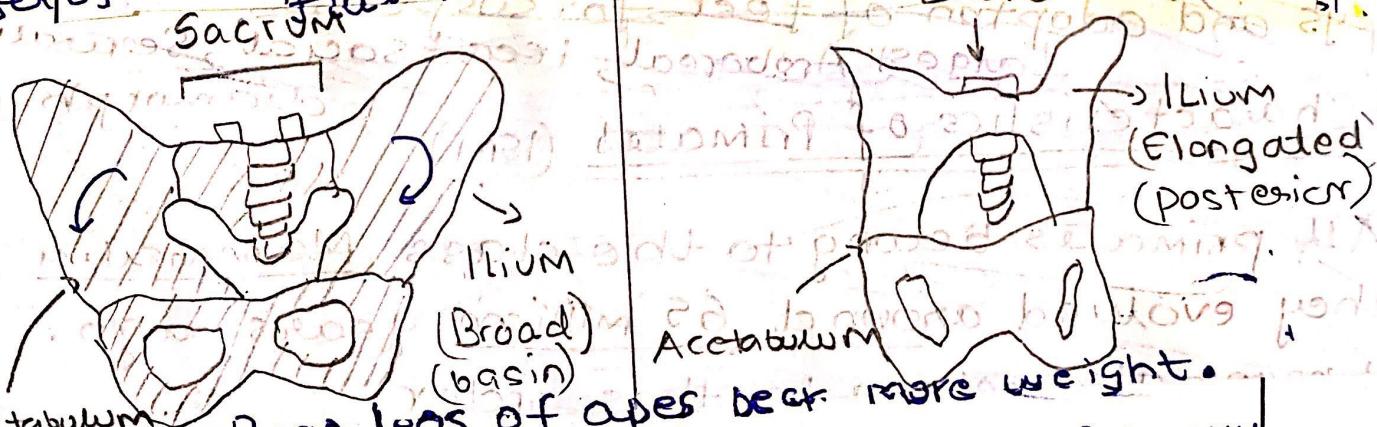
Phalanges curved in apes but straight in man. Angle of thumb & palm more in apes & thumb is bigger.
Apes → Power grip ; Man → Precision grip



Brain: Visual cortex > olfactory sense
Broca's area more in man

Pelvis: Sacrum enlarged & contains more bones. In humans, sacrum is shorter.

S-P joint closer to, Basin shaped pelvis & broad illic
P-F joint for better bladder in man. In apes it is long,
transfer of load, if flat & runs at back of the body.



Legs: Rear legs of apes bear more weight.

Femur of apes is short, thick & heavy.
In man it is strongest bone & placed at angle to hip; thus lower end of femur is closer at knee while in apes the alignment is straight. Linea Aspera (not in apes)



femur of ape → curved & thick
" man → straight & slender

L.A.

U.P.S.C.

Foot: Big toe enlarged in man & in-line.

Phalanges are short & tarsals are longer in man while opposite in apes.

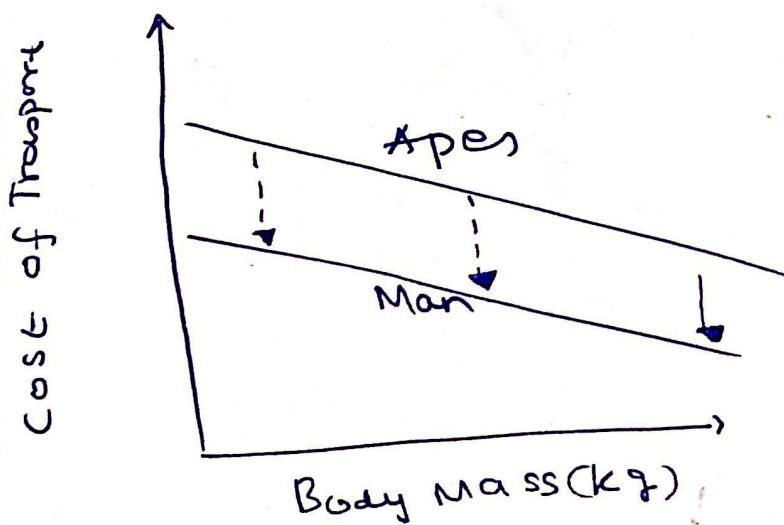
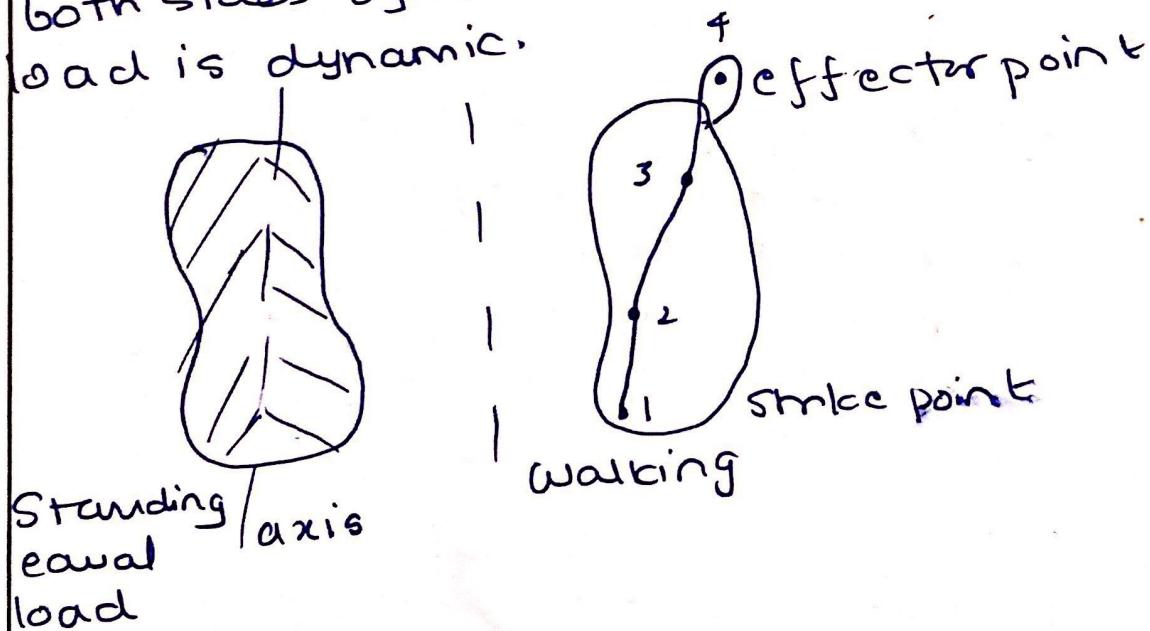
Apes have thick padding on their feet.

* knee \Rightarrow Double knee function in man
No function in ape.

Human foot \Rightarrow Stability & weight bearing for erect postures.

Ape foot \Rightarrow locomotion; grasping branches, etc.

Plantigrade with double arch. While standing load equally distributed on both sides of ankles and while in motion load is dynamic.



U.P.S.C.

Gorilla → Massive jaws => NO resemblance to man.

→ Hands, feet & penis similar

→ Largest living ape; chest beating, most powerful

→ Silver back => 'X' / 1° male.

Orang → forehead & ribs are similar

→ legs & adoption of feet for suspension are different.

→ Sexual dimorphism, least social

→ Largest arboreal.

→ Reddish Brown hair

Chimp → chest prot., skull & pigmentation similar

→ Hierarchical society

→ ~ to Bonobos.

→ Partly arboreal & partly terrestrial

→ New tree nests each time they sleep.

Q =

Skeletal Changes due to erect posture.

→ very similar answer

Rodman & McHenry (1980) → efficient locomotion

Pete Wheeler → heat dissipation ↑ as lower back exposed to sun.

Painful birthing → birth canal narrowed

lower back problems

Effects → freeing of hands for tool making

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20

→ Heel joint rounded in Man, but not in the apes.

→ Hairy body on ape / fur coat.

→ (man) v/s (apes) | v/s (and apes)
→ arms & legs → equal in man (actually longer for bipedalism)
→ arms longer in ape.

∴ Most of anatomical differences

⇒ bipedal gait
↓ later
brain size (↑)

② Behavioral Differences

→ Culture!

→ Man is habitually erect, whereas apes walk upright upto 21cm & that too if holding something in hand. Man is perfectly erect. Apes are usually knuckle walkers.

→ Man uses tools to make other tools.

→ Man is omnivorous whereas apes are usually frugivorous.

→ Man has stronger male-female bonds.

* If question: Man v/s O, G, C ⇒ same answer.

U.P.S.C.

Q Place of Man in Animal Kingdom. [10M]

Man is an animal.

why man is chordate & not non-chordate?
(2-3 points)

Why man is vertebrate & ...

Why man is Mammal & not a bird, fish,
reptile/Amphibian,

Why Man is Primate \Rightarrow Mivast !!

why man is Anthropoid & not a Prosimian.
(2-3 points)

Why Man is Hominoid & not a Monkey.
(2-3 points)

Why man is Man & not an Ape.
(2-3 points)

Why Man is Man? 4 features of Man
that make him an unique primate.

- ① Only animal that is habitually bipedal.
- ② Most evolved brain qualitatively & quantitatively.
- ③ Lang & vocal expressions most evolved.
- ④ Capacity for culture.

Q Place of Man in Primates. [10M]

Ans: Start from Primate & rest is same.

Q Is Man a Uniuue Primate. [10M]

Mivart (Defn) → 1873 ✓

- ∴ Man is a primate.
- 4 unique features of Man
- ∴ Man is unique primate.

If above question asked for [20M]
Then add the following:

Place of Man in Primates. ✓

Q Locomotor Adaptations in Primates [15M]
Anoboreal & Terrestrial Adaptations
(Trees)

LOCOMOTOR Adaptations refer to

changes in an animal's body (mostly anatomical) that enable more efficient movement of the animal from one place to another.

Primates both terrestrial & anoboreal have different types of L.A.

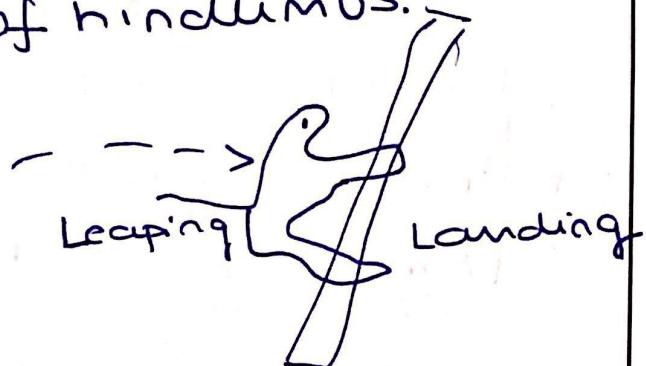
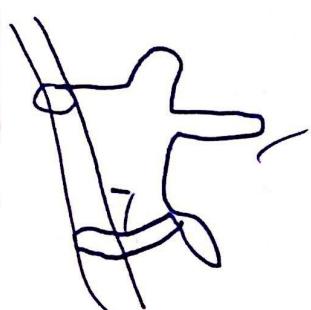
① Vertical Clinging & Leaping

Napier & Walker consider this to be the basic form from which all other modes evolved. The body is held vertically at rest & pressed to the trunk or main branch of a tree. Movt. S 22

done by leaps between trunks & branches by propelling body through rapid extension of hindlimbs.

When on ground-hopping.

V.C

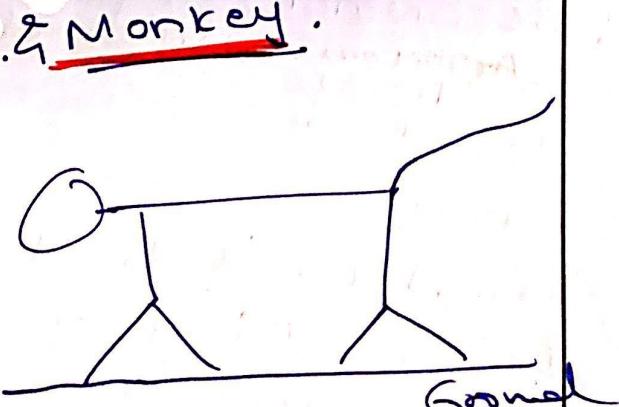
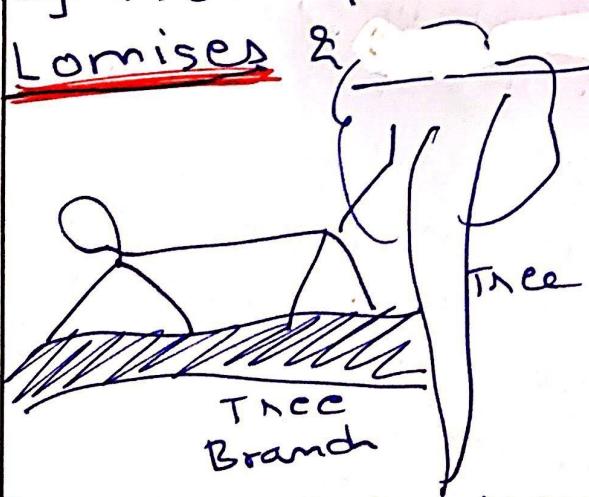


Ex: Lemurs & Tarsiers; Galagos.

↳ Tarsal bone extremely long *
& it acts as spring.

② Quadrupedism

① Arboreal Quadrupedism: Walking & running on all 4 limbs along branches of trees. Found in Lorises & Monkeys.



② Terrestrial Quadrupedism: Moving on

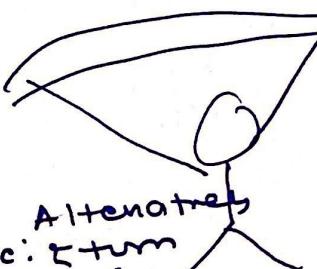
ground on all 4 limbs. Ex: Baboons, Macaques. A variation herein

is called Knuckle-walking: forelimbs hold fingers in a partially flexed posture that allows body weight to press down on the ground through knuckles. Ex: African Ape like Asilis & Chimp.

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③ Brachiation: Arm swinging locomotion; forelimbs used for securing hand holds above the head. the body is suspended below the branch of a tree & is propelled by swinging alternate arms from branch to branch. The hindlimbs support the body in the trees. Ex: Gibbon & Siamang.

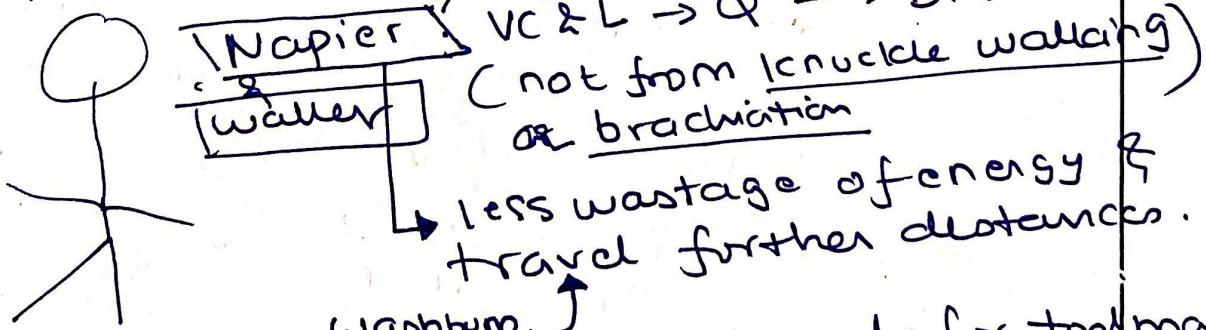
@ Modified Brachiators

 Use brachiation as secondary mode of locomotion. Ex: O, S, G.

① Primitive: turn 180° .
② True: flight in air

④ Semi-Brachiators: indulge in arm-swinging with the use of prehensile tail & little leaping.
Ex: N.W.M.

④ Bipedalism: walking & running on hindlimbs which move alternatively to propel the body & gait is characterized by the act of striding which involves propulsive movement. Ex: Man.



Gordon Hawes: free hands for toolmaking.

Peter Rodman: (↓) radiation from sun

Henry McHenry: Env & Patchy forest hypothesis²⁴

Bipedalism: In addition

Adv → Hands are pre-hensile & opposable thumb ⇒ Manipulated Dexterity

→ Savannah Scanning Prey

→ Dev of facial exp.

Dise → Groin area Danger Prolapse (ring)
→ Herniations of intervertebral disk
→ Slip Disc's; pressure on brachial plexus;

All these locomotions are result of many factors; chief among them being the environment & body size of the primate.

Social Hierarchies in Primates

Many primate societies are organized into hierarchies which impose a certain degree of order by establishing parameters of individuals behaviour

Though aggression is frequently used to assert an animal's status; hierarchies usually lower the amount of actual physical violence as the lower ranking animals are unlikely to attack or threaten a higher ranking animal.

Individuals rank/status is measured by access to resources, food/mating partners.

The dominant animals called as X males/females are given priority over others.

Many primatologists opine that the primary benefit of hierarchies is the greater reproductive success observed in higher ranked animals.

Sawyer et al (1997) demonstrated Case study: Pusey et Al (1997) demonstrated that offspring of higher-ranked female chimp in National Park of Tanzania survived better due to more access to resources than others.

Individuals position in hierarchy varies throughout life based on age, skills, sex, aggression, etc. Also primates learn their position in the hierarchy from birth itself. Ex: Infant observes how the mother responds to other members.

Social hierarchies in primates thus have significance in knowing primate behaviour including that of human beings \Rightarrow "Reproductive Success". L, Franz De Waal also studied.

U.P.S.C.

Q Fossil Primates of Paleocene & Eocene.

Defn Primate → Mivart

Explain Paleocene & Eocene.

