IFAS ONLINE

VARIOUS EVIDENCES OF EVOLUTION



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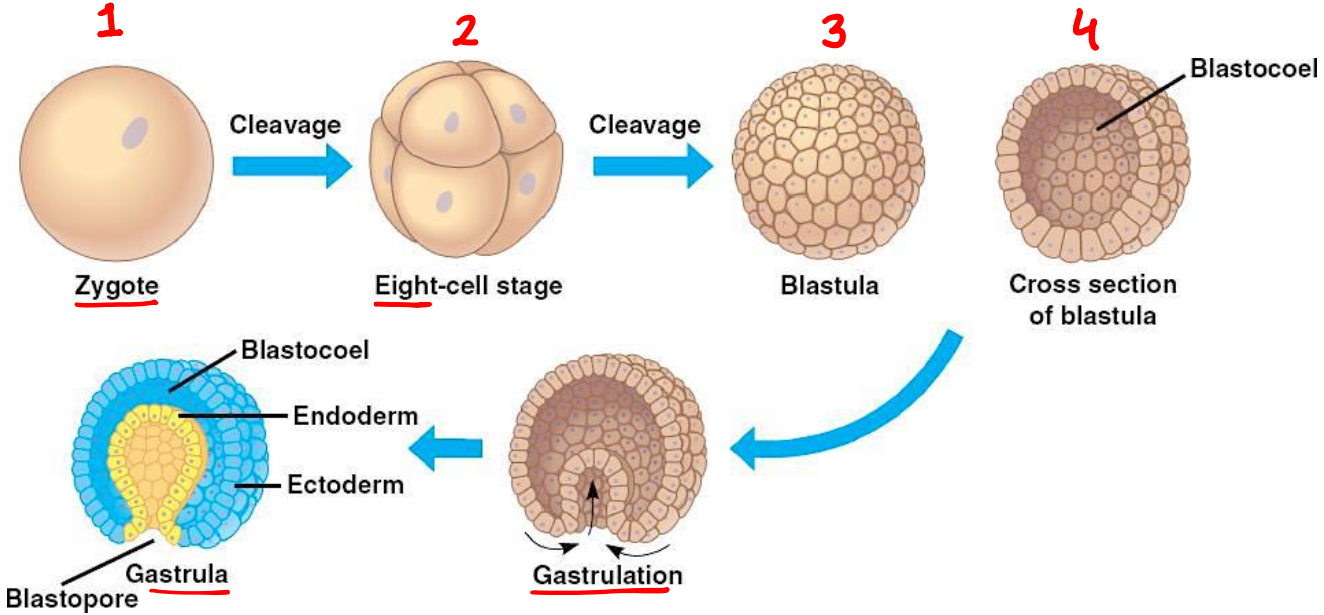
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Various evidences of evolution

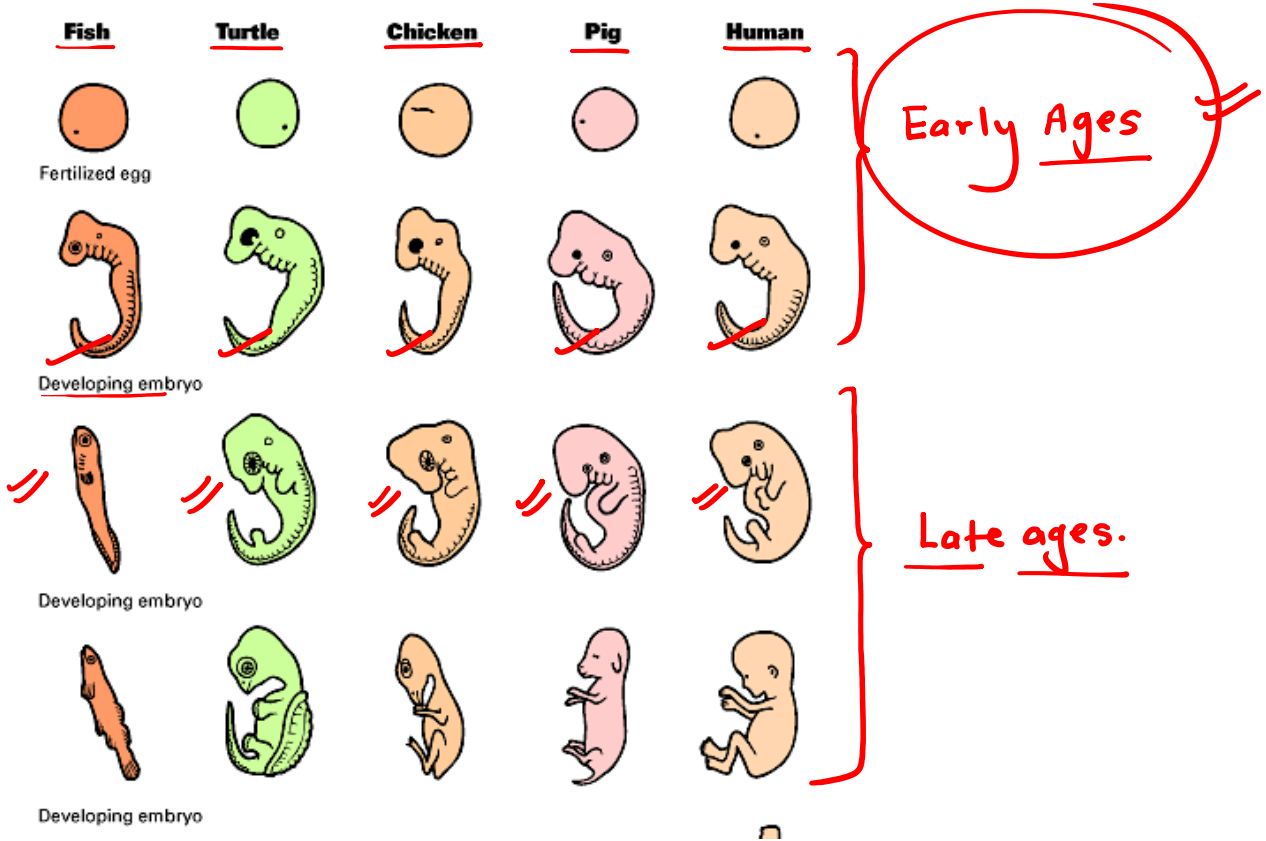
1. Paleontological evidences
2. Comparative anatomical and morphological
3. Comparative embryology
4. Biogeographical
5. Biochemical and molecular