The 1st evidence of primate fossils comes from Paleocene Epoch of Cenozoic era about ~65 mya. The fossil is called

Purgatorius Ceratops Only a few teeth have been found. It was Plesiadapiform.

found in W. N America. It was arboreal. Though it didn't have forward facing eyes or nails. Paleocene ⇒ 3 families of primates.

Carpolestidae, Phenacolemidae, Plesiadapidae

The 1st recognised fossil with proper record is Plesiadapis. It has claws, large snout but due to dental similarities it is placed with other primates. It also shows certain limb modifications especially in wrist/ankle ⇒ sign of arboreal adaptation.

In Eocene, true primates evolved. They covered most of the world ⇒ 5 families

Anaptomorphidae (56–33.9 mya); Microgopidae; 43 genera.

Ex: Tarsiidae, Adaptidae & Omomyidae.

↳ only primate that exclusively eats other animals: Insects, etc.

wrt to Paleocene, the eocene fossils

Show:

- orbits rotated forward → 3D stereoscopic vision
- larger brain size. → dry noses.
- reduced snout → reduced dependence on sense of smell.
- foramen magnum slightly forwardly

✓
No
forward
facing
eyes/
nails

✓
even
lemurs
found

placed; indicating a possible deviation from quadrupedal locomotion.

Thus Primateology has increased its focus on these fossils as it helps to study evolution of man prior to Pliocene Epoch (Paleolithic age) especially, the ancient fossils.

Oligocene → few are found & that too mostly in Africa.

Ex: Oligopithecus, Aeolopithecus, Aegyptopithecus, Panapithecus, Propithecus, Megapithecus,

- ↳ Intermediate of Primates & Anthropoids
- ↳ Fayum, SW of Cairo, Egypt
- ↳ Jaw n to Tansier; 2123

→ Talk about Dryopithecinae (D, S, G)

Not just GA;
but much more

Q Living Major Primates: Give def'n of primate (✓)

L, L, T, Tu

NWM → Spider Monkey, Tamarinid, Marmoset

swift OWM → Rhesus, Langur, Baboons

swing G, S | O, G & C [+ Bonobos
+ Pan]

Man

(Simply expand few points)

Molecular clock: Applies on non-coding

Parts of dNA as NS doesn't apply
on them. Since mutations accumulate
at a constant rate over time we
can tell age ✓

U.P.S.C.

Fossils		10,074ya ✓	
Eon	Era	Period	Epoch
Ozone Layer		Quaternary	Holocene only micro evolution 10kya - Now
		H. Erectus → H. Sapiens → H. N (Man) Pithecius → Ape	Pleistocene 2.58 mya
	Cenozoic	Sivu → Ape of Shiwaliks (South) Dry oak tree → Ape of the forest Mammals / Tertiary	Pliocene 5 - 2.58 25 - 5 38 - 25
		Primates (Leader) Those who suckle their young ones.	Oligocene (Apes evolved) Eocene (True Primates) Paleocene (Primates evolved) 65mya
	Mesozoic	Age of Reptiles	Cretaceous Jurassic Triassic Permian Carboniferous Pennsylvanian Mississippian
	Paleozoic	(Age of fish)	Devonian Silurian Ordovician Cambrian
Proterozoic		Primitive life Invertebrates evolved (simple) Lw/o backbone/ventral column Ex: Insects, Crabs, etc.	550mya Pre-Cambrian
Archaeon		Primitive life Non-chordates evolved (simple) → Actually non-chordate Primitive central Nervous system are called Chordates	2.5bya
Hadean		Hellish conditions on earth No life. Ex: Archaic (w/o life) Era	30

U.P.S.C.

Skull - Mandible = Cranium

(Cranial)
Cavity

Hollow cavity
--- inside filled

with brain completely.
so much so that vol
of brain/vol of cavity
is the same.

Upper jaw → Maxilla

Eye socket → Orbit

2 parietal bones

Supraorbital crest/ridge

frontal
Torus

Neocortex: Part of cerebral cortex

Mental foramina: holes in skull for vessels

Platigrade: flat

Vault: Top

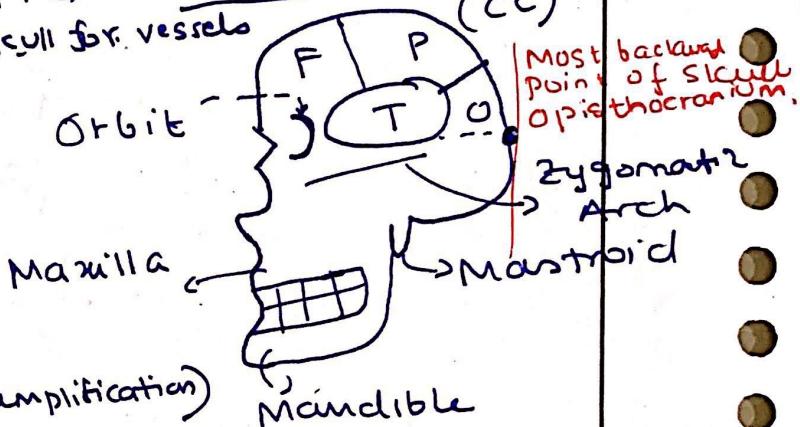
Platy: flat

Process: Projection

Sinus = Hollow cavities in skull &
related to voice (amplification)

"cranial capacity

(CC)



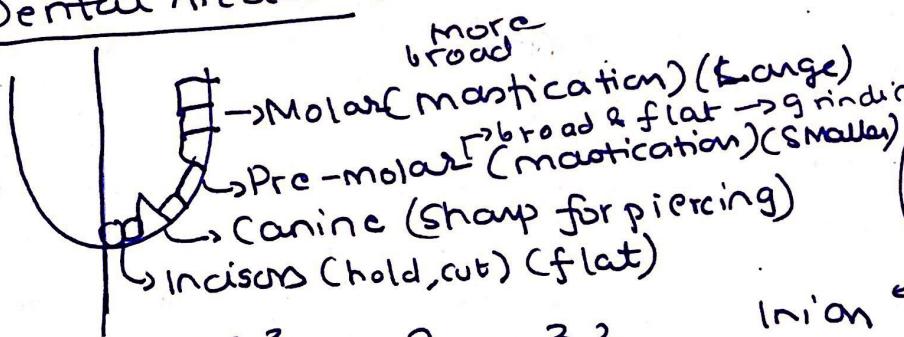
fossa = depression

Pinna = Ear lobe

Kneel: Knott

Balanced dentition: Same level of teeth

Dental Arcade: Arrangement of teeth



$$\begin{array}{r} 2 \ 1 \ 2 \ 3 \\ \times \ 2 \\ \hline 2 \ 1 \ 2 \ 3 \end{array} \quad = 32 + \text{teeth}$$

dental formula

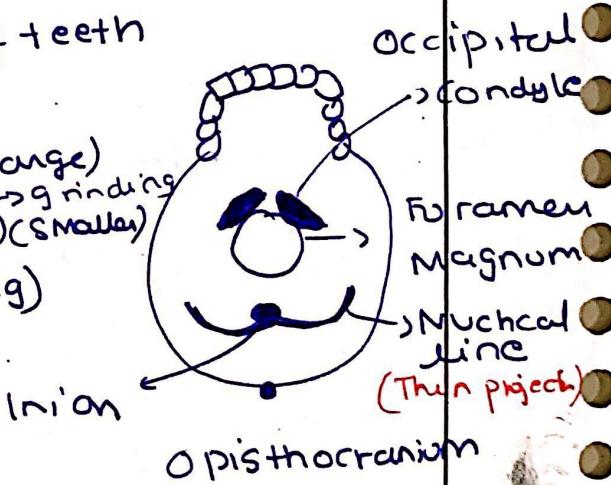
Pelvis → Sacrum + Coccyx

+ Hip Bone

(Ilium, Ischium, Pubis)

↳ elongated & fragile in apes

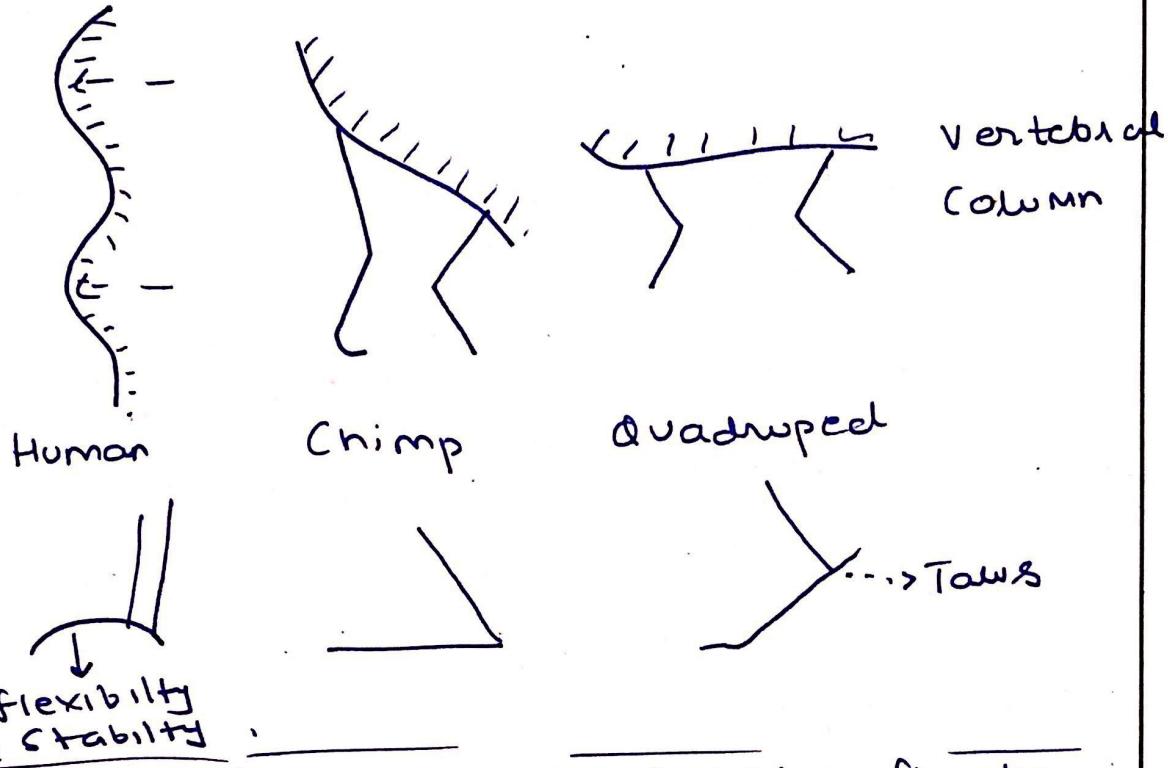
Human Skull



(Line → Ridge → Crest
(H: Grecus))

Torus
(Gorilla)

(As if forming
a continuous platform)



Apes & Monkeys use hind legs for holding firmly.

↳ Opposable hallux.

↳ femur small & cannot support body weight for longer duration.

⇒ Sacral curve in humans (extra) & spinal cord upright.

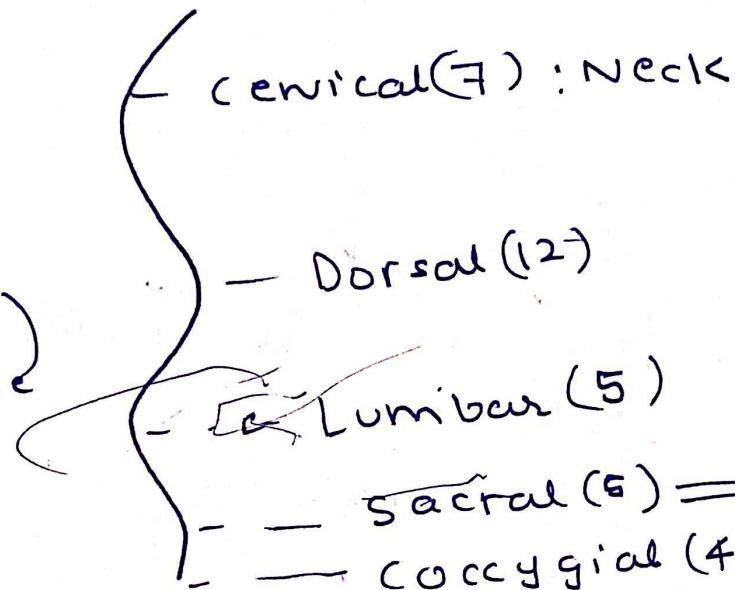
⇒ Plantigrade foot in man. It refers to walking on soles of feet. This is in contrast to Digitigrade.

U.P.S.C.

vertebral column : backbone; elongated double S shaped

33 vertebrae

4 curves
(Sacral &
coccygial
are in 1 curve)

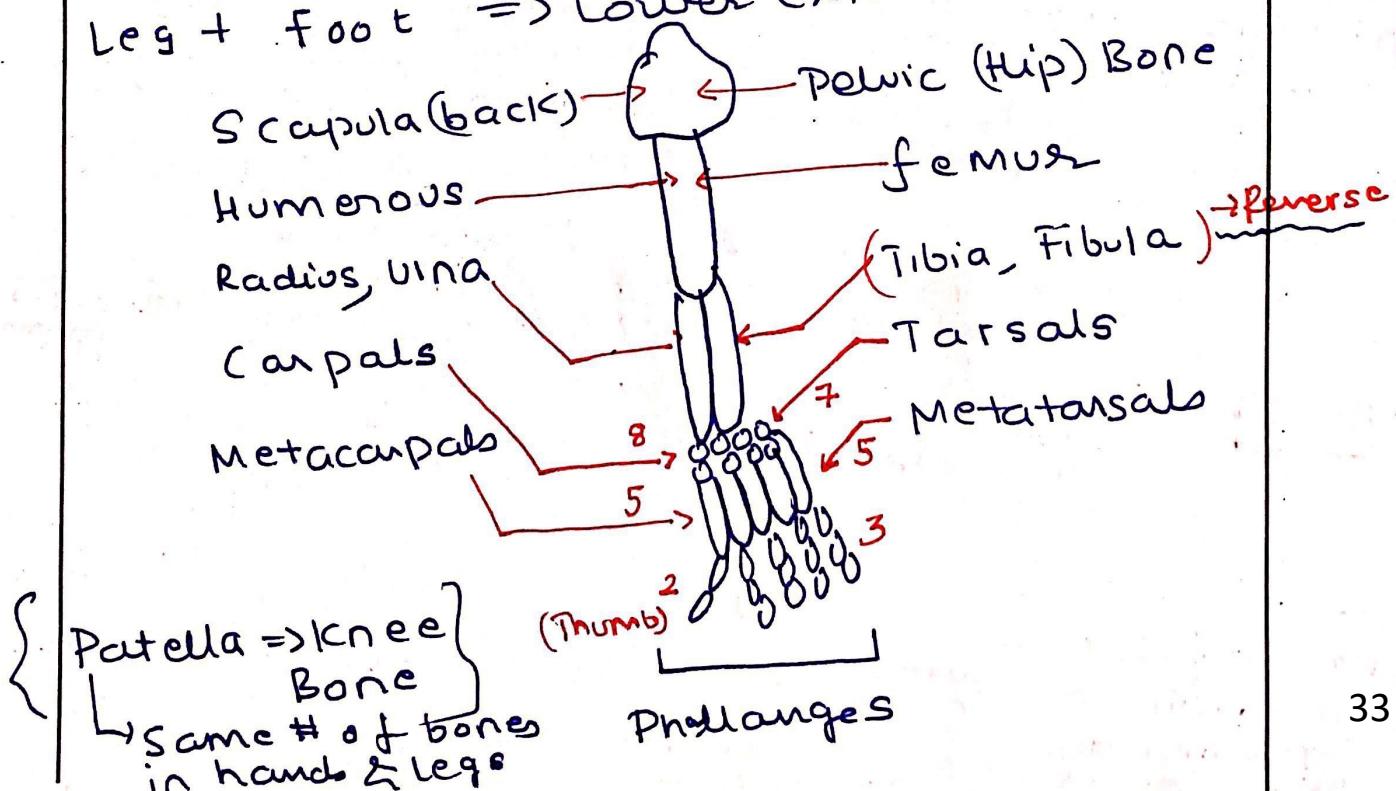


* cervical & Dorsal \Rightarrow other animals also

Lumbar & Sacral \Rightarrow Humans have in addition.