Comparative "Embryological" Evidences

1. Similarity in "early stage" of development :-



2. Resemblance in young "vertebrate" embryo (Von bear)



- **Haeckel (1834-1919) :**

" Recapitulation theory" or Biogenetic Law

" Ontogeny repeats phylogeny "

↓ ↓

" Life History" " Evolutionary History"

e.g. Frog's tadpole.

3. Temporary embryonic structures:

Examples

1. Frog tadpole



"Fish"

- Ammonotelic
- Gills breathing.

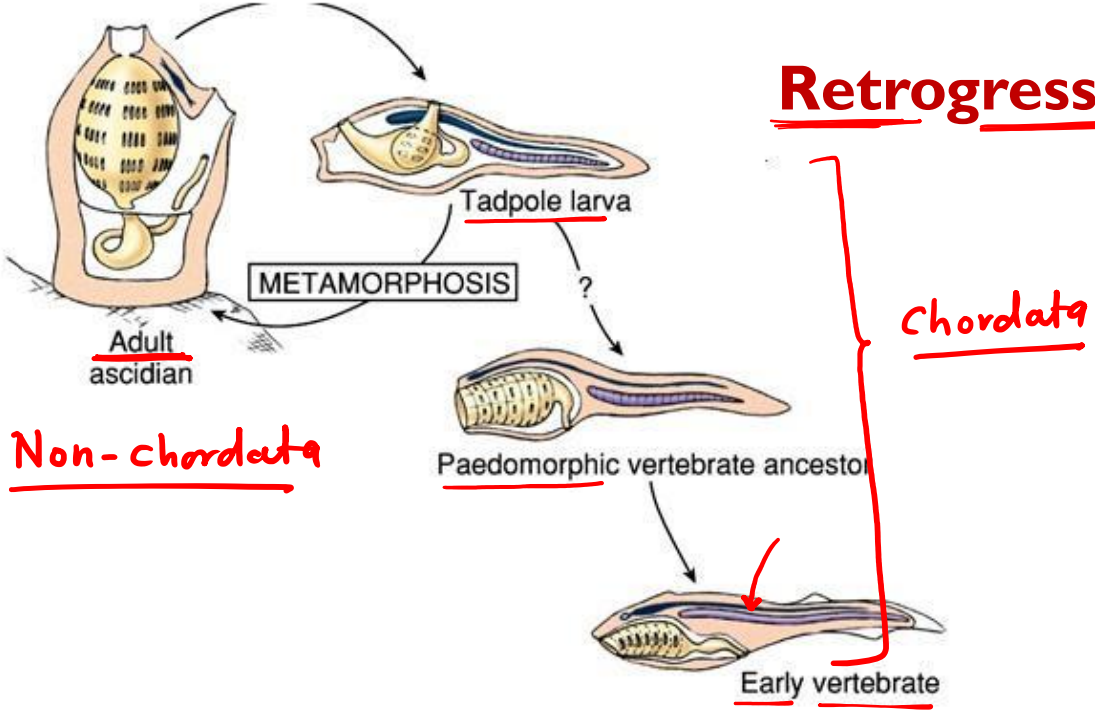
etc.



"Adult"

- Ureotelic
- Skin

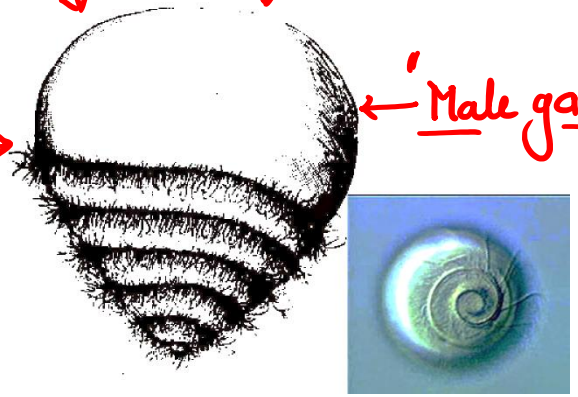
2. Larvae of *Herdmania* : 'Imp"



Retrogressive Metamorphosis

3. Cycas and Ginkgo with ciliated Gametes : Gymnosperm's
— Pollination

"Cilia"

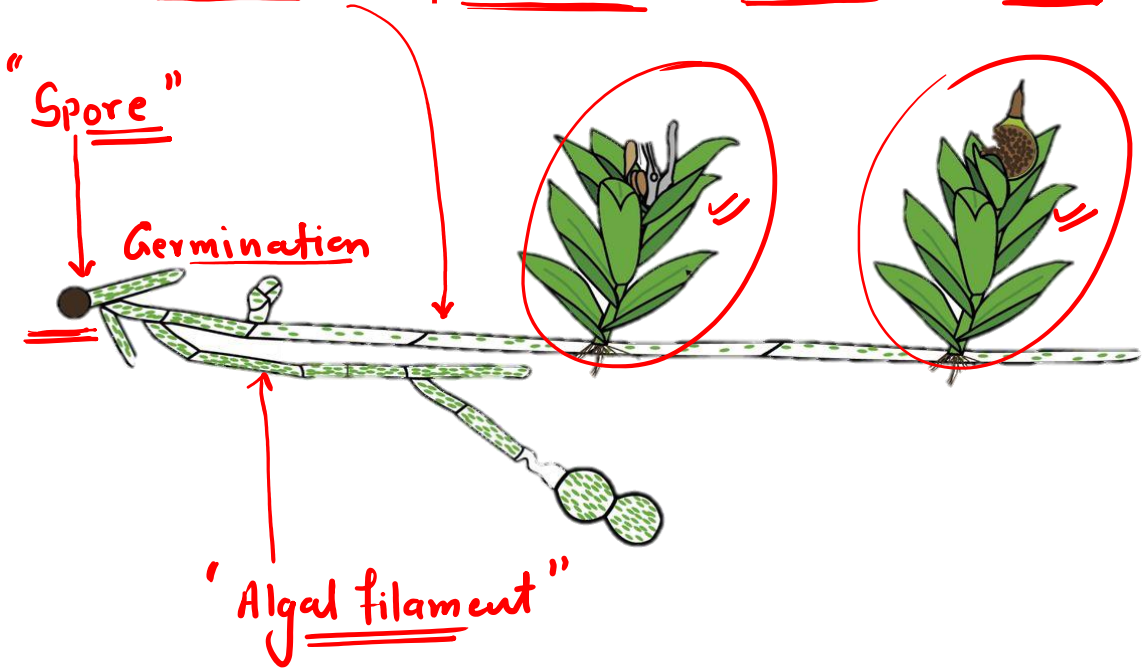


"Male gametophyte"

→ Primitive character

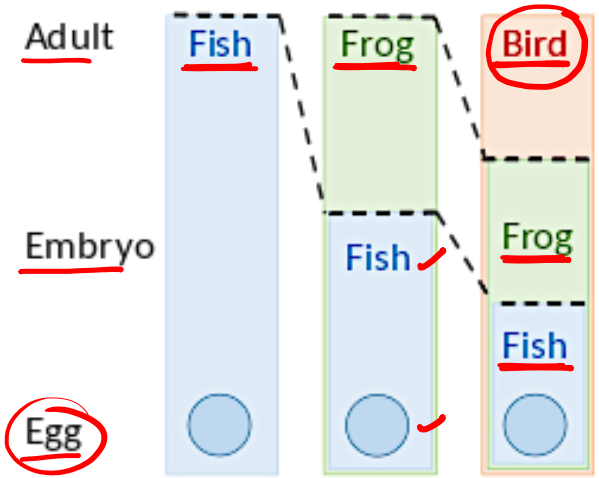
B. P.

4. Filamentous protonema in mosses and ferns



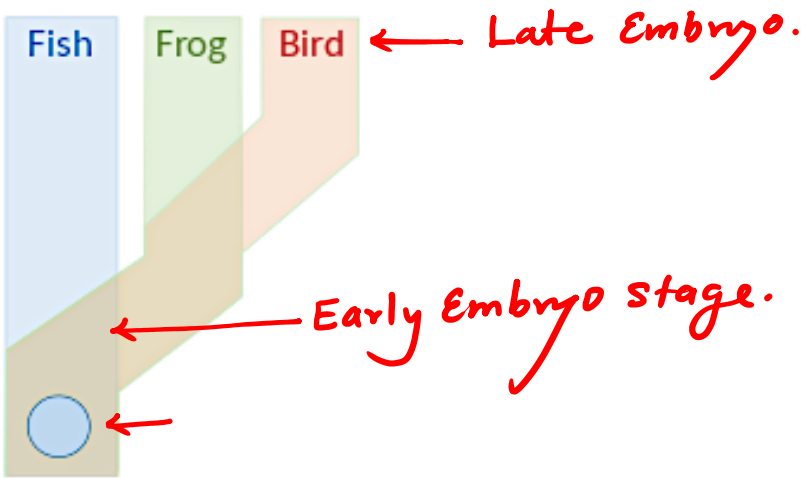
Haeckel

Development stages recapitulate adult evolutionary stages



Von Baer

No recapitulation: embryo's development increasingly diverse



Biogeographical evidences

a. Theory of continental drift: Alfred wegner 1912

Palaeozoic era.

280–200 MYA

All continents are joined into one supercontinent, Pangaea.



100–65 MYA

Present-day continents form and begin to drift apart.



Mesozoic era.

181–135 MYA

Two major continents form.