Arm + Hand \Rightarrow upper extremities

Leg + Foot \Rightarrow lower extremities



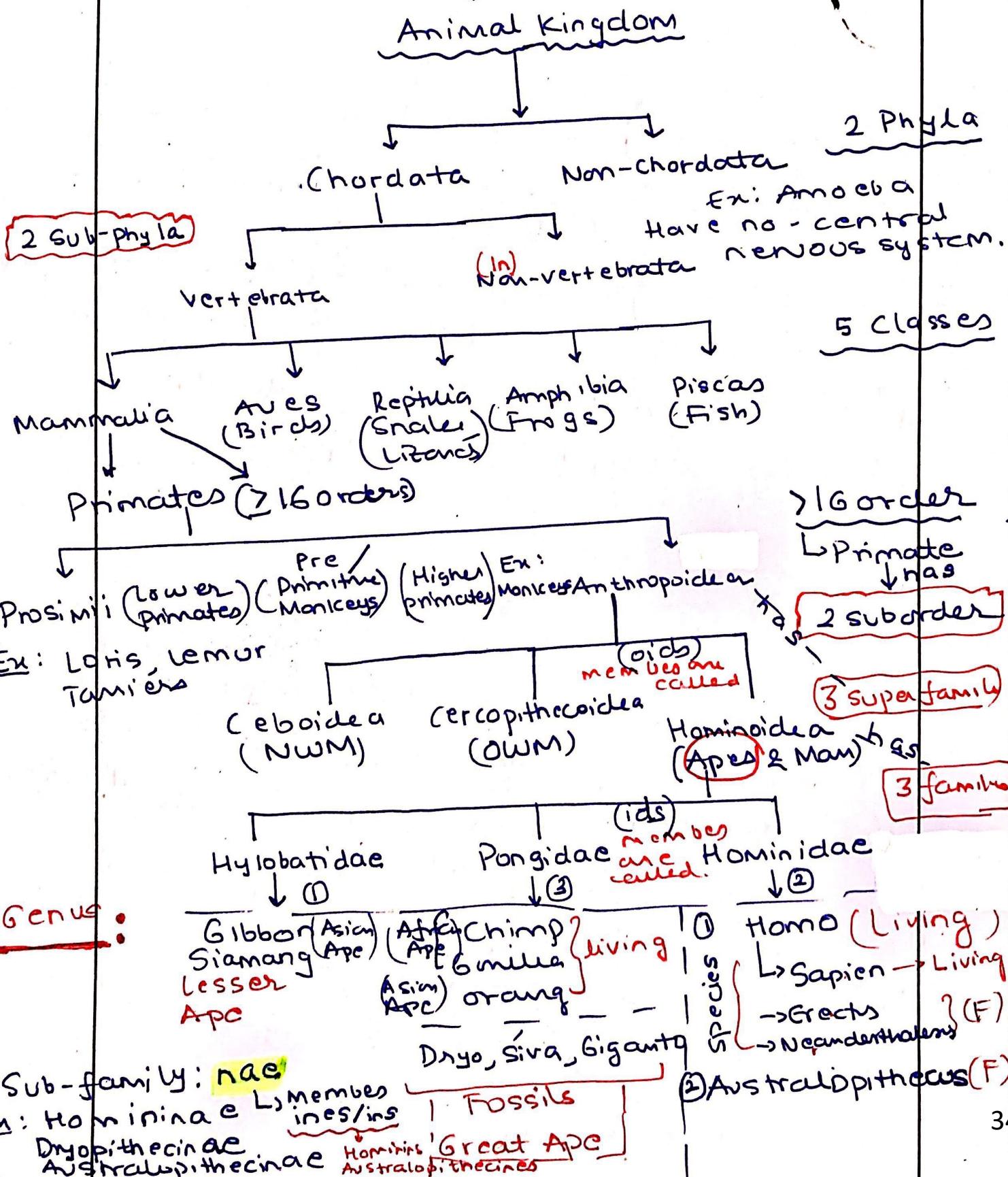
U.P.S.C.

प्रश्न संख्या
(Question No.)

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

Science of Classification \Rightarrow Taxonomy

All life \Rightarrow 5 Kingdoms



U.P.S.C.

Binomial Nomenclature = Genus + Species

- Words of non-english origin have to be underlined. → 1st letter always capital
- If one only name then it is Genus. → Can abbreviate → full Ex: D. major
- 1st letter is always small.

Dryopithecinae (Dryopithecines members) → Dryo, Siva, Gi {Sub-family} (3)
 Homo erectus
 Genus Genus Genus } Genra

Australopithecinae (Australopithecines members are called Australopithecines) → Australopithecus (Genus) {Sub-family}; (1)

Homininae (Members Hominins) → Homo (Genus) {Sub-family} (1)
 Ex: species of Dryopithecus: D. major (Species)
 (Genus) D. Africans, etc.

Missing Link: Continuity broken

Connecting Link: Connects; when missing link discovered it becomes cl.

1830's fossils \Rightarrow Not preserved

U.P.S.C.

प्रश्न संख्या
(Question No.)

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

1856 : Dryopithecus; ^{Edward} Lartet; Southern France
Mandible teeth

1856 : Neanderthal
by Quarrymen.

Most excavations in Africa \Rightarrow Most fossils in Africa.

Lemur [SE Africa
Madagascar
Comoros Isl and]

Prosimii : Loris [Sub-Saharan Africa
SE Asia]

Tarsiurs [Phillipines &
Indonesia]

\rightarrow Resemble mammals more closely.

\rightarrow Difactory sense more.

\rightarrow Quadrupeds / VC & L. $\left\{ \begin{array}{l} \text{less in} \\ \text{Anthropoids} \end{array} \right.$

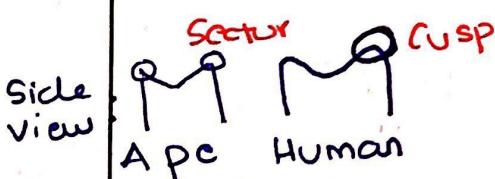
\rightarrow Tail, whiskers, Mobile ears

Fixed facial expression

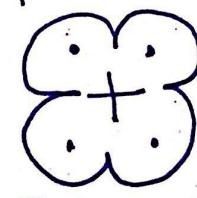
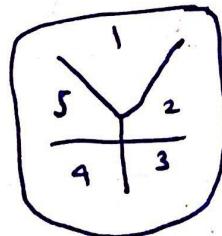
\rightarrow Small snouts

Evolutionary Changes in Skull

- Snout/reduced & almost eliminated/eliminated muzzle
- Space for teeth (\downarrow);
- $\text{U} \Rightarrow \begin{matrix} \text{U} \\ \text{Parabolic} \end{matrix}$; Dental Arcade
- Human skull is very rounded unlike animals which is flat in all directions.
- Animals lower 3rd molar: '4' cusp pattern
- Dryopithecus: 'Y-5' bi cusp pattern



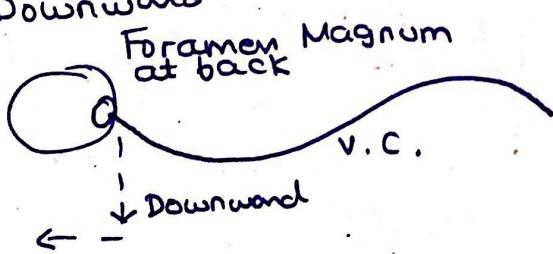
Sectorial (Premolars)



(4 pattern)

- Brain has almost covered the face in humans. (earlier it was at back)

Apes = Downward



Forward

- Alveolar/Facial Prognathism (\downarrow); though might be present. Not in everyone.

{Mouth area}

Projection face

(Dryopithecus: 32)

- # of teeth not declined; only size (\downarrow)

Avg C.C.

Progressive &

Regular increase

brain size

(many canines \uparrow)

Dryopithecus : 167

Australopithecus : 450

H. erectus : 950

H. sapiens : 1350 - 1450

↓ particularly

Canines

3X

3X

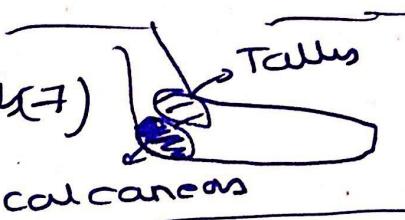
U.P.S.C.

→ Not indicator but direct evidence of bipedalism

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

Animals = $\frac{W}{4}$; Humans = $\frac{W}{2}$; → Femur is the strongest & largest bone.
↓
Mastroid → Projection → extra muscles → buttocks & se bhi muscle attach hoti hai to support head. linea Aspera

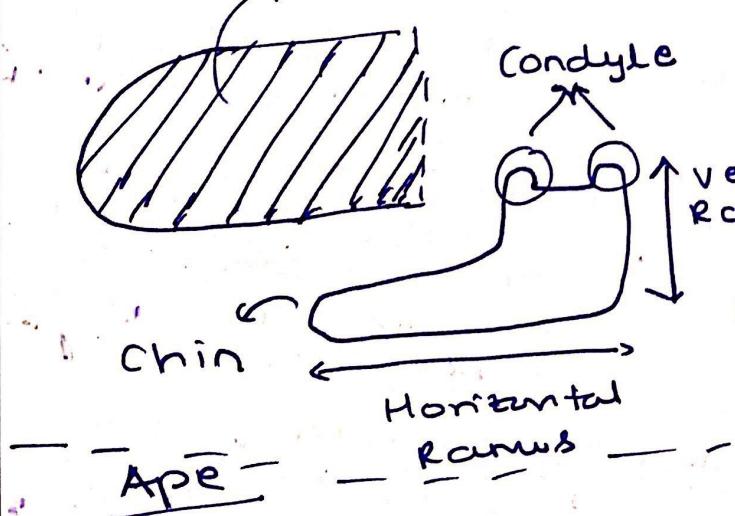
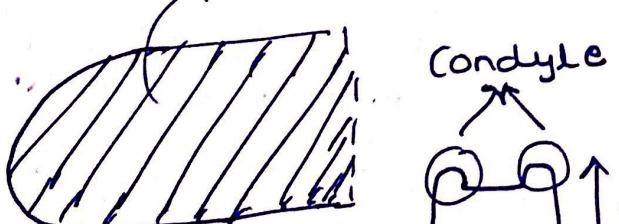
1. Talus → Ankle Bone
2. Calcaneus → Heel bone



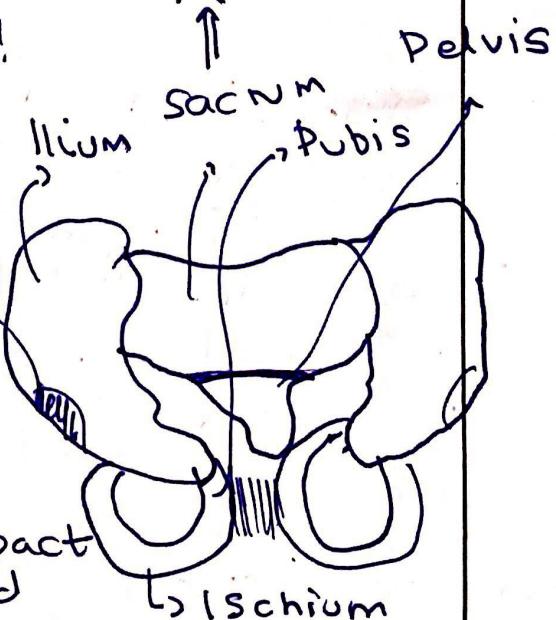
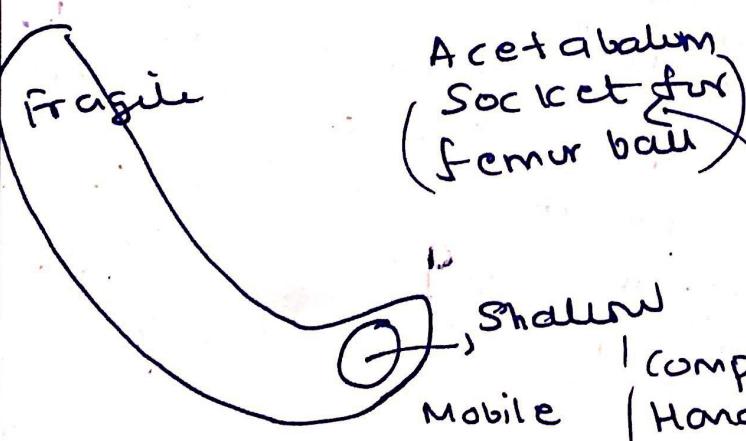
Balanced Dentition: Teeth start on same level.

Longest & final Part of Ileum: Small intestine.

Simian Shelf



Can tell if less in male/female.



U.P.S.C.

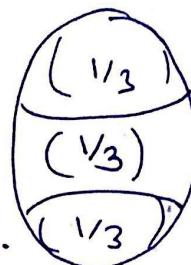
Climate of Pleistocene

(2.58 mya - 0.01 mya)

→ There were glacial & pluvial periods & then came inter-glacial & inter-pluvial periods

Upper → 100 kya - 10 kya
late
Middle → 1 mya - 0.1 mya
early
(Lower) → 2.5 mya - 1 mya

→ 4 glacial-pluvial &
3 interglacial-interpluvial
→ End of Pliocene ⇒ cooling started.



Earth

Glacial	Interglacial	Pluvial	Interpluvial
Günz	→ Günz-Mindel Interglacial	Kageran	K-K
Mindel	→ M-R	Kamasian	K-K
Riss	→ R-W	Kanjeran	K-G
Würm		Gamblian	

[115 kya - 110 kya] = Last ice age

→ 7 types of climate & 6 changes

Contrast with Mesozoic ~ 180 mya and there was only 1 change ^{towards end} ⇒ elimination of mighty the Reptiles & emergence of mammals

Pressurised to Adapt

So evolution became faster.

At least these many; there may be more.

U.P.S.C.

30-40 kya; ice made bridge between Siberia & Alaska by which 1st hominins entered new world.

Man would live at mouth of caves in G-P & in open areas in I-G/I-P period.

Pleistocene: Gelasian \rightarrow Lower [2.5 mya - 700 kya]
 Calabrian
 Chibanian \rightarrow Middle [700 kya - 120 kya]
 Tarantia \rightarrow Upper [120 kya - 10 kya]

→ Lorenzo Parrot (1865).
 En: 6.5 mya; Meso-cenozoic Transition.
 Ex: 3.5 - 1 mya; Australopithecus fossil found (cvs faster).

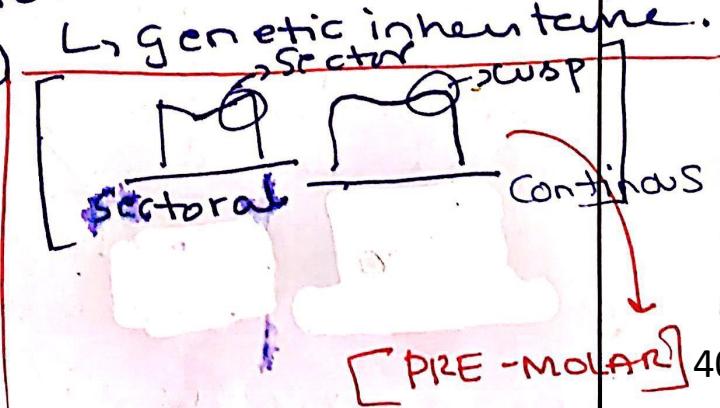
When sudden climate change willafranchian takes place betw 2 or 1 layer flora-fauna is formed that has similarities (mixed type) with prev & after periods.

Dryopithecus Ancestor? 2.5 mya gap
 ∵ not based on facts but certain logics

\rightarrow Y-5 bicusped pattern.

Lower 3rd Molar
 (raised areas)

whereas Apes had the 4+4 pattern.



U.P.S.C.

Man - Ape divergence \Rightarrow 6-8 mya \rightarrow Genes
(G.A.) \rightarrow Mol Bio

Ape - Monkey Divergence \Rightarrow 20-30 mya

OWM \Rightarrow Cercopithecoids (our ancestors) \downarrow
y-chrom from male

NWM \Rightarrow Ceboidae \downarrow
Mitochondrial DNA from female

Quadruped \rightarrow Knuckle \rightarrow Bipedalism
Walking \downarrow
 \rightarrow Holding \rightarrow Tool use \rightarrow Tool making
& throwing

Lamarck: 1809
Descent of Man, 1871: Darwin \rightarrow Origin of species
(1859)

\hookrightarrow Apes \Rightarrow Human

In Africa * ; as Darwin said Macaque
of apes are found there

1887: Haeckel said whenever we discover
missing link we must name it "Pithecanthropus
Alalus"
i.e.
"Silent Ape Man"

1891: Eugene Dubois \rightarrow Pithecanthropus Erectus
(Captain)
 \rightarrow Java Man
(H. E. Erectus)

"Erect Ape Man"

Fossil was reanalysed in 1962 by
Büttner-Janzsch & found it is
fully human \rightarrow H. erectus.

Charles Dawson: Fraud; earlier than body.
(1912-15) Piltdown Man (Cranium \rightarrow Human
41
died 1916 (Orang) Mandible \rightarrow Ape

U.P.S.C.

Eoanthropus Dawsoni i.e. (1st Man of Dawson) 1912

⇒ Said to be ancestor of man.

1953: Fraud detected by Fluorine Dating.
by Langdon.

Some say Arthur Smith Woodward also helped
Dawson commit fraud

(Friend)

Rover Broom & Dart scanned whole of Africa
and discovered >50 fossils of Australopithecines
from N, E & South Africa.

* Recognition came only after 1953
detection of Fraud; almost 3 decades.

- Not as old as believed
- Piltdown Fraud
- Child's fossil
- Brain before bipedal was norm then.
- Found in Africa so it can't be.

U.P.S.C.