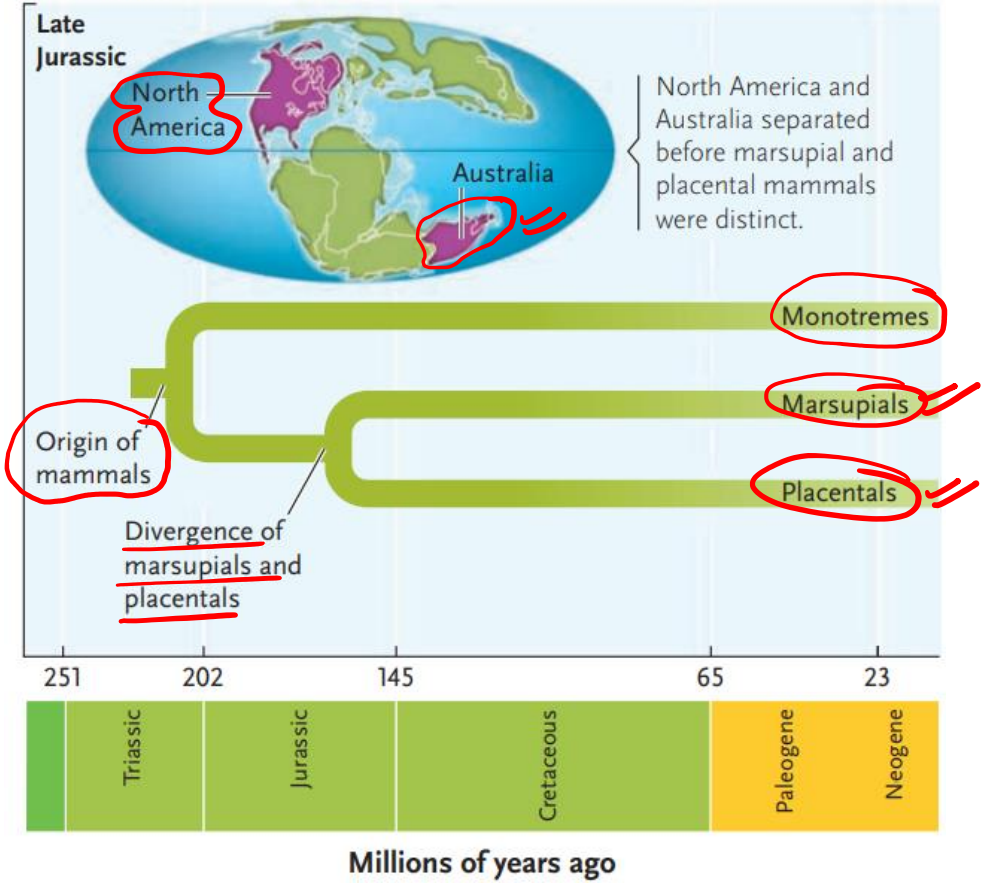


Today

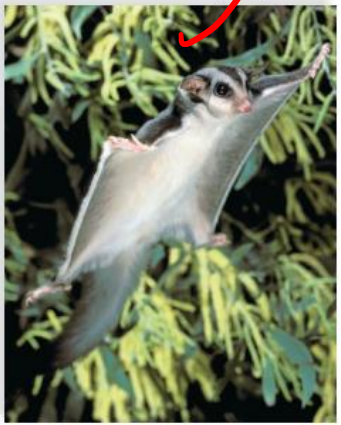
Continents continue to drift apart.



A. Mammal evolution and continental drift



Each type of marsupial in Australia is adapted to a different way of life. All of the marsupials in Australia presumably evolved from a common ancestor that entered Australia some 60 million years ago.



Sugar glider, *Petaurus breviceps*, is a tree-dweller and resembles the placental flying squirrel.



The Australian wombat, *Vombatus*, is nocturnal and lives in burrows. It resembles the placental woodchuck.



Kangaroo, *Macropus*, is an herbivore that inhabits plains and forests. It resembles the placental Patagonian cavy of South America.

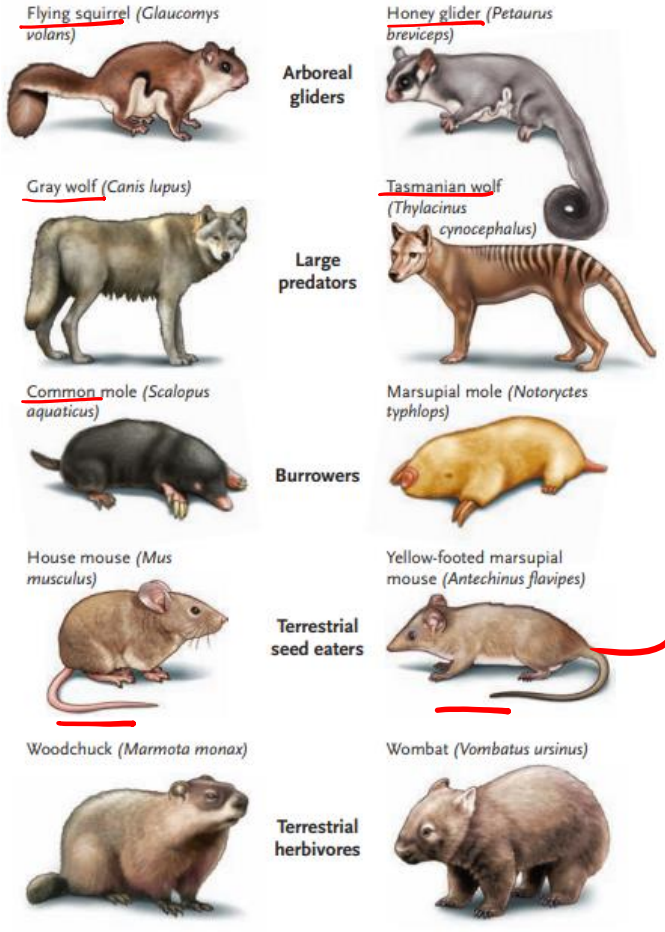


Tasmanian wolf, *Thylacinus*, now extinct, was a nocturnal carnivore that inhabited deserts and plains. It resembles the placental grey wolf.



The Australian native cat, *Dasyurus*, is a carnivore and inhabits forests. It resembles the placental wild cat.

B. Convergence of placental and marsupial mammals



"Convergent evolution"

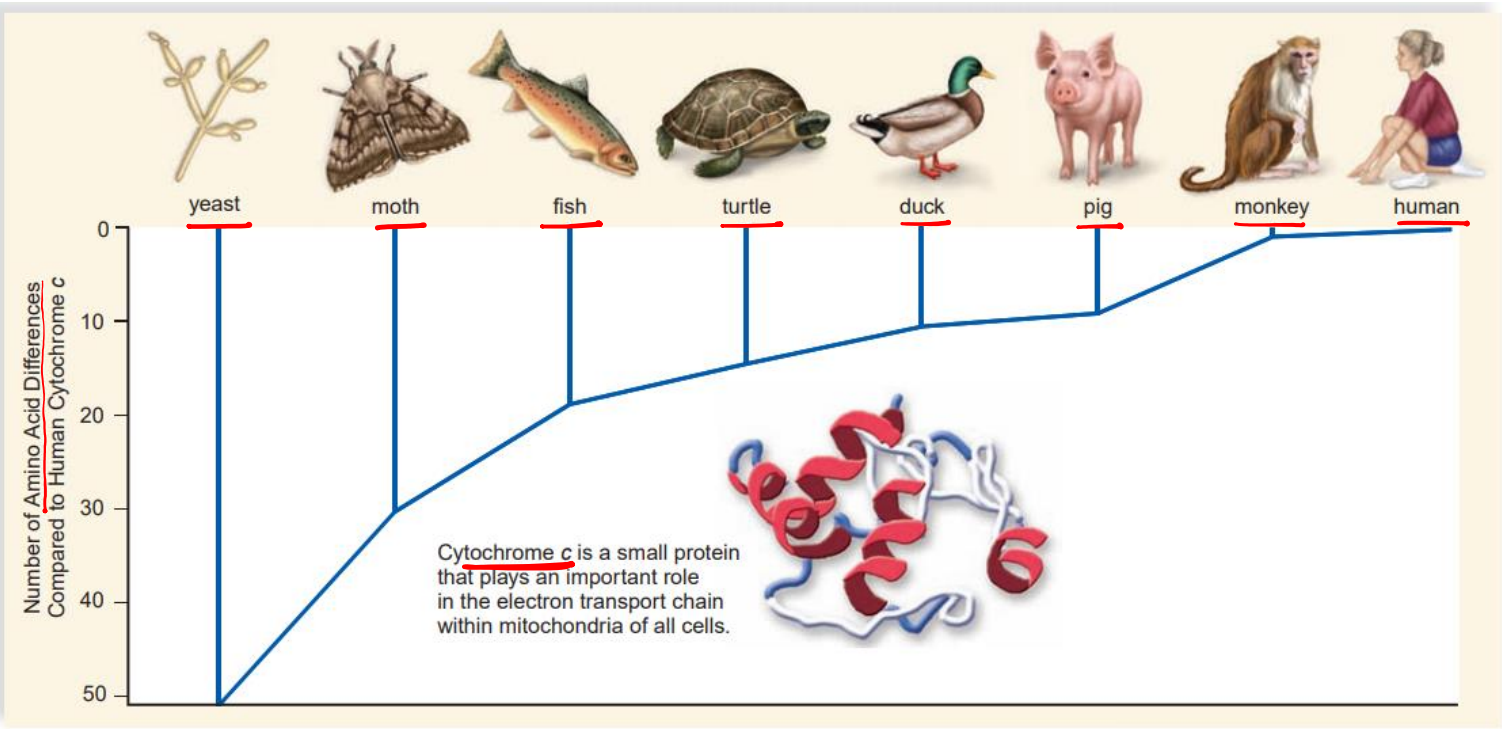
Biochemical & Molecular evidences

BIOMOLECULES

- DNA
- RNA
- ATP
- ENZYMES
- TRIPLET CODONS
- 20 AMINO ACIDS

BIOCHEMICAL PATHWAYS

- TRANSCRIPTION
- TRANSLATION
- GLYCOLYSIS
- KREBS CYCLE

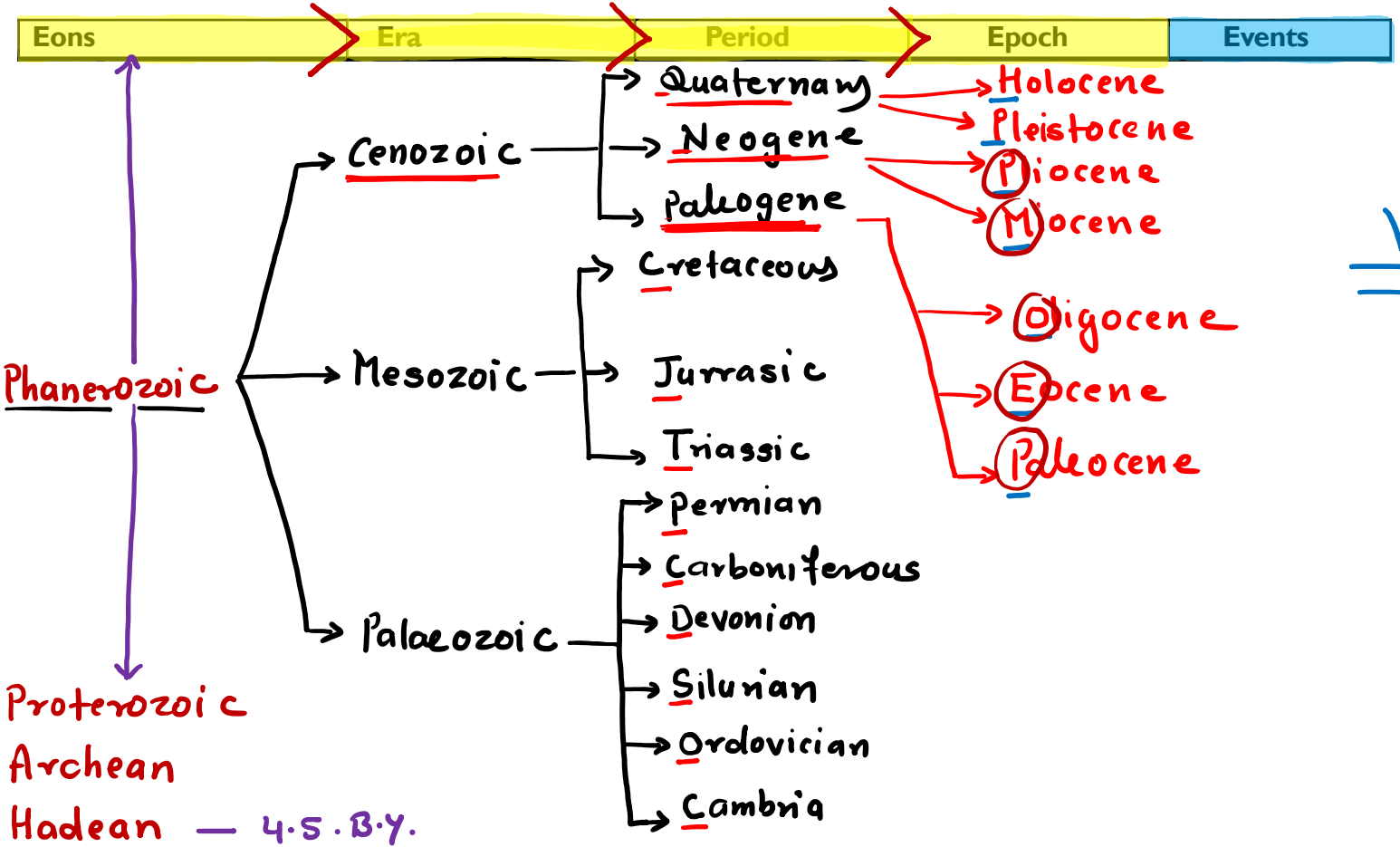

yeast
moth
fish
turtle
duck
pig
monkey
human
Number of Amino Acid Differences Compared to Human Cytochrome c
0
10
20
30
40
50
Cytochrome c is a small protein that plays an important role in the electron transport chain within mitochondria of all cells.

V. Very imp.

Geological time scale

C				and radiate; origin of mammals
I	3. **Paleozoic**	Permian		**Radiation of reptiles; origin of most present-day groups of insects; extinction of many marine and terrestrial organisms at end of period**
C		Carboniferous		**Extensive forests of vascular plants form; first seed plants appear; origin of reptiles; amphibians dominant**
		Devonian		**Diversification of bony fishes; first tetrapods and insects appear**
		Silurian		**Diversification of early vascular plants**
		Ordovician		**Marine algae abundant; colonization of land by diverse fungi, plants, and animals**
		Cambrian		**Sudden increase in diversity of many animal phyla (Cambrian explosion)**