So prevent this damage 2 changes took place
 1) Additional layer of enamel was added
 → protect from outside
 → Pulp cavity became bigger \Rightarrow teeth implanted more firmly.
 Thus previously the way molars/premolars were placed could have resulted in 2 types of damage to them
 → Teeth could break from outside
 → Teeth could be altogether deslocated from the root

2102
2102

[20]

II

Deciduous Permanent

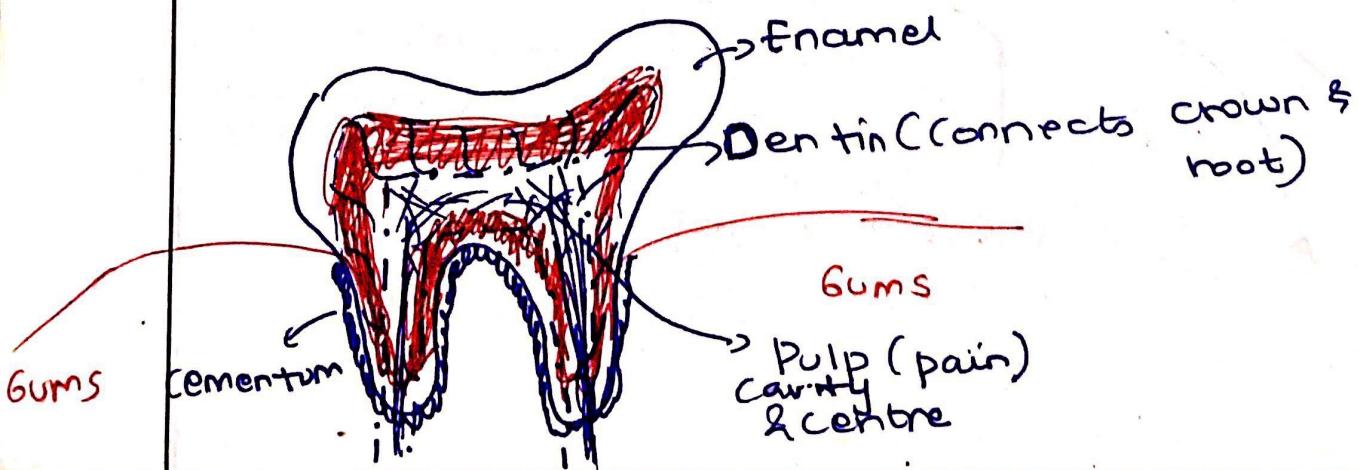
Diphyodont : 2 sets of teeth like other mammals

Because of interlocking canines
 (in apes \Rightarrow mandible can move only vertically
 \Rightarrow Molars cannot move.
 But in A & H. erectus mastication possible so fⁿ of molars & premolars several times

Root : Bottom part

Crown : Part we can see

Teeth Structure :
 Side view
 Located with enamel which is hardest part of body.



U.P.S.C.

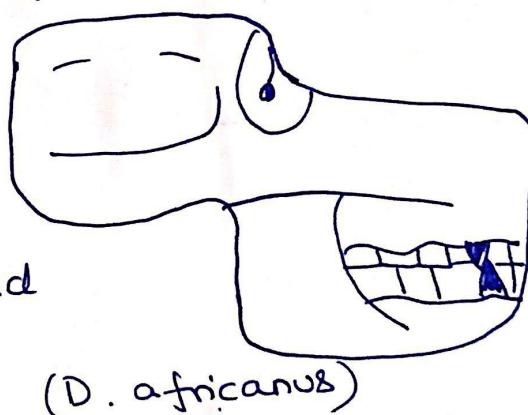
Dryopithecus

- ① Meaning: Oak Tree ; → 'Ape of Forest'.
- ② Founder : Edward Lartet in Southern France , 1856.
- ③ Find : Mandible & Teeth
- ④ Timespan : 23 - 8 mya ; Miocene Pongid [Hominoid]
- ⑤ Species : There are 2 species only ;
 - a) D. major → Gorilla
 - b) D. africanus → Chimp

Note: D. sivalensis which led to Orangutan has been clubbed under Sivapithecus.

- ⑥ Geographical Distribution : Africa ; at Uganda, Kenya [Caswanga]
Primate site
- Asia ; at India, China & Saudi
- Europe ; at Turkey, Germany & Italy

- ⑦ Skull Diagram:



- ⑧ Phylogenetic Position:

Draw the standard diagram neatly.

*
Interlocking canines implies Diastema

(D. africanus)

U.P.S.C.

Characteristics:

① → Physical: Cranial capacity: 167 cc [Walker & Trifford]
Size betⁿ: Gibbon & Gorilla avg.

Lower 3rd Molar: $\frac{Y-5}{Cusp}$ instead of ' $\frac{+4}{cusp}$ '
pattern (Diagram)

[Genetic &
Evolutionary
1st time]

Pre-molars are sectoral.

V-shaped dental arcade

Frontal sinus was present

NO forehead

Simian shelf was present

Inter-membral Index \rightarrow length of arm: length of leg

$$\frac{H + R}{Fe + T} \times 100 \rightarrow \sim 100 \text{ [approaching]}$$

Apart from dentition was similar to monkey.
It's dentition was more ape-like.

② Environmental:

Lived in trees but was not spl^{zed} tree dweller. He used knuckle walking instead of VC&L or brachiation. He was a slow walker.

Krishnapithewa Krishnali (2017): Anek Ram Sankhyay

- Hanitayalnagar ; 100km NW of Shimla
- 1st time pliopithecoids (primitive) is in India
- अग्न्याशी to Gibbon
- Infant ; lower molar teeth.

U.P.S.C.

Sivapithecus: That is Ramapithecus.

① Meaning: Ape of Shiwalik's;
Rama's Ape

② Founder: Some fossils found in 19th century,
before Ramapithecus declared [which
Find I now proved incorrect] Ex: Palpa, Nepal *

Actually all these finds are Sivapithecus only. In 1934, Edward Lewis in Hanitayalnagar
in Bilaspur district, H.P.

Simon coined term Ramapithecus as
it was different from previous
Sivapithecus fossils. (14 mya)

③ In 2002, David Pilbeam found
Si' in Potwar Plateau, Rawalpindi.
(8 mya)

④ In 2018, A. Bhandari & B.N. Tiwari
found Si' in kutch region of GJ.

③ Timespan: 14 - 8 Mya; Middle Miocene
Earliest in South Asia with evidence.
Pongid [Hominoid]

④ Species: S. punjabicus → India
S. wickeri → Africa
S. brevirostris → China [led to] D. Orang sivalensis

⑤ Geographical Distribution: Hungary → Rudabanya Mountains
China → Lufang valley where 1000
bones & 5 complete skulls found
[In addition to above places]

⑥ Skull Diagram:

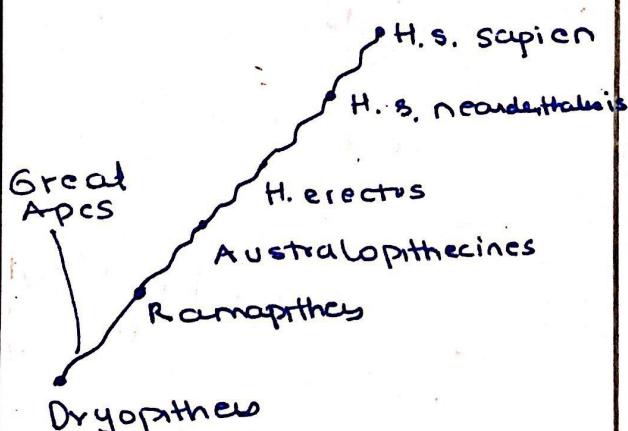
⑦ Phylogenetic Tree:

As usual.



Debate:

Till 1980's it was believed that Man & Ape diverged 20 Mya. ① So it was thought that Ramapithecus (14 Mya) was 1st ancestor of man away from ape line. Even Pilbeam had supported this, apart from Edmund Lewis. Thus R was hominid.



Focus more if question of Ramapithecus.

Post 1980's it was found that Man & Ape split only 6 Mya. ②

In light of new fossils found ③ → might be female S. Blamed confusion for Sexual Dimorphism.

In 1992, Pilbeam agreed.

Both R & S are same.

No longer hominid but one hominoid [Pongid].

{ Now considered as ancestor to Orang. There is no more controversy. ✓

U.P.S.C.

Characteristics:

Size: Large & similar to Orang.

Quadruped

jaw similar to Orang → Ghosh & Sen (1980)
'U'-shaped dental arcade; but somewhat parabolic.

David Pilbeam (1992) : Post cranium & behaviour
(why not completely orang) are not similar to orang.

Strong grip as thumb opposable and also
No bony sinus in brow area.

Marked Sexual Dimorphism

Molars thick enameled → Similar to orang and
unlike African Apes.

Forest Woodland Type Ecology, mixed areas of

forest, marshes & open was his habitat.

Most time on ground (^{forest-fringe}) → Double benefit.

but was capable of brachiation.

Gigantopithecus

Gigantic-Ape

~~(Indian) (9-4.5/9) (old)~~

Bilaspurensis ; Blacki

~~(Chinese
Vietnamese)~~

9 - 0.5 MYA

SRK Chopra of PI
UNV

also same
place as
Hannay Nagar

Young

1935 ; Koenigswald in medical store
of China (use big animal bones for medicine)
He named the genus Gigantopithecus
⇒ Mandibles, Teeth,

Some say. → Snowman, Ancestor
of Yeti of Himalayas.

5. Distribution : China
 India
 Vietnam

⇒ Not ancestor of man.

→ Largest & heaviest of any primate known.

Solid Hand Teeth Enamel

Quadruped

6. Characteristics : Large sized ; Large teeth
 Interlocking canines, Diastema

G. B named by Simons
 see Chopra (1969) 'U'-shaped dental arcade.

but Szalay & Delson (1979) Simons: 6 - 9 ft tall & 450 - 600 lbs
 say it is I G / I B.

Jolly : Seed Eater Hypothesis says
 that diet determines structure
 of teeth : G ate hard nuts
 & solid fruits.

↳ Many disagree.

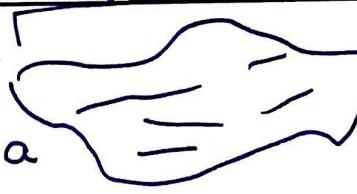
↳ Distinct from G.
 → It is a
 ground dwelling herbivore

→ Died due to SPL.

Biochemical study of blood proteins of Primates :

Gibbon sep 20 Mya. ? C-G : 6 - 8 Mya
 (Lesser Ape)

DNA Study : C-G : 6 - 8 Mya

Narmada Man

1. Meaning : Man of Narmada
2. Founder : Arun Sonakia of GSI in 1982
in Hathnora, Hoshangabad (MP)
found cranium of '30 yr female'.
3. Time period : varies; Lower Paleolithic
Acheulian Tools
(calvaria) Only place where fossil of human found in India.
4. Finds : a) 1982 find by Sonakia (1984)
said it was Erectus and 0.1 Mya.

Even it to be H. e. narmadaensis;
Even GSI consider said it was Erectus and 0.4-0.3 Mya.
Kenneth AR Kennedy, Sonakia et al in AJPA (1994)
raised doubts about it being Sapien.

But in UoD Seminar (2005), Sonakia
So Sonakia considered it as H. erectus.
- Even Marie Antoinette De Lumley considered it as advanced H. erectus due to its high 'cc'.
But after discovery of H. s at Jebel Irhoud
[worked in ASI]
Morocco [0.309 Mya]; Aneek Ram Sankhyay has
(2018)

U.P.S.C.

Youngestइस पाठ में कुछ
न लिखें
(Don't write anything
in this part)

raised doubts about it being H. sapien or 'oldest erectus'. The debate to this day remains inconclusive.

b) In 1997, he found right clavicle & lower rib at same place and dated it ~700 - 500 kya. In 2010/11 he found long bones again.
'In-situ'

Publication: Current Science & DTE "this lady"
Review or
part 2, 2003

Facts: women (135cm); stocky & robust

↳ the pigma / dwarf not possible to tell; but she was shorter than smallest pygmy female of Jarawa/Onge.

ARS(2018) called it as "Archaic H. sapien"

Theory

Parallel Evolution

Narmada Man (1997) is diff from tall & well built African H. sapien, so both one parallel evolutions.

But rejected Chinese claim as Peking Man was at best only zoolaya.

Narmada Man (1997) is earliest H. sapien. So Narmada Valley was the centre of Human Civ. Man spread out from here to Africa, Europe and cause of Paleolithic cultures there.

Australopithecus

① Meaning: Southern APC ;

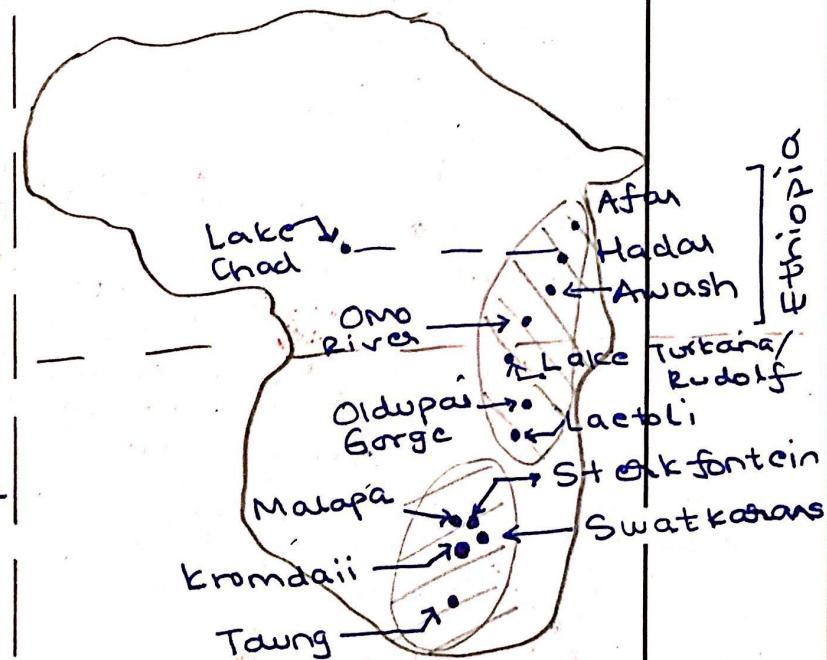
② Time span: 5.5 - 1.8 mya, Hominid Plio-Pleistocene

③ Geographical Distribution :

They have been found only in Africa.

Southern Parts → Caves

Eastern Parts → Lakes, River valleys & flood plains



④ Species: On the whole closer to humans than Apes.

1. A./An. ramidus → 4.5 mya → Awash → Tim White (1994), Nature
2. A. anamensis → 4 mya → Oldupai Gorge → Meave Leakey (1995)
3. A. bahrelgazai → 3.5-3 mya → Chad → Brunet (2005)
4. A. afarensis → 3.2 mya
 - a) Lucy: 1974; almost complete fossil found by Mary Leakey & Donald C Johanson
 - b) 1st Family: 1975;
 - c) Laetoli Footprints: 1979; By Mary Leakey; they are oldest & direct evidence of bipedalism.
5. A. africanus → 2.5 mya → Taung near Kimberly, SA → Raymond Dart (1925)

It was 1st A to be discovered.
6. A. sediba → 1.97 - 1.78 mya → Malapa, SA → Lee Berger (2011)
7. A. boisei → 1.9 - 1.2 mya → Oldupai Gorge → Mary Leakey (1959)

H. habilis → 2 mya → Oldupai Gorge → L.S.B Leakey (1962/64)

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in this part)

→ Some say Ramidus is Andipithecus & others say it is A.

→ Paranthropus is an outdated terminology no longer used

→ 2-branch & 3-branch are now outdated.

Initially 2 different species wt

→ Robustus is Robustus &

boisei is hyper-robustus so differences are only quantitative.

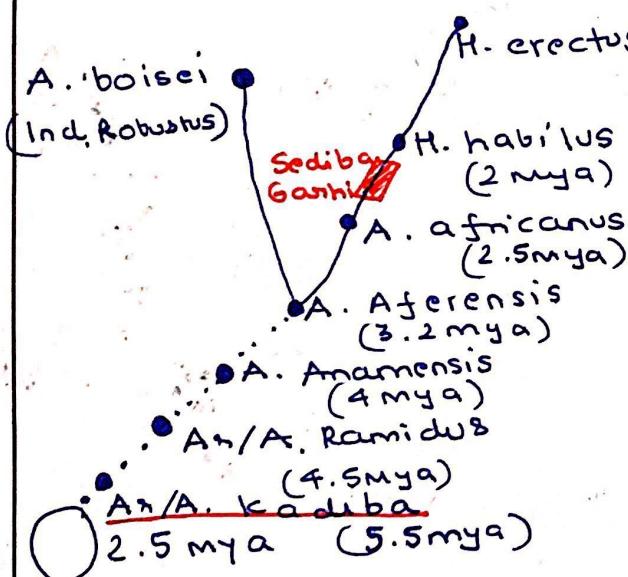
Now same species.

→ Robustus → Male [Rough & Tough]

Africanus → Female [Gracile]?

But then at places only Robustus fossil & at others only Africanus fossil ⇒ so separate species.

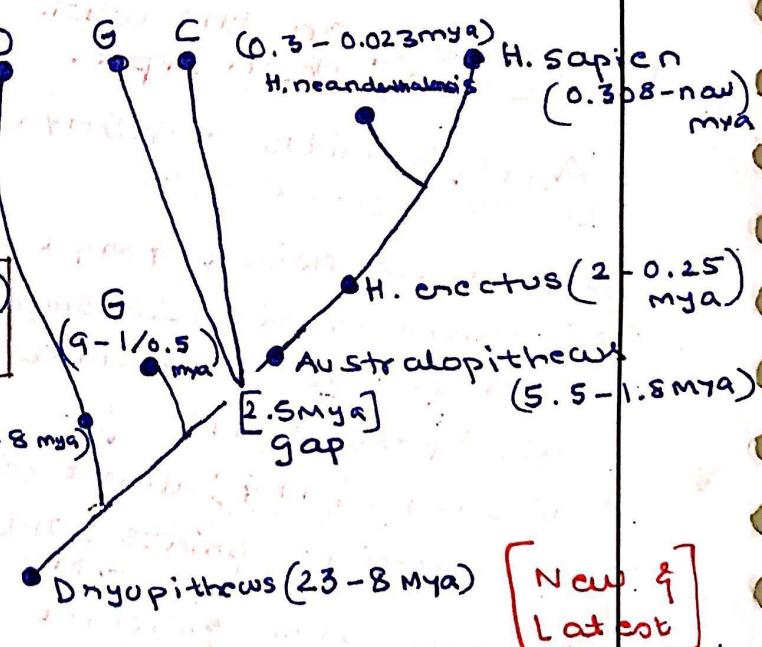
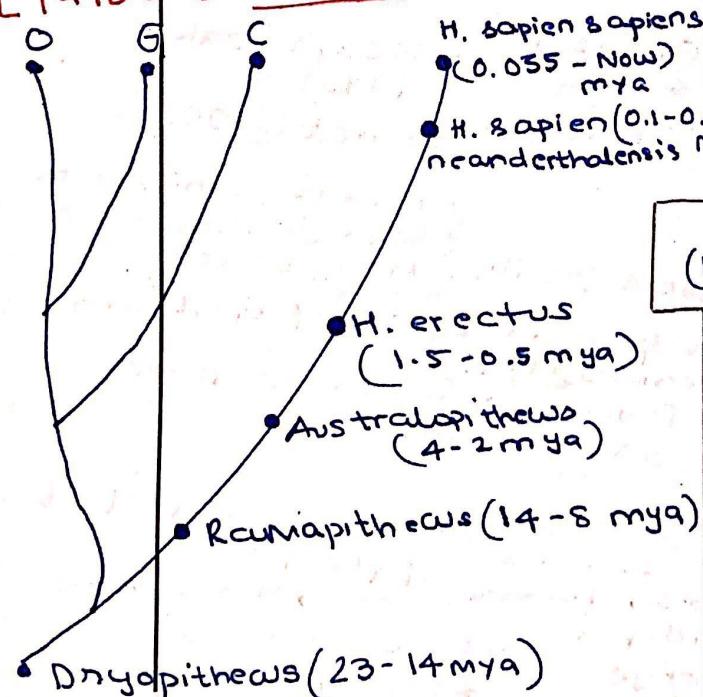
→ H. habilis is just slightly more advanced than A. africanus. Majority opinion [not consensus].



→ Over specialization in diet and competition led to extinction of A.

⑤ Phylogenetic Position:

[Outdated 1970's] → Based on logic that Great Apes separated ~20 mya.



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Maximum
Apes is 650cc.

Characteristics: Cranial : 375 - 775 cc.

Capacity [Avg = 450] cc

Min of humans is 823 cc.

1st known bipedal; semi-erect.

Size: 4ft & ~100 lbs.

PHYSICAL

Face Prognathism present

Foramen Magne at base of skull

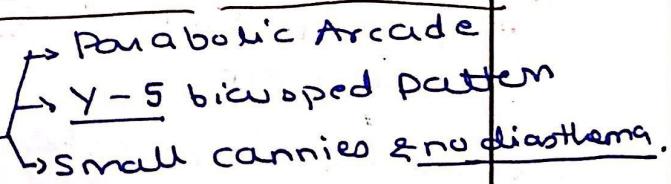
① Inverted 'Δ' structure just behind ear occurred for 1st time in A & well dev in H. erectus. It is indicator of Bipedalism as it helps to balance the head. \Rightarrow Mastoid.

② Same thing for linea Aspera.

③ Same thing for forehead. It is not present in Apes.

No chin & Simian Shelf.

Dentition was human-like zygomatic Arch present



Men & women groupings occurred as long childhood so the mother needed help.

DOL as males hunting & female at home-base.

Casual Tool Maker and oldest are 3.2 mya. It was Chopper-Chopping crude. Not part of survival strategy.

Pilbeam (1992): Hunted small animals by capturing them in his Bolas. [Trapping animals]

it can climb trees also.

Grassland & Savannah

Lng is doubtful & no evidence yet. Called as Nut-cracker man.

Cave near Olduvai Gorge \Rightarrow Stone wall at entrance of cave that acted as wind-break.

1st known to have culture: Osteo-donto-keratic.

(R. Dant)

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Value Addition

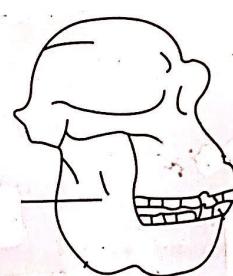
- ① → Dean Falk Et AL (2011) in PNAS has revised age of Taung Baby from Raymond Dart's estimate of 5-6 years to baby of 2-3 years.
- ② → Lovejoy (2010) did biomechanical research. Said that atleast in early stages A had shifting gait while walking slowly.
- ③ → Prof Sussman (2007) says w/o knowledge of fire & in absence of large canines hunting would be meaningless. So at best he was scavenger/hunter of very very small animals. Otherwise he would be easy pray to large carnivores. So he lived in groups and spent the night in trees provided him with protection.
- ④ → Shorter Hind-limbs so less efficient bipedalism than man.
- ⑤ → 'Lucy may not be our Mum': Nature (2015)
There existed A. deyiremeda at same time & in same region. It is better candidate.
- ⑥ → Donald C. Johanson in 1975 in Hadar discovered 1st human family of 13 individuals [> 5 are adults]
It was also A. afarensis. Even Many Leakey in same team. (3.2 mya)
- ⑦ → Should A be included in Homo? Generally felt that Bipedalism, Culture ought to be enough
Infact molecular biologists consider Chimp to be in homminini due to genetic similarity. It is incorrect as their family is Pongidae. Name suggested is: Homo Africanus.
↳ If you follow this then doesn't A have a much better claim. So it is an ongoing debate.

8 → Ben-Dor & Boncristiani (Quaternary Journal, 2021) show link between ↑ brain size & [the extinction of large mammals]. Subsequent killing of smaller & swift animals required greater group org. & greater cognition & better comm' skill resulting in larger brains. Diagrams → skull, brain

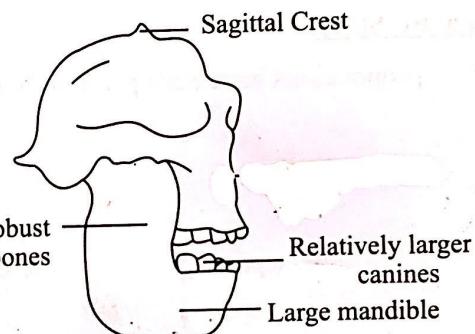
So we thank extinction of large animals for our brain dev in early pliocene.

- ① Dental Arcade
- ② Sectoral Molars
- ③ Foot; locomotion
- ④ Tools of A.
- ⑤ Lined Aspera

Actually after A; the biological changes are much less.



Australopithecus (gracile)



(robust)

AUSTRALOPITHECINE TOTAL MORPHOLOGICAL PATTERN

	(AFRICANUS) More evolved	(ROBUSTUS)	Bipedal features Similans Culture
Cranial Capacity	450-600 cc.	250-600 cc.	
Frontal region	rounded and well developed	underdeveloped	
Suborbital region	lack of development	large supraorbital ridges	
Simian Shelf	absent	present in some	
Dentition	balanced	unbalanced	Boisei → E. Af
Dental Arcade	parabolic	parabolic, but less so	Robustus → S. Af
Foramen Magnum	in hominid but not modern position	even more forwardly placed	
Pelvis	hominid	gorilloid and hominid	
Foot	non-divergent big toe 4ft, 100lbs	divergent big toe	5ft, 120lbs

Homo Habilis

- ① Meaning: The Handy Man;
- ② Timespan: 2 mya; Upper Pleistocene Hominin
- ③ Founder: LSB Leakey in Oldupai Gorge in 1962/64.
- ④ Geographical Distribution: Omo River, Ethiopia
Tukana Lake, Kenya
Sterkfontein, S. Africa
- ⑤ Phylogenetic Position: → Most say allometrically scaled version of A. africanus.

Cranial Capacity ⇒ 650 - 800 cc → Frontal lobe not seen so advanced in A as per the endocast studies.
 Braincase was rounded.

Size ~ 40-50 kg

Physical
↓
Dentition ~ A. africanus.
But pelvic & leg bones more similar to H. erectus.

→ Savannah & Forest Woodland Type Ecology

- * Oldowan Industry of Pebble Tools (~2 mya); one of the oldest found.
- Unique behavioural pattern different from non-human primates at the time.
- Food Source? Scavenging & hunting? but frequency not known.
Barter? Maybe by storing, sharing & transporting.

Homo Erectus

① Name: Erect Man;

② Time Period: 2-0.2 mya, ^{1st} recognised member of our Genus.

This stage represents bio-cultural evolution of man.

③ Founder & Find:

Eugene Dubois in 1891 in Solo River region of Java. Hence called Java Man. He called it Pithecanthropus Erectus as in betw Ape & Man. But in 1962 research by Buettner Janusch showed it to be completely human so he called it H. erectus.

WC Pai in 1921-29 in Peking region of China discovered another fossil. It was studied by D. Black. (750kya)

④ Sub Species:

a) Java Man: H. erectus erectus/H. erectus javanicus
→ 1.8 - 0.2 mya [Youngest of all H. erectus here too]
Infact believed that African H. erectus had disappeared by n 400kya.
Java man was least evolved of all.
↳ 900cc was avg cranial capacity only

Mojokerto → Oldest by K-Ar dating
(Java) (1.8 mya)

Dated in 1993 by
Curtis & Swisher.
58

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b) Peking Man: *H. erectus pekingensis*

→ 1.7/1.5 - 300 kya;

→ More advanced than Java Man.

→ 1000 cc avg; but some even 1300 cc.

DEBATABLE c) Narmada Man: *H. erectus narmadaensis*
(1982 Discovery)

→ 0.3 - 0.4 mya

→ Most evolved of all *H. erectus*.

→ 1260 cc avg

As per
Sonakia
in UOD(2005)
but ARS(2015)
disagrees

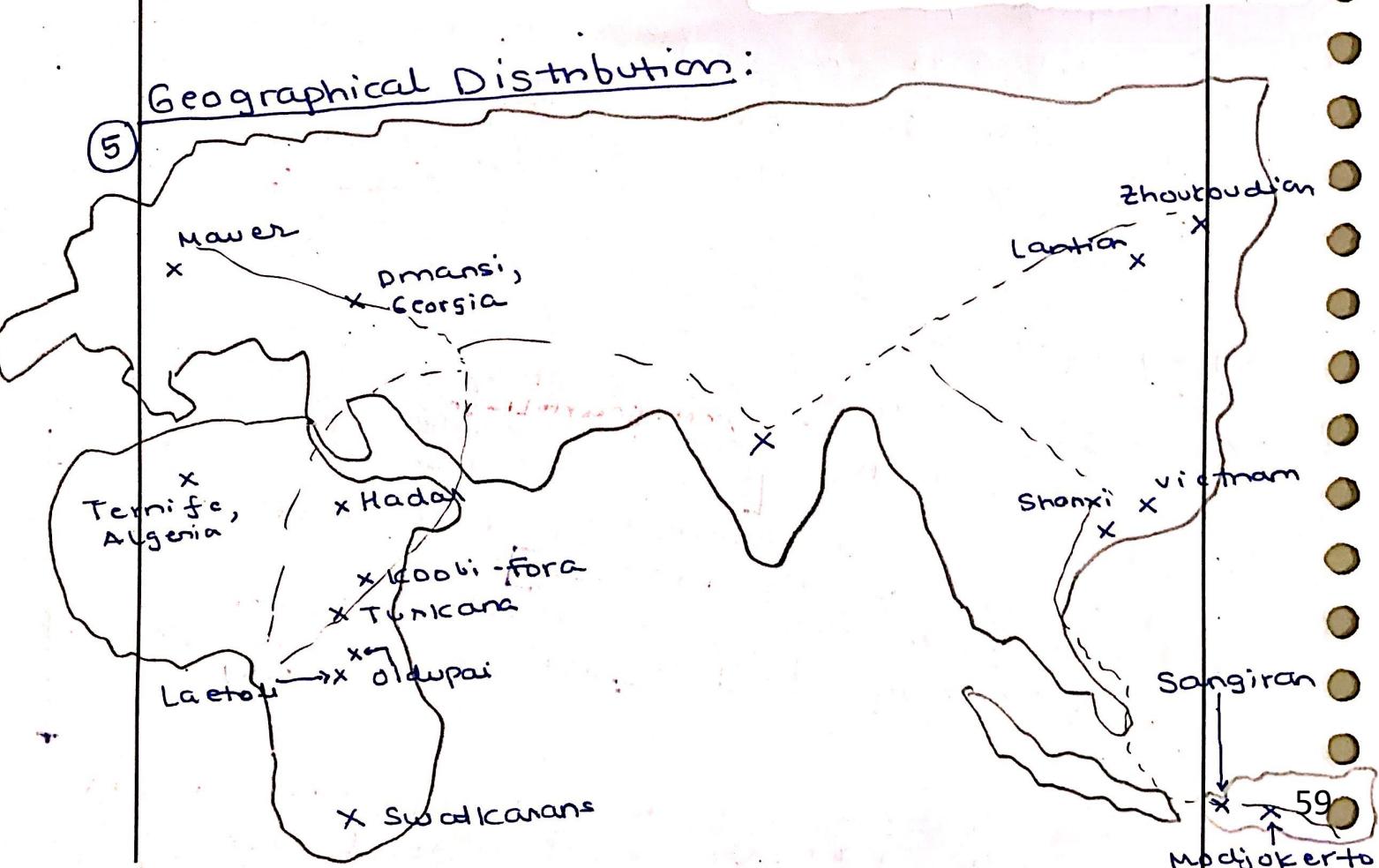
(X) d) Heidelberg/Mauer Jaw: *H. erectus Heidelbergensis*
Nowadays it is highly debated here
& considered *H. heidelbergensis*.

Note: Africa found in

- Oldupai Gorge: 1.2 mya by Leakeys
- East Africa: 1.7 - 1.5 mya

Geographical Distribution:

(5)



(6) Characteristics:

	<u>Primitive</u>	<u>Advanced</u>
①	Prominent <u>brow ridge</u> across brow & both orbits which is nearly absent in modern <u>H. sapiens</u> .	Cranial capacity is approaching that of modern <u>H. sapiens</u> . 950/ arg
②	Facial & Alveolar Prognathism (primitive face)	<u>Erect</u> & <u>Bipedal</u>
③	<u>very thick</u> cranial vault bones & flat	<u>Pelvis</u> & forelimbs modern
④	<u>Chin</u> was <u>not</u> well developed yet. Only in few fossils evidence found. In <u>H. n</u> it was present but receding backwards. Only <u>H. s</u> have proper & distinctive chin.	Parietal lobe was well developed \Rightarrow <u>Lng?</u> <u>Paranasal?</u> As per Dubois
PHYSICAL		So: Teeth & Post-Cranial \Rightarrow Similar to <u>H. s</u> Max differences in <u>skull</u> .

UNIQUE FEATURES

→ Shovel shaped Incisors; many H. n's of today also have

→ Taurodontism in molars & pre-molars \Rightarrow Evolutionary feature

1st elaborate culture ; in Lower Palaeolithic.

He was regular tool maker,

Ex: Zhoukoudian in China tells that raw material was distance of 5km; yet he had travelled. Because it was essential for him.

[B.R.C. TRIM]**[CULTURAL]**

Point of Tools
Point

① Tools :



⇒ Levallois technique too

Needs proper Dol
(Mudholes) used

Ambraza & Torralba
Spain
Zhokoudian: Elephant,
Lion, tiger
Horse

② Big Game Hunter;

③ Marriage Institution developed;

④ Rituals: Pech De'Le Atze cave in Spain → Victor Burnow found bison rib with 2 exactly parallel lines.

⑤ Cannibalism : China?
doubtful

⑥ Fire : 1st to discover fire; n 1.5 mya.

→ Used for breaking large rocks, working at night & cooking [↓ in size of teeth]

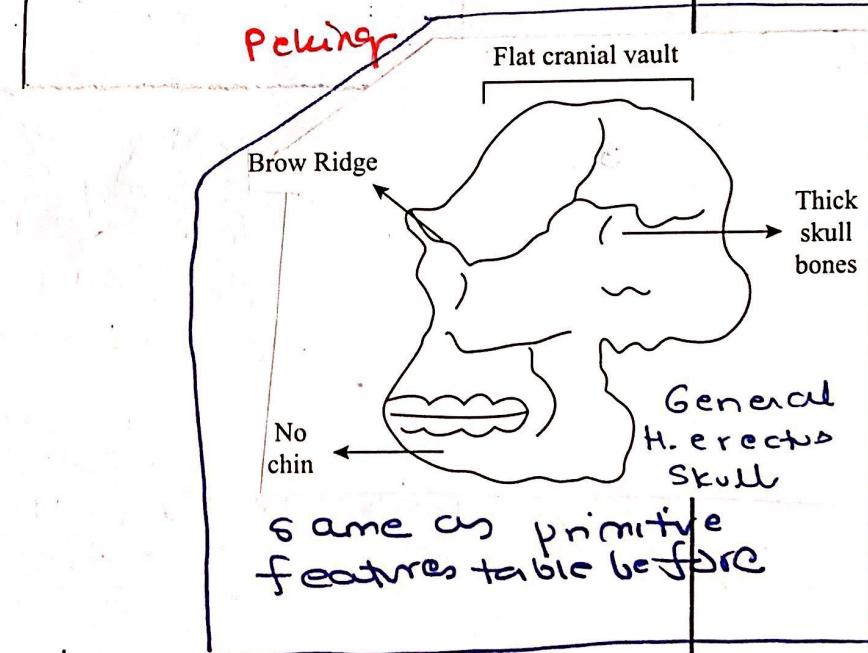
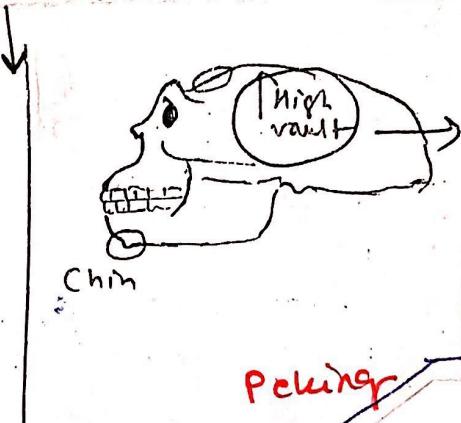
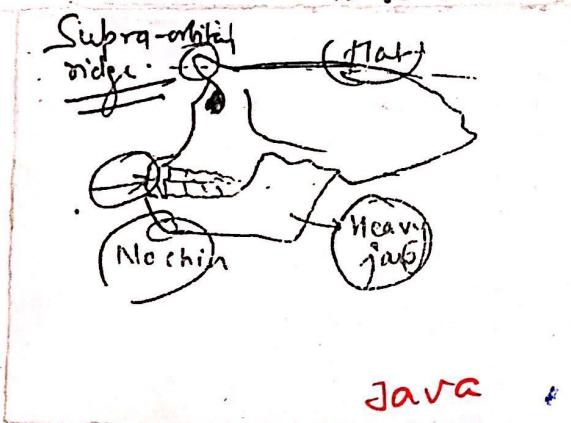
→ Able to capture colder climates.