PROTEROZOIC		Ediacaran		**Diverse algae and soft-bodied invertebrate animals appear Oldest fossils of eukaryotic cells appear**
Archaean				**Concentration of atmospheric oxygen begins to increase Oldest fossils of cells (prokaryotes) appear**
Hadean				**Oldest known rocks on Earth's surface Origin of Earth**

Eons	Era	Period	Epoch	Events
PHANEROZO	1.Cenozoic	Quaternary	Holocene	Historical time
			Pleistocene	Ice ages; origin of genus *Homo*
		Neogene	Pliocene	Appearance of bipedal human ancestors
			Miocene	Continued radiation of mammals and angiosperms; earliest direct human ancestors
		Paleogene	Oligocene	Origins of many primate groups
			Eocene	Angiosperm dominance increases; continued radiation of most present-day mammalian orders
			Paleocene	Major radiation of mammals, birds, and pollinating insects
	2. **Mesozoic**	Cretaceous		Flowering plants (angiosperms) appear and diversify; many groups of organisms, including most dinosaurs, become extinct at end of period
		Jurassic		Gymnosperms continue as dominant plants; dinosaurs abundant and diverse
		Triassic		Cone-bearing plants (gymnosperms) dominate landscape; dinosaurs evolve and radiate; origin of mammals


Eons
Era
Period
Epoch
Events
Phanerozoic
Cenozoic
Quaternary
Holocene
Pleistocene
Neogene
Pliocene
Miocene
Paleogene
Oligocene
Eocene
Paleocene
Mesozoic
Cretaceous
Jurrasic
Triassic
Palaeozoic
Permian
Carboniferous
Devonian
Silurian
Ordovician
Cambria
Proterozoic
Archean
Hadean — 4.5 B.y.