Oldest but
not definite ⇒ Turkana
(1.5 mya)

; 100%
sure → Swatikarans
(1 mya)

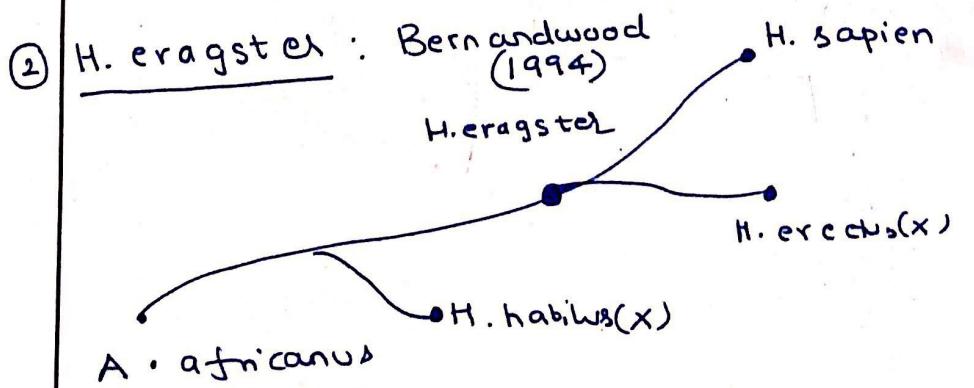
COMPARATIVE CRANIAL PATTERNS OF JAVA MAN & PEKING MAN

Trait	H. E. Javanicus Java Man	H. Erectus Erectus	Peking Man H. E. Pekinensis
Craniocapacity range	775-975 cc	850-1,300 cc	More evolved
Average craniocapacity	875 cc	1,075 cc	More erect than Java Man
Platycephaly	extremeless	pronounced	(Younger)
Sagittal keel	extreme	reduced	
Supraorbital region	huge torus	reduced, beginning to divide into separate ridges	
Occipital torus	Robust	less massive, occipital region more expanded	
Mandible	massive and well-defined	reduced, more modern	
Chin	large & heavy	slight indication of beginning	
Dentition	absent	absent	
Canine teeth	occasional	nonprojecting	
	some projection	Smaller	
	longer teeth		



⑦ Phylogenetic Position:

① H. habilis: Leakey, Johanson, White, Napier & Pilbeam



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Homo heidelbergensis

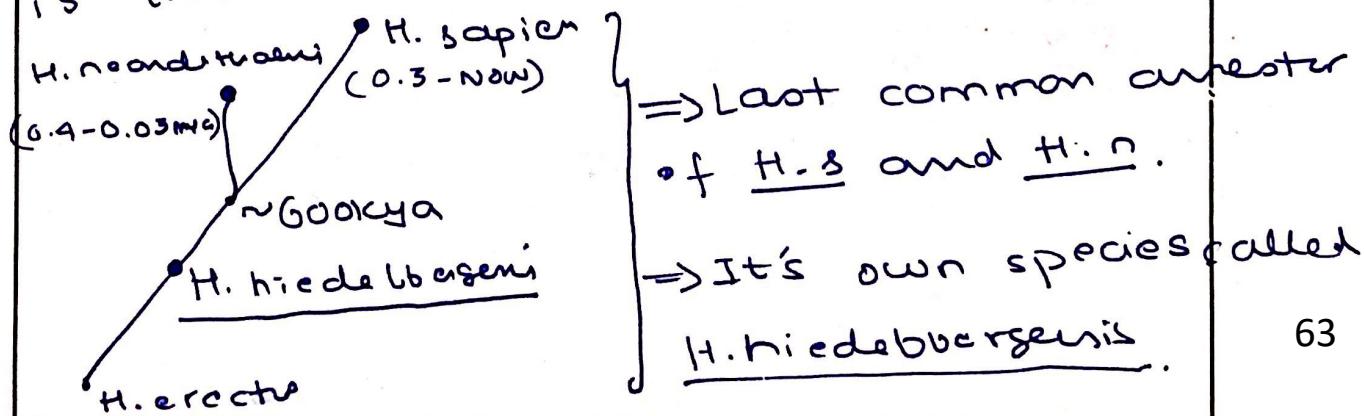
Meaning : Man of Heidelberg

Time Period : 700 - 200 kya; Middle Pleistocene
Lower Paleolithic

Find : Mauer Jaw in Sandpit in Heidelberg,
Germany by Daniel Hartman (1907).
Studied by Otto Von Schoetzen stack,
who said jaw is ~450 kya.

Phylogenetic Position

1. Considered sub-species of H. erectus, so it proved presence of H. erectus in Europe. Boule & Vallois further opine that it led to H. n. of Europe.
2. However, latest evidences acc. to Chris Stringer (2010) say that it was a very widely distributed species. It is transition between H. erectus & H. sapiens.



⇒ Last common ancestor of H. s and H. n.
⇒ It's own species called H. heidelbergensis.

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H. heidelbergensis
Intermediate
of H. S & H. n
Characters

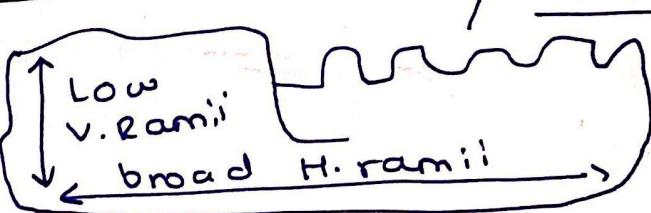
→ H. n in Europe,
→ H. S in Africa.

Characteristics → Abbevillian Tools !!

(Simian)

- Jaw: Similar to Gibbon → No chin
→ Between 'U' & 'V'
- Sigmoid Notch shallow → 'n' to Gibbon
- Angle of Jaw truncated → 'n' to orang
- Square & Massive
- Condylar round & blunt and one at higher level compared to H. S; so it is a Simian character.

H.ramii > V.ramii
> H.sapien



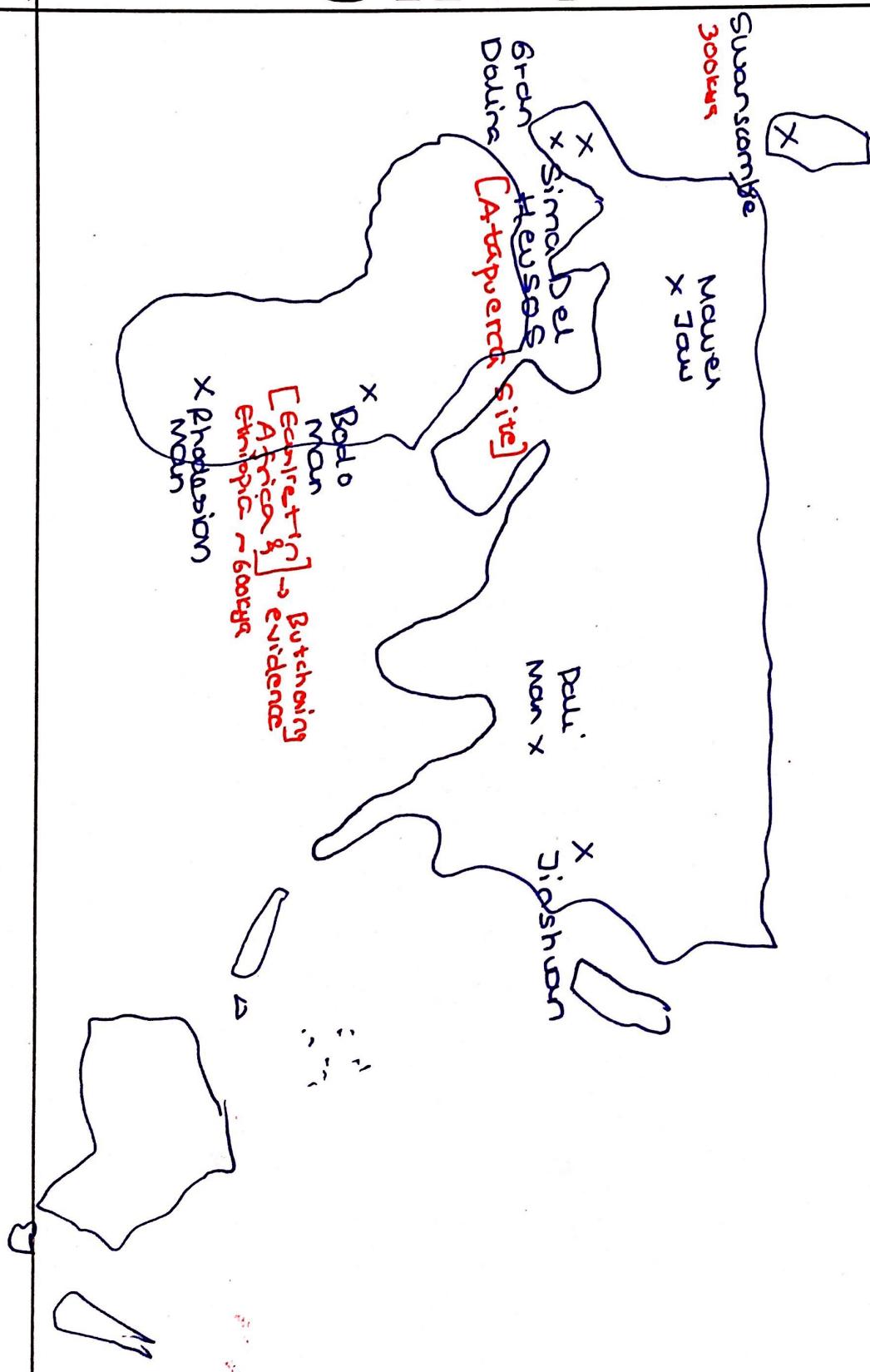
Teeth
(Sapient)

- ① Macrostomia → Normal Size
- ③ γ - 5 → No diastema
- ② Normal Size
- ④

Breadths Scm

[only 3.7 cm in
humans]

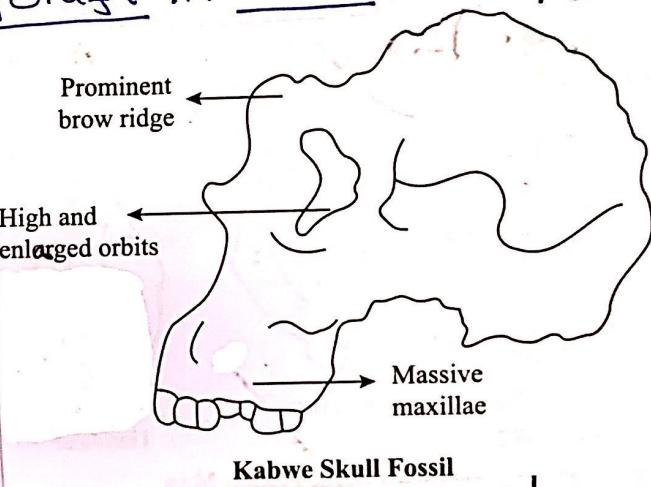
Distribution of *H. niederbergensis*



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Rhodesian Man

- ① Name:** Man of Rhodesia;
- ② Time Period:** 0.8 - 0.12 Mya; Middle Pleistocene
- ③ Founder:** → SKULL & Limbs by Twijelaar in 1921 at Broken Hill (cabwe), Rhodesia.
Find So called 'Broken Hill Man'. [↪ ancestor of this specimen]
- SKULL by Pycraft in 1928 [Same place]
- ④ SKULL Diagram:**
- ⑤ Phylogenetic Position:**
- ↳ Definite advancement over erectus noticed.
 - ↳ van Bonian says close to divergence of H. S & H. N.
 - ↳ Arthur Woodward Smith called it as H. rhodensiensis (1921).
- ⑥ Characteristics:**
- ↳ Receding forehead
 - ↳ strong cheek bones.
 - Skull → Similar to Au x Lachapelle H. neanderthalensis.
 - Dolicocephaly.
 - Post Cranial → Like H. sapiens & very good.
 - Teeth → Like H. sapiens
 - Affected by caries
 - Normal size & fewer wisdom teeth.



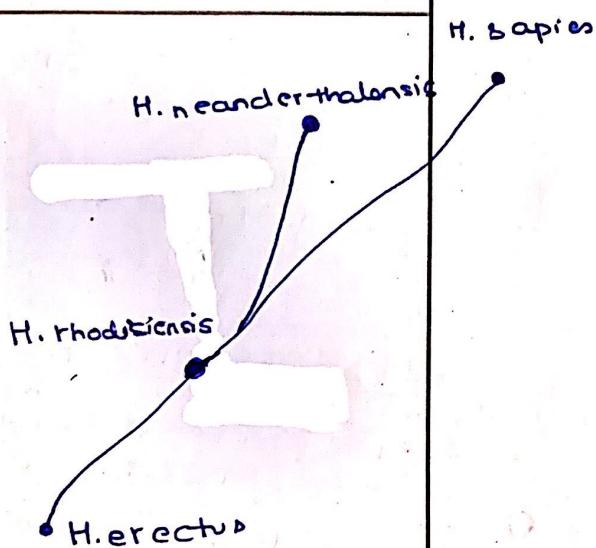
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Ex-
Exam
Topic:

View 1

Dubois: H. n & Rhodesian Man, similarities are only superficial. He says it is more similar to Australians [H. s akin to Australian type] but even more primitive than that. He says it deserves title Proto-Australian. It was very different from all races & varieties of African Negroes.

Neandertal Man, Rhodesian Man, and the modern Australian race present a common stock of primitive characters. In spite of differences which distinguish them, it may be admitted that the three forms have a common origin; they must have spread and lived for a long period over vast extents of territory. In Europe, Neandertal man seems to disappear somewhat abruptly after the Glacial period, but perhaps it was not total extinction. He may have continued to live in other regions. Indeed, it seems that Homo rhodesiensis reveals to us the persistence in Africa of a human type, long since become fossil in France. This type seems to have preserved in his skull and in his face the primitive features of brutishness, but, in the course of ages, he seems finally to have attained a perfectly upright attitude; in this direction he evolved further than his ancient European brother. We are thus led to think that he must have survived for a long time in the Dark Continent, as the last representative of a very ancient human form, now obsolete.



⇒ Now mostly considered synonym of H. niedebergensis.

CULTURAL

Even Bushman (↑) use similar implements.

Homo Neanderthalensis

- ① Meaning: Man of Neander valley
Coined by William King.
- ② Time period: 300 kya - 23 kya; Now 400 kya due to Sima Del Hueso
- ③ Founder: 1856 in Dusseldorf, Germany
by Quatremere. It was 1st human skeleton to be discovered.
Aix La Chapelle by 3 priests:
A. Bouyssarie, J. Bouyssarie & Bardon in 1908 at Correze Cave, France.
It was studied by Boule in 1957.
- ④ Geographical Distribution:



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⑤ Phylogenetic Position :

It is believed that H. S & H. n split 750kya.

→ The 'old' pre-1970's single line theory leading to Cro-magnon has been rejected.

→ Dual Phase Theory by G. Kennedy & Stringer (1980) is most popular. Even Pilbeam (1992),

Ex: In Levant; H. s & H. n coexisted but there was minimal gene-flow between them.

— — — — — — — —
How did Neanderthal's go extinct?

① Physical Extermination / Replacement / Discontinuity :
Argues that there was very limited inbreeding. [Andrew (1988)]

Warfare didn't occur always. In addition, H. n dna is found in European populations.
(w2%) genes in

② Interbreeding Theory / Continuity Model

It is most widely accepted today.
By Dr Krause Et Al in Nature (2017) based on DNA studies. But why so less % :

a) Pop of H. n was smaller & isolated.

b) Bad H. n genes eliminated by NS.

c) Male Human & female neandertal mating was not too successful; as H. n m-dna which is maternally derived is rare in

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human populations.

d) H. n. 'Y chromosome' dna had mutations that caused miscarriages.

↳ Fernando Mendez [American Journal of Human Genetics, 2016]

Thus cummatively H. n genes are less. Modern non-african populations share ~2% H. n genes & ~20% of H. n genome has been preserved in our population. *

③

Other Minor Theories:

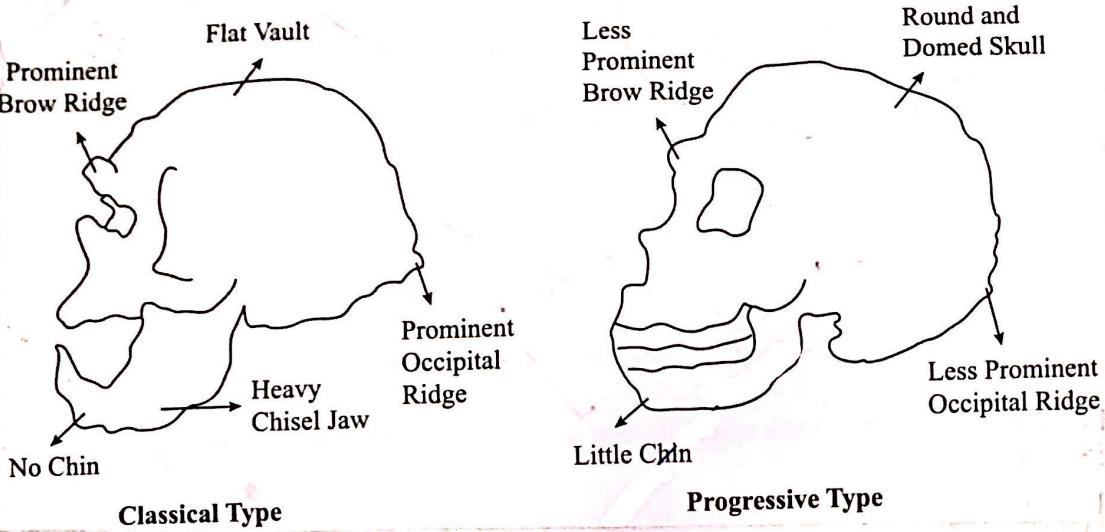
a) H. n became unfit due to env 'A's.
Ex: Over sp^{ec} for cold; but when it became hot \Rightarrow unfit.

But truth is 40-25 kya no major climatic changes took place. Rather 25 kya was coldest part of pleistocene.

b) Mary Stiner says H. n lacked sex based division of labor as women hunted too which was disadvantageous.

c) Lack of GV & Inbreeding:

Ex: A Habi Mountain & Vindija (cave, Croatia) fossils of H. n one genetically very similar to each other.



Case Study: H. n noses took in more O₂ (2018)

As per 3-D models due to large protruding noses to warm & humidify cold dry air.

Infact H. n & H. s >> H. e. h;

It was because of high energy req [4480 kcal/day] in cold climates. So more O₂ needed for metabolism.

Oval shaped cranium shorter & stocky cranial capacity ~ H. sapiens

Characteristics: Taurodontism \rightarrow H. n descended ss incisors from H. e.

⑥

Progressive	Classic
→ Mt. Carmel & Amud-Grot, Israel in 1931.	→ Aix La Chapelle in France (1908)
→ 200 - 50 kya	① Ecological shift → 75-40 kya. Evolved from Progressive as adaption for cold
→ 1400 cc. [More evolved than classic neanderthal]	→ 1600 cc; More cranial capacity yet considered less evolved
→ More Sapien; no brow ridge.	→ More Erectus; had brow ridge
→ Chin & forehead normal"	→ Less dev & receding".
→ Normal Height; smooth skull which was vaulted & round.	→ Short & stocky & heavier; rough skull which was platycephalic; oval.
→ Supraorbital ridge minimal	→ Continuous & rounded.
→ Less broad nose;	→ Nose broader
	→ Ribs stronger;

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Classic vs Progressive Debate

Traditionally N in W. Europe \Rightarrow Classic
N in elsewhere \Rightarrow Progressive

* It was said that classic was specialized for living in colder conditions. The term Specialization in biology leads to only

1 conclusion i.e. Sp^z leads to extinction.
Since in those days we considered N our ancestors we thus traced decent from Progressive N.

Dichotomy by Hooton & Montagu

Sp^z: 3 types;

① Ecological: If species adapts to particular ecological niche; then as the climate changes the species can't adjust to new conditions & becomes extinct.
Ex: Himalayas was Tethys sea earlier.

② Anatomical: If size of individual becomes so large that it can't be retracted if required then it is called Anatomical Sp^z.

Ex: Elephant today is on verge of extinction. Similar thing can be said about Gir. But man & his close rel' have retained Gen Mammalia Anatomy & there is no anatomical sp^z as a consequence.

③ $f^n sp^{2n}$: If organ is used diff from its original fn then it is called as $f^n sp^{2n}$.

Ex: Birds \Rightarrow forelimbs have become wings.
Man \Rightarrow forelimbs used for grasping.

However this type of sp^{2n} doesn't lead to extinction but leads to further evolution too.

\therefore Classic was said to have ecological sp²ⁿ. But in early 1970's, some classic type fossils also found in west Asia that never had been a cold region. After that; it was concluded that differences between C & P were small & quantitative but not large enough to divide Neanderthals into 2 different types.

H.n: Shows us that evⁿ need not always be progressive as Classic was less evolved than Progressive.

'La Chapelle Aux Saints': Mischaracterisation
& Controversy of Boule.

→ Unique posture; walked bent forward.
So there was debate why H.N like
this when H.E was erect. Debate
continued till WW2 end.



But 'Row'; N were just as erect as H.S.
So Paleopathological Analysis was applied.
It is study of diseases in ancient man.
Fossil at time of death \Rightarrow 40+
10 years before death \Rightarrow Arthritis



Thus reflects strong social orgⁿ of N.
in a H & G society.

Lumpers \rightarrow 1
Splitters \rightarrow Many

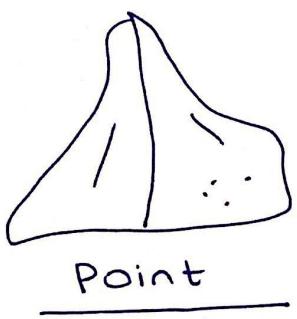
Boule's description is outdated;
and racist/ethnocentric.

Mt Carmel: views of Schlosser $\xrightarrow{\text{Evolutionary divergence}}$

- ① McCown & Keith: 1 single people, Sichuk & Tabun are extreme forms but are same type.
- ② Ashley Montagu, Hooton & Dobzhansky: felt Mt. Carmel was Hybrid.
- ③ Le Gros Clark: Mt. Carmel one in transition of evolutionary change.

Cultural Features

→ Mousterian Culture of Mi Pa, dominated by Flake Tools.



Point



SideScrapper

Shanidar Irae

→ Floral offerings

→ Bear skulls arranged

→ Complex 5th Org^{zn} as Aix chapelle man suffered from Arthritis yet taken care of.

→ Big Game Hunting & Bear cult.

→ Cannibalism: Goyet Cave, Belgium has evidence of deliberately carved human remains

→ Rituals: 1st direct evidence from Teshik-Tash in Uzbekistan. There wild goat skulls & horns pointed towards burial.

→ Cave Art: Gorham's Cave in Gibraltar has [#] symbol; [PNAS] (2014)

→ Language: "Could they speak like us" [Plus One Journal] (2018)

In 1989 in Ikebara Cave, Israel a H. n' hyoid bone found which was very similar to us. Earlier it was believed that 'complex' language evolved Homo Naledi and only H. Sapiens were capable of it.

Yet others argue that shape of pharynx would have made some 'sounds' speech tough.

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ब्रंडेनर ने तात्पुरता में मानव का अवधारणा किया है।

Similarities:

- (a) Similar cranial capacity
- (b) Dentition fully human
- (c) Molar teeth cusp less curved
- (d) Simian shelf absent
- (e) Long jaw, depression in nose
- (f) Australopithecus - Australopithecus
- (g) Broad nose
- (h) Similar cranial capacity.

Differences:

- (a) Height
- (b) Flat feet
- (c) Inward torsion of tibia, radius → not curved
- (d) Wavy sombra and less brachiation
- (e) Foramen magnum back placed in N.H.
- (f) Prosthetic droccus present in N.H.

Front

- (g) H.C. was less + tall
- (h) Heavy & muscular C.C. more but i. was similar
- (i) Heavy browridge differences
- (j) Broad nose

Classical
Neanderthal

Europeans

→ Canine fossa
was absent

- (a) parieto-temporal suture straight (arched in sapiens)
- (b) zygomatic arch more projecting
- (c) general flattening of the skull
- (d) mastoid process not so developed
- (e) alveolar region does not merge with nasal floor
- (f) symphysis of jaw slopes backwards and inwards
- (g) foramen magnum slightly backwardly placed.

Capra et. al (2016), Kelso et. al. (2016) have listed some of the abnormalities / characteristics associated with Neandertal genome –

1. Keratinocyte variant: The gene variant affects skin pigment cell, keratinocyte, so that it is unable to protect the skin from UV radiation and pathogens, inducing skin lesions, called Keratosis. Neandertals are believed to possess less keratinized, melanin-deprived skin that allowed deeper penetration of sun rays in murky environment for vit. D synthesis.
2. Increased blood Coagulation: This variant may have proved beneficial in the Neandertal's environment by sealing the wound quickly as they were game hunters. In modern humans, it increases risk for stroke, pulmonary dysfunction and pregnancy complication.
3. HLA (Human Leucocyte Antigen) : It has been suggested that this gene gave early modern sapiens immigrants to Europe and Asia critical protection to diseases that had not existed in the African environment. Mating with Neandertals would have helped them to combat virus, bacteria and parasites.
4. Nightowl and prone to daytime napping: This variant would have helped them survive by protecting themselves from large carnivores during night.
5. Overweight/eating disorders: As Neandertals lived in extreme environment, regular food supply was not ensured. Whenever large animals were hunted they used to eat as much as they can. This ensured stored food in body that can provide energy during lean and starving periods.
6. Upper respiratory tract infection: The nasal mucosa of Neandertal is supposed to have been moist to humidify dry air lest it would have caused lung infection. The variant in modern humans is source of upper respiratory tract infection.
7. Atherosclerosis/Visceral fat accumulation/Lipid metabolism: - Obesity was combined with higher visceral fat accumulation. As fats contain highest amount of energy hence the variant enhanced fat accumulation so that high energy source would be available to them during starvation. High LDL Cholesterol variant INSIG2 (insulin induced Gene 2) also served the same purpose. In modern humans the variant increases risk of coronary thrombosis. High or low levels of INSIG-2 protein causes body fat accumulation.
8. PAX-3 variant – A mutation in the gene causes waardenburg syndrome, characterized by deafness and pigmentary disturbances, affecting Vit. D synthesis. In savanna climate depletion of melanin allows sun rays penetrate deeper in the skin, damaging vit.D.

In addition, many other gene variants are associated with Neandertals such as:

- (i) Rheumatoid Arthritis
- (ii) Schizophrenia
- (iii) Response to antipsychotic drugs
- (iv) Lack of red hair
- (v) Nicotin addictions
- (vi) Depressions / loneliness / low mood.

Homo Sapien

Meaning : Wise Man

Time - Period: 0.309 MYA - Now; found at
Jebel Irhoud, Morocco.

Charles Darwin, in Descent of Man, 1871

had proposed that 'Man' evolved
in Africa from apes [chimp & gorilla].

→ Julian Huxley's comparative anatomy
Studies also supported this view.

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Spread & Dispersal of H. sapiens

H. erectus did same so it is called
as "Out of Africa" Theory

① "Recent OOA" Theory :

By Chris Stringer [said ~100 kya]
Irenen Et Al (1987)
in Nature
Andrews (1988)

→ Neo-Darwinists support it; also acc. to
HGP [1st Report: 2003] the maximum
genetic diversity occurs in Africa.

Evidences → H. s fossils in Africa ~300kya
Israel ~175kya

but in other places are much recent
Ex: Omo Kibish, etc.

It has 2 variants:

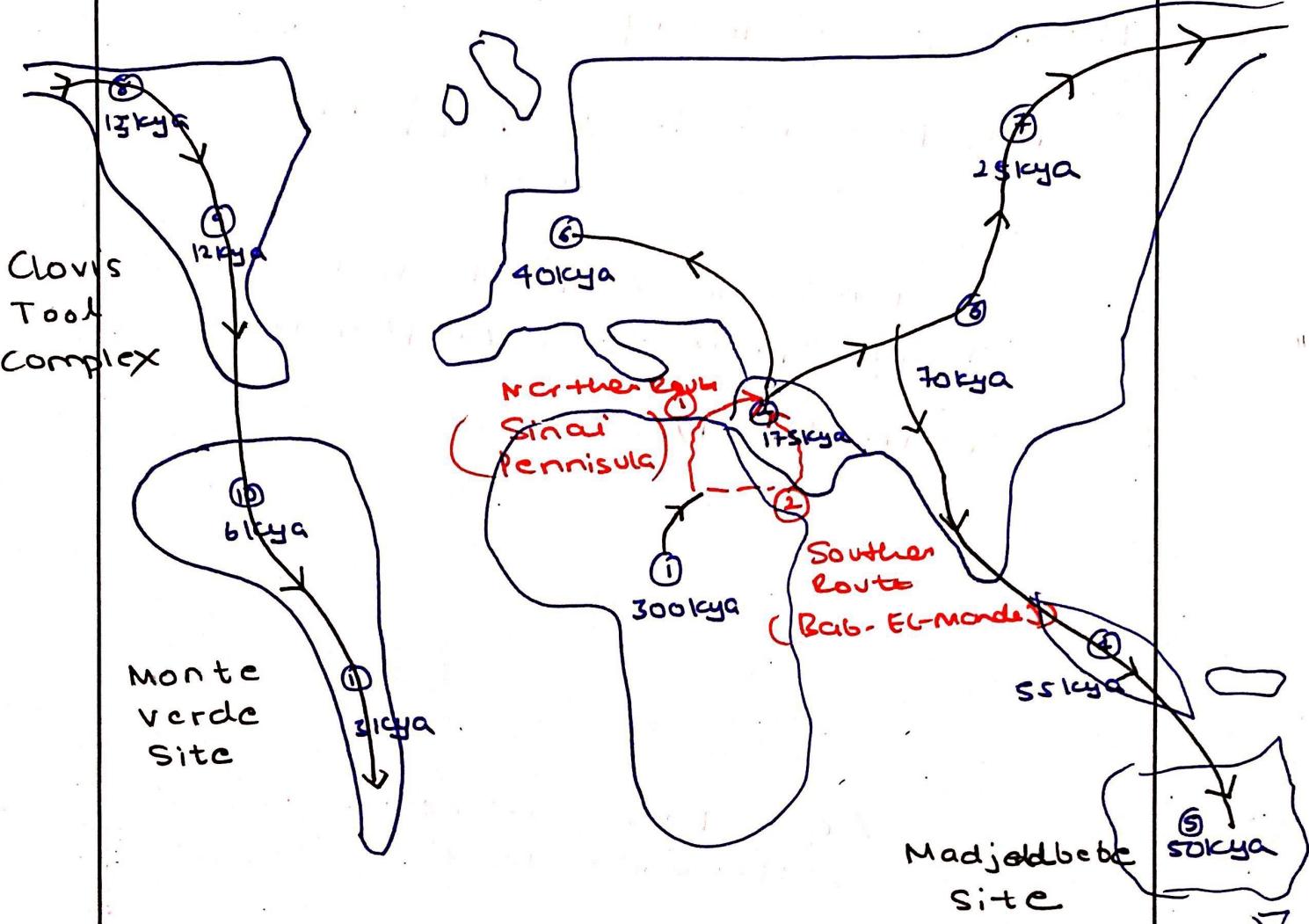
① Assimilation: Gunter Brauer, Krueger Et Al

② Replacement: Not much in favour nowadays

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- Several waves possible
- Southern Route considered latest wave
n70kya.
- Above graph based on Haplotypes,
mt-DNA & Y-chromosome.

② Multiregional Theory

By Milford H. Wolpoff (1984)
and Alan Thorne

- Kramer in AJPA (1991) too supported it by study of Java Mandible.
- Smith (1989)

→ Anek Ram Sankhar (2018) based on Narmada Man findings.

Evidences

Oldest fossil of erectus \Rightarrow 1.8 mya at Modjokerto
and ever youngest \Rightarrow 0.2 in Java.
Since H.e \rightarrow H.s; then Asia must be another centre of human evolution.

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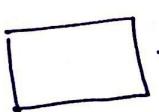
Cro-Magnon

It is an H. S and anatomically modern human, found by Louis Lartet in 1868 at Rock shelter site called Cro-Magnon in Ley Eyzies, France.

Time - Period : 35kya, younger than Grimaldi.
so 2nd oldest.

Culture : Aurignacian of UP Pa Europe

Characteristics:

- Dolicocephalic; short face \Rightarrow Hence face and skull are disharmonic.
- muscular & tall; $\approx 180\text{ cm}$
- cranial capacity $\approx 1600\text{ cc}$ [$>$ Grimaldi]
- Chin well developed.
-  \rightarrow Orbit shape
- Less brow ridges than $H. erectus$ \Rightarrow rise of facial expressions

Phylogenetic Position

Initial Tree — — — → New Tree

→ So thought that Cro-Magnon was the earliest H. s.s of the world. But post Jebel Irhoud discovery today Cro-Magnon is not important in human ancestry. But interestingly it is still 2nd oldest fossil of H. s found in Europe.

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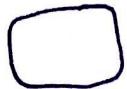
Gimaldi

Find: women (30) & boy (15) in cave called Grotte Des Enfants in Gimaldi village on the Mediterranean sea by cannon De Villeneuve in 1901.

Time-Period: 40kya; oldest

Culture: Aurignacian of UPPA.

< Characters >

- Negrito dominant with large projecting jaw. It represents Negroid incursion into Europe. So Cro-Magnon and Gimaldi seem to be different races.
- Cranial capacity → Boy = 1450 cc
→ Women = 1250 cc
- Hyper-dolicocephalic
- Elliptical contour of skull
- Chin less developed
- face was disharmonic with skull.
-  → orbit shape

Chancelade

Find: Skeleton of man with hands folded on chest and knees touching jaw discovered by Jean-Léo-Tastut in 1888.

Time-Period : 20k - 12 kya,

Culture : Magdalenian;

Characteristics:

- Close resemblance to Eskimos; and lived in extreme artic climate.
- Cranial capacity: Slightly less than cro-magnon
n 1530 cc;
- Dolicocephalic; but sagittal keel found
- Less tall than cro-magnon.
- Face - Harmonic with skull.
-  → Orbit shape.