V. Very imp.

1. Plant's history
2. Animal's history
3. Continental drift.
4. Mass extinction's.

Eon's

- **Hadean** (4.6 – 4.0) : Formation of earth, Reducing environment.
- **Archean** (4.0 – 2.5) :
  - First life (LUCA) form
  - Chemo-Heterotrophic
  - First cyanobacteria – (O_2 Revolution)
  - Unicellular eukaryotes
- **Proterozoic** (2.5 →) :
  - First Multicellular eukaryotes
  - Soft body animals
  - Algal dominance.

Plants

Q -

N -

P - Grass evolve.

C - Angiosperm's dominant.

J - Flowering plants appeared

T - Seed bearing Gymnosperm's dominant

P - Cycas + Ginkgo appeared.

C - dense forest - Pteridophytes + Gymnosperms

D - Seed plants (Gymno)

S - Vascular plants (ptorido.)

O - Bryophyte 1st Appeared.

C - Greenplants / Animals Ancestor's. / Cambrium explosion.

Animals

Q-

N-

P- First large size mammals.

C- Dinasours extinct./small size mammals.

J- Dinasaurs dominant

T- Appearance of dinasours (Pangea break)

P- → Adaptive Radiation of reptiles.

C- → Amphibian's

D- → Trilobites, bony fishes (Age of fishes)

S- 1st jaw fishes

O- Echinodermata (1st Vertebrates)

C- Maximum invertebrates

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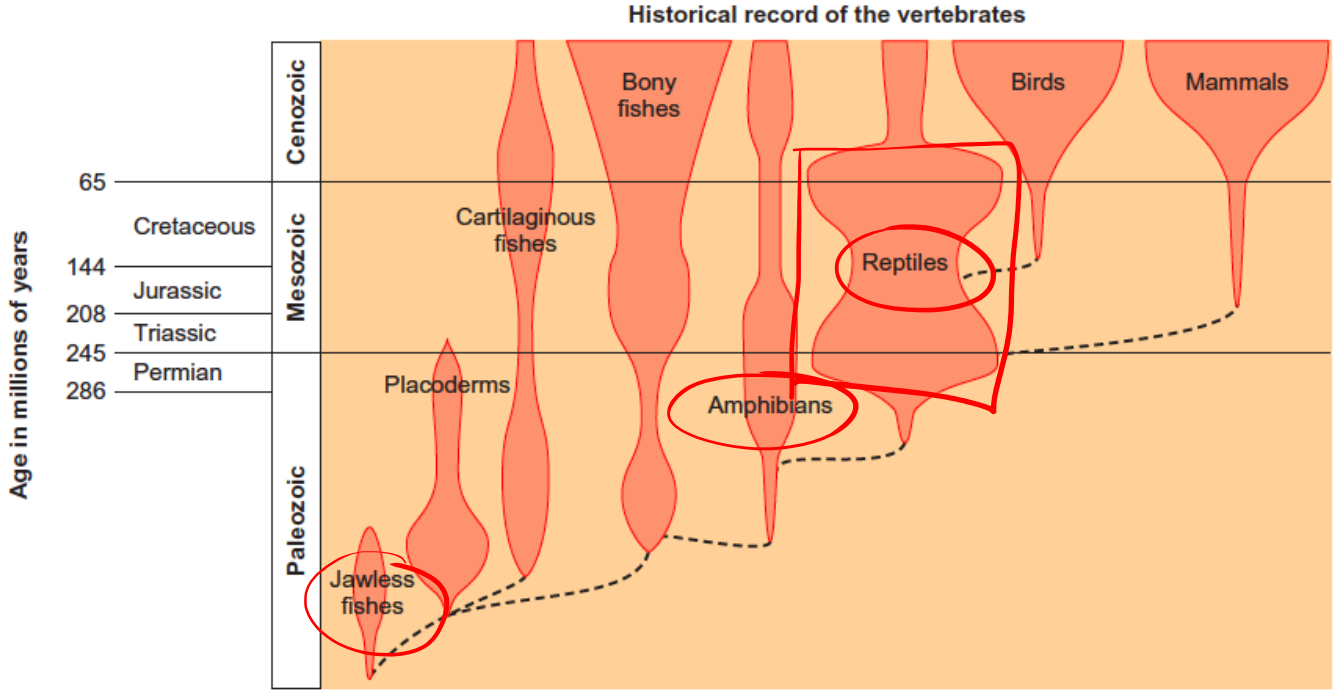
Holocene Epoch	Age of Man
Quaternary peri.	Age of Ice
Cenozoic Era:	Age of mammals, birds, insects and angiosperms, **periodic glaciation**
Mesozoic Era:	Age of reptiles (**Jurassic Period**) Gymnosperms Dominant
Carboniferous Peri.	Age of amphibians
Devonians Period	Age of fishes
Ordovician Period	Age of invertebrates, Massive glaciation
Cambrian Period	Cambrian Explosion(Maximum diversity of Marine invertebrates)

Cenozoic Era	
Quaternary	1st Human
Pleistocene	Origin of genus *Homo*
Pliocene	1st Ape man
Miocene	Earliest direct Human Ancestor
Oligocene	Origin of many Primate groups
Eocene	Angiosperm dominance increases
Paleocene	
Cretaceous	• Radiation of Mammals • Radiation Birds • Insect pollination • Origin and Diversification of Angiosperms • Extinction of dinosaurs