Denisova

① Meaning: Man of Denisova Cave;

② Time period: 400 kya - 30 kya;

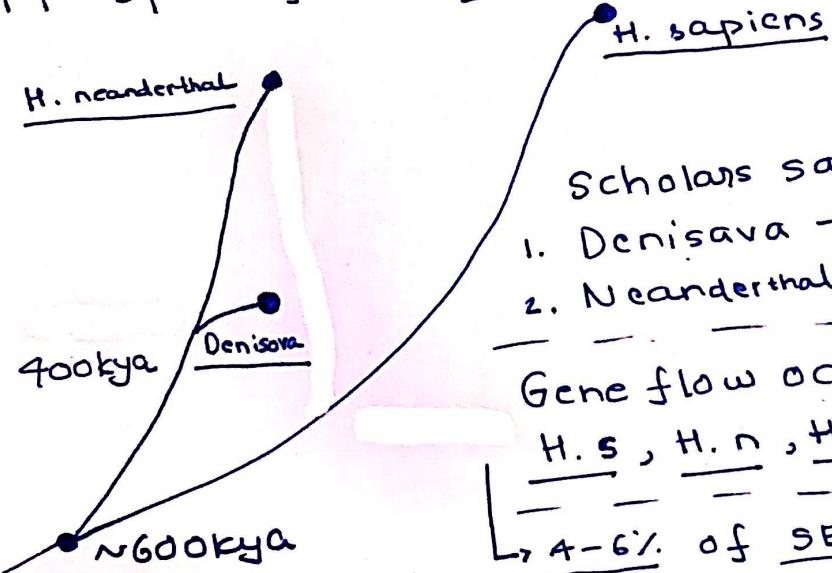
③ Founder : In Altai Mountains of Siberia by Nikolai Ovodov, in 2010.
Find : Teeth & Pinky bone was found, of a girl hominin.
(~65 kya)

Also found in Baishiya Karst Cave in Tibet. Here the Xiahe Mandible was found. It is n 160 kya. It is 2nd Denisova fossil.

Phylogenetic Position

It is neither H. s nor H. n. Many say it split from H. n and is its sister.

So naturally more similar to H. n



Scholars say that:

1. Denisova → East Europe
2. Neanderthal → West Europe

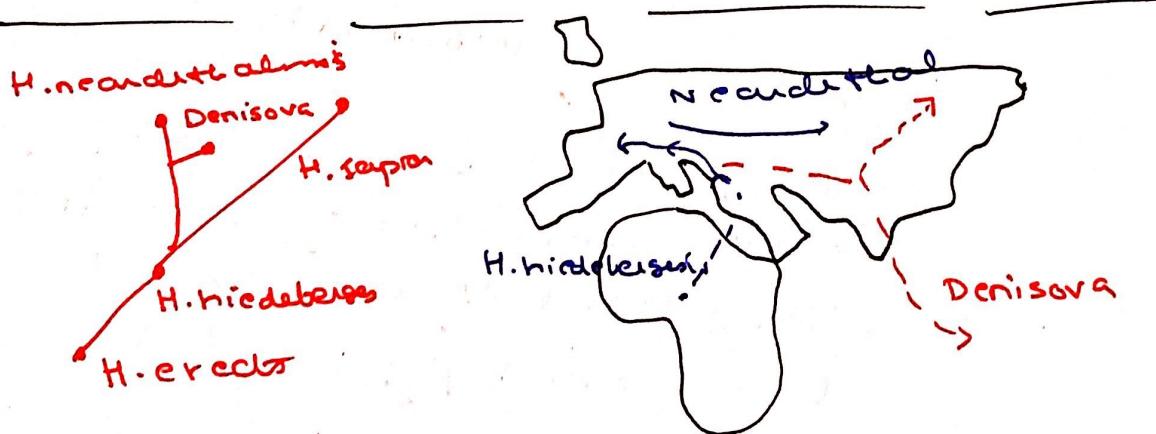
Gene flow occurred betw
H. s, H. n, H. f & Denisovans.

↳ 4-6% of SE Asian, Melanesian & Australian Aboriginal DNA are from Denisovans.

m-dna analysis ✓
 dna analysis ✓

Case Study : "Mum's Neanderthal, Dad's Denisovan"

- 1^o generation offspring; By Viviane SLON; Nature (2018); Svante Pääbo
- Called Denny, She is female [~90kya].



NO species name given yet.

Fig: 1

Hobbit Man

- Called *H. florensis*;
- Lasted till 17kya in Indonesia Islands.
- Interbred with *H. sapiens* & Denisovans.

Dragon Man

- ① Name : Homo Longi; also called Harbin Cranium. named from Dragon (Longsi) river in the NE part of China.
- ② Find : 1933 discovered under bridge construction when region was occupied by Japanese. Hid in well for 80 years but finally given to Geoscience Museum of Hebei Geo University in 2018. Research published in "Innovation" Journal (2021).
- ③ Time - Period : 309 - 146 kya; Male Adult (large)
- ④ Characteristics :
- Cranial capacity: 1400cc; (7y. ↑)
 - Tooth has 3 roots [rare in modern humans]
 - Square eye sockets which are large & deepset
 - Elongated cranium
 - Flat round nose; Flat face & cheeks
 - Adaptation to colder climates and was relatively isolated.
 - Thick brow ridges and wide mouth.

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⑤ Phylogeny: very very debatable

Facts → Closet relative of H. s; and similar to Dali Man (1978) found in Shanxi Province [NW China].

H. daliensis H. sapien
 ancestor

Another group says that closest to Xiahe Mandible found in Bashiyalangst Cave, Tibet which is Denisovan. So it is actually Denisovan and we know how they looked like now.

Homo Naledi: Most similar to H. erectus.

- 800m from Savatbaans in Rising Star Cave system in Cradle of Humankind (WITS), ^{Johannesburg} South Africa.
- Lee Berger (2013); evidence of ritual behaviour.

Time-period: 330 - 230 kya;

- Such small size persisting so late
- Brain Size: 450 cc; primitive shoulders & pelvis.
- Curved fingers yet modern;
- Modern foot; almost like us.
- More anovorell than bipedal; even though perfectly capable of bipedalism

Nesher Ramla Homo

Find: South east of Tel Aviv by Israel Herskovitz and Yossi Zaidner. Published in "Science" Journal (2021).

Time-Period: 400-120 kya

Characteristics

- very large teeth
- No chin
- flat skull
- Mixture of Archaic Homo + H.N.
- Lady of Tabun [Tabun C 1]

may be part of this group which was found by Dorothy Garrod in 1932.

Phylogeny: Questions view that H.N. originated in Europe. Some say NRH was the ancestor of Neanderthals.

Lived side-by-side with humans ⁹⁰
Capensis

Chronology: Order in which series of events happened in past period.

↓
Geological chronology

→ Era's & Epoch's in life of earth with corresponding lifeform
Ex: Miocene / Pliocene

↓Cultural chronology

→ Refers to the Cultural Evolution
Ex: Paleolithic, etc

1.8

Chronology:

It is the science of arranging events in their order of occurrence in time. It is achieved via the use of dating methods.

Chronology
of
Artifact

- ① Absolute Dating: Also called as Chronometric. They provide numerical age or range; in contrast with Relative dating, which places events in chronological order w/o any measure of age between the events.

Types of Absolute Dating Methods

1) Radiocarbon Dating : J R Arnold W F Libby (1946)

1950
Physics
Nobel
Prize.

Atmospheric N₂ $\xrightarrow{h\nu}$ C¹⁴; It is inhaled by living orgs till equilibrium of outside atmosphere & body. But once org. dies the C¹⁴ inhalation stops & body starts losing C¹⁴ as N₂. Half life of C¹⁴ \rightarrow 5730 yrs; so we can detect range of [5k, 50, 000k].

Challenges: 1) fossils till only around ~50k years are datable

Reference: 2) Throught this time H. Sapiens { 2) Atmospheric C¹⁴ not constant dated, so inaccuracies creep in, using it.

2) Potassium-Argon Dating:

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$K^{40} (s) \xrightarrow{\text{decay}} Ar^{40} (g)$; Half life $\Rightarrow 1.3 \text{ mya}$

Dating range $\rightarrow (5 \text{ Lyr} - 5 \text{ mya})$:

In molten rocks the Ar escapes
whereas in cold rocks the Argon
is trapped.

Limitation: 1) Only possible on volcanic
rock & ash.

2) Sites older than 5 mya
cannot be dated using it.

\rightarrow Australopithecus, H. Erectus & H. H ✓

L) Used at Olduvai Gorge by Mary Leakey
Uranium Lead Method: & Louis Leakey.

3)

$U^{238} \rightarrow Pb^{208}$; half life $\Rightarrow 3 \text{ mya}$ [till 15 mya]
it can be detected

Dryopithecus & Sivapithecus dated.

4) Tree Ring Dating: Tree rings in
Dendrochronology. Tree rings in

Cambium. The concentric rings maintain
minute differences of structure for
each year depending upon temperature,
humidity and age of tree.

Ex: Bristle Cone Pine provided diff.
ring structures for 4,905 years.

Any prehistoric sample of unknown
date is compared for ring

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~~only wooden objects;~~
 ↗ old age
 ↗ trees reg
 ↗ rainfall
 ↗ seasonal
 ↗ growth or
 ↗ river regulation

Structure with already identified structures & age is determined.
 It helps better approximation of C14 Method.

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⑤ Varve Analysis: Summer → glacial lakes have more water

winter → less water

thus thickness of fine clay deposition more in summer and less in winter.
 Thus physical counting of these darker varves can give exact age of deposit due to glacial events.

Ex: Method gave exact date for end of Pleistocene.

⑥ Fission Track Dating:

U^{238} decay → α particle → tracks on glassy surface
 So amount of U^{238} & density of α cracks tells us age of sample;
 as rate of decay is a pre-determined constant.

Limitation: Only for glassy surfaces.

⑦ thermoluminescence: Based on ^{principle} that:

all objects absorb radiation from the environment. materials trap energy by trapping $[e^-]$ in impurities of lattice.

ΔE → e^- released as light → measured
 { given to find
 $\geq 500^\circ C$ Cooling → reabsorption of out the last time material was heated
 energy (rate) is calculated

⑧ Limitations: Accuracy ~ 15%. as

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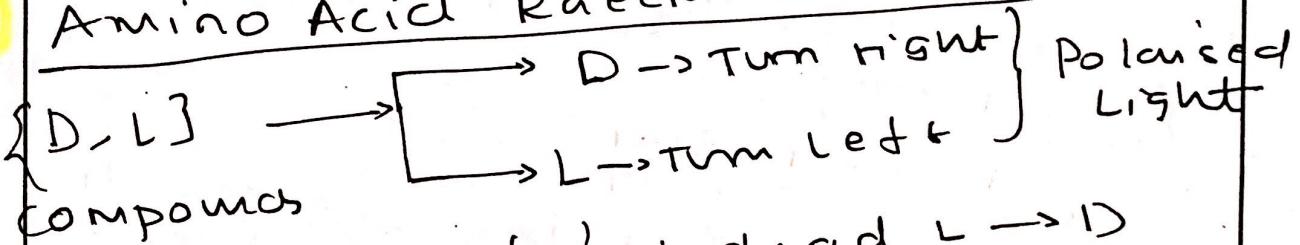
Ex:
Ceramic
Pottery
in
IVC

repeated heating/cooling of sample
may not give accurate results
Also sample may be absorbing the
energy from the present env too.

⑧ Electron Spin Resonance (ESR)

Radioactive Materials in a rock
induce electrical charges in the
adjoining fossils which can be
measured by ESR. Ex: Used in
determining age of hominid fossils

⑨ Amino Acid Racemization:



* Living mainly 'L' ; dead L -> D
transformation (Racemization); the
aspartic acid takes around (5k-150kyr)
So we can find age of fossil. Range
Only small sample size needed. of
Limitation: generally organic materials only
[T] & H₂O affect things.

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2

Relative Dating Methods By Petrie

- ① Seriation: Any "style" initially starts with low frequency then (\uparrow) & finally decreases. Ex: Tools of particular type.



② Pollen grain Dating

or Palynology

Pollens are having excellent preservative ability. It is also different pollen for different types of plants.

Arboreal Pollen \rightarrow Trees

Non-Arboreal Pollen \rightarrow Grassland

$$\left(\frac{AP}{NAP} \right) \times 10^2$$

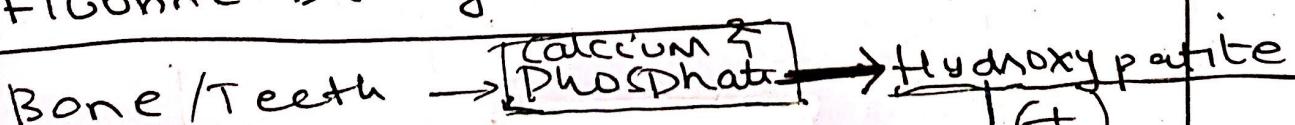
can give the environments from Tundra to Tropical

→ used for artifacts, stone tools pottery.

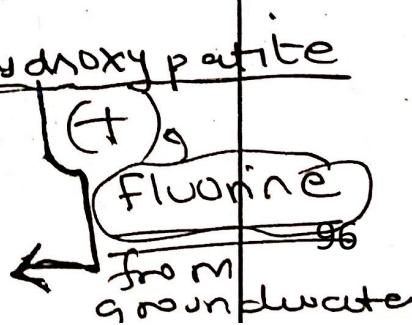
→ Some styles show very little chronological variation; so typology is very important.

→ Popularity need not be well curved always.
→ It need not be same across several locations. → life spans of diff designs must overlap.

③ Fluorine Decay Method



{Fluorapatite}



used if stratigraphy fails.

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~~Older bones have more fluorine~~
fossil dated relatively. Because not all fossils absorb fluoride at the same rate, the accuracy of this method is questionable.

In 1953, used to test 'Piltdown Man' and to scientifically conclude

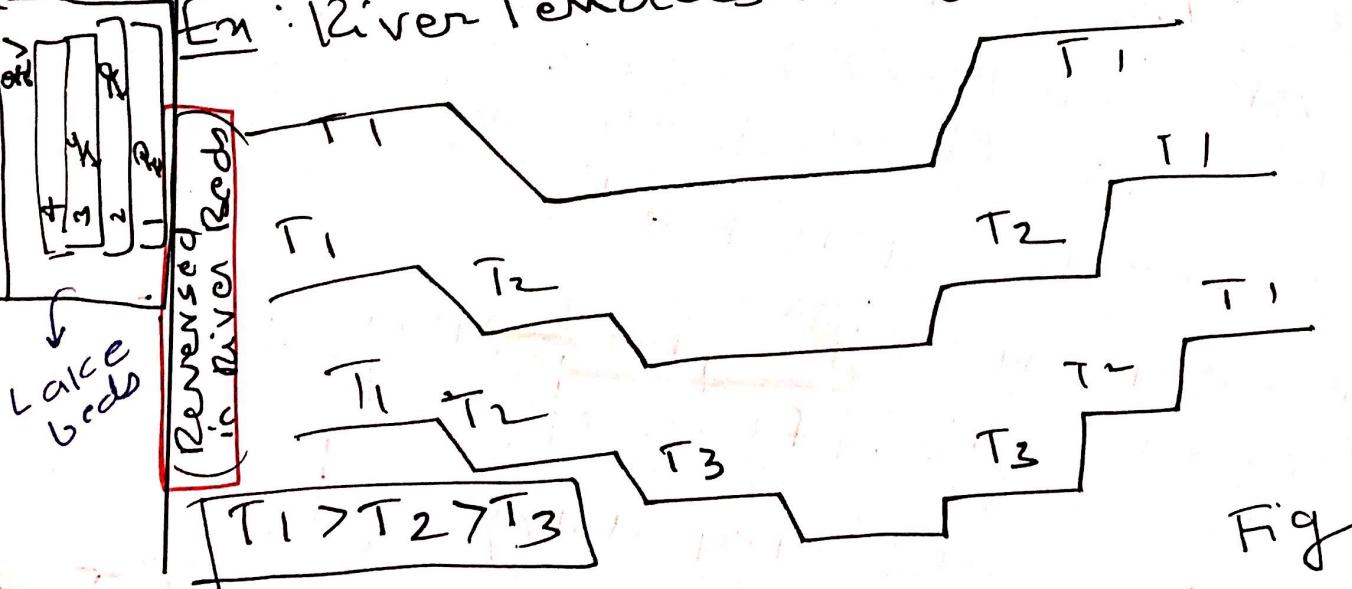
that it was forged fossil.

But by accommodating chances of error it can be used for relatively dating fossils.

④ Paleomagnetism: Magnetic induction of rocks on the surface at that time exhibit polarity as induced by earth. So the polarity & stratigraphy help in relative dating.

⑤ Stratigraphy: Lowest layer of any natural process of deposition is older than layer on the top provided if there has been no disturbance.

Ex: River Tercaces 'One good idea':



Fig

⑥ Matter Fossils: These have undergone proven speciation with considerable changes.
Ex: Elephants, etc.

↳ Palaeontology

→ Not suitable when complex changes of Stratigraphy inversion take place.

- humidity, volcanic activity, Inversion, etc affect it.
- Scientific → more hypothesis
- for old dates → Not too old dates found

- | | |
|--|-----------------|
| <u>A</u> | <u>R</u> |
| → Defn | → Defn |
| → Both help to determine chronology | |
| → Ex | → Ex |
| → More accurate | → less accurate |
| → Uses | → Uses |
| + used when absolute fossils or too much error | |