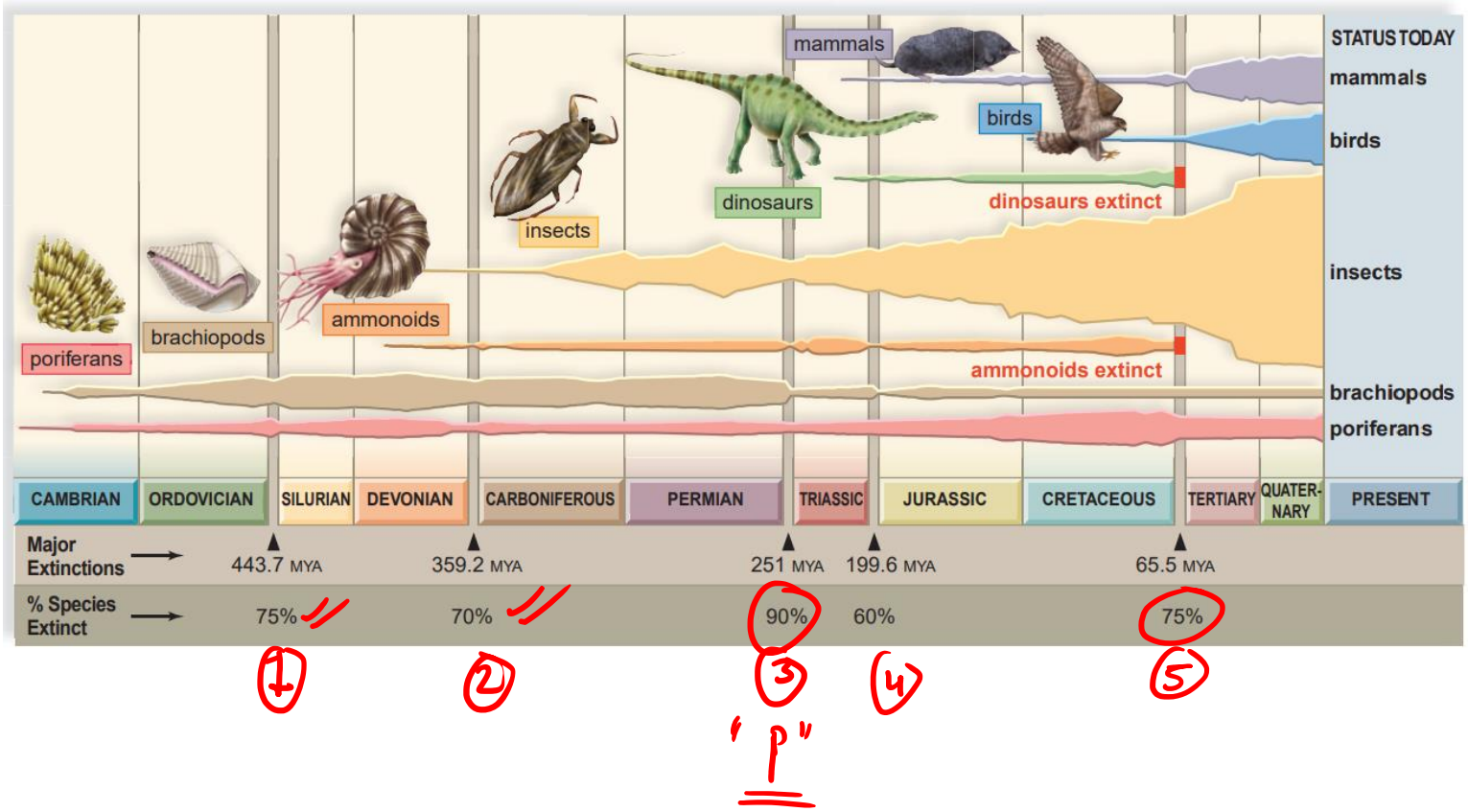
1st Origins

Mesozoic Era	
• **Jurassic**	1st lizard
	1st crocodile
	1st bird
	1st Angiosperm
	Break up of Pangaea in late Jurassic
• **Triassic**	1st mammal
	1st dinosaur
	Insects radiate

Paleozoic Era	
• **Permian**	
• **Carboniferous**	1st reptile
• **Devonian**	1st insect
	1st gymnosperm
	1st tetrapod
	1st amphibian
• **Silurian**	1st ray fin fish
	1st land plant (trachaeophyte /vascular land plant, (Psilophyta)
	Origin of Jawed fishes
• **Ordovician**	1st coral , 1st fungi, 1st vertebrate
	Diversification of echinoderms
• **Cambrian**	


Historical record of the vertebrates
Age in millions of years
65
144
208
245
286
Cretaceous
Jurassic
Triassic
Permian
Cenozoic
Mesozoic
Paleozoic
Bony fishes
Birds
Mammals
Cartilaginous fishes
Reptiles
Placoderms
Amphibians
Jawless fishes

Mass extinction



MASS EXTINCTION

O D P T C

1st mass extinction :- Ordovician

2nd mass extinction :- Devonian

3rd mass extinction :- Permian (Largest ; 96% species extinct)

4th mass extinction :- Triassic

5th mass extinction :- Cretaceous

HAPPY LEARNING

THANKS

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