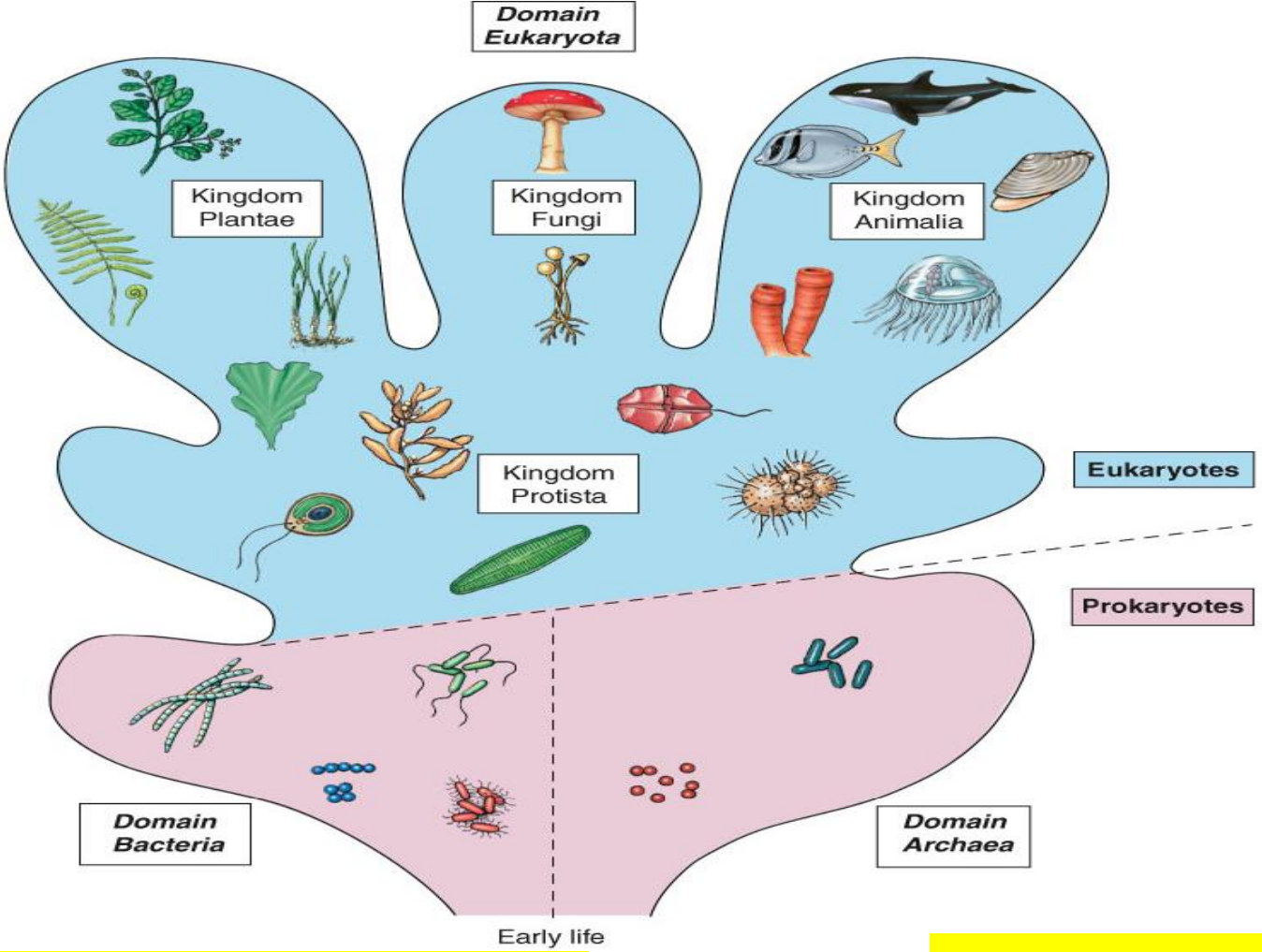
Zoology
Mammalia
Taxonomy
Chordata
Animalia
Vertebrata
PERISSODACTYLA
EUKARYOTIC
URSIDAE
Proboscidea
wildebeest
SUPERFAMILY
RHINOCEROS
naked mole rat
Paucituberculata
CRESODONTA
science
armadillos
dhole
WALRUS
mammoths
aye-aye
canis
RABBITS
dolphins
KOALAS
TAPIAR
hedgehogs
Rodentia
PLATYPUS
four-chambered heart
moles
WOMBATS
Edentata
PROTOTHERIA
INSECTIVORA
shrew
aardvarks
bilbies
sea lions
PINNIPEDIA
evolution
marsupials
Peramelemorphia
EMBRITHOPODA
WARM-BLOODED
FELIDAE
EUTHERIA
OPOSSUMS
KINGDOM
JAGUAR
hyraxes
Hyracoidea
Carnivores
PANDA
PHYLUM
DIPHYODONTY
Dasyuromorphia
CLASS
BATS
ORDER
FAMILY
camels
multicellular
CAPYBARA
Microbiotheria
GENUS
humans
SPECIES
ungulates
APES
SLOTHS
cheetah
hippos
bandicoots
SUBPHYLUM
life
Artiodactyl
numbat
Tasmanian wolf
seals
behavior
organisms
PIKAS
Cetaceans
Didelphimorphia
equines
Racoon
Macroscelidea
monito del monte
ENDOTHERMY
vervet
WHALES
biology
extinction
antelope
ELEPHANTS
Notoryctemorphia
METATHERIA
Lagomorpha
Condylarthra
lemurs
monotremes
MANATEE
squirrel!
hominidae

Day	Date	Time	Lecture room
Wednesday	19. 10. 2022.	10:00 - 12:00	BO-9P
Wednesday	26. 10. 2022.	10:00 - 12:00	BO-9P
Wednesday	02. 11. 2022.	10:00 - 12:00	BO-9P
Wednesday	09. 11. 2022.	10:00 - 12:00	BO-9P
Wednesday	16. 11. 2022.	10:00 - 12:00	BO-9P
Wednesday	30. 11. 2022.	10:00 - 12:00	BO-9P
Wednesday	07. 12. 2022.	10:00 - 12:00	BO-9P
Wednesday	14. 12. 2022.	10:00 - 12:00	BO-9P
Wednesday	21. 12. 2022.	10:00 - 12:00	BO-9P



3 kingdoms or domains (Woese Carl, 1978)

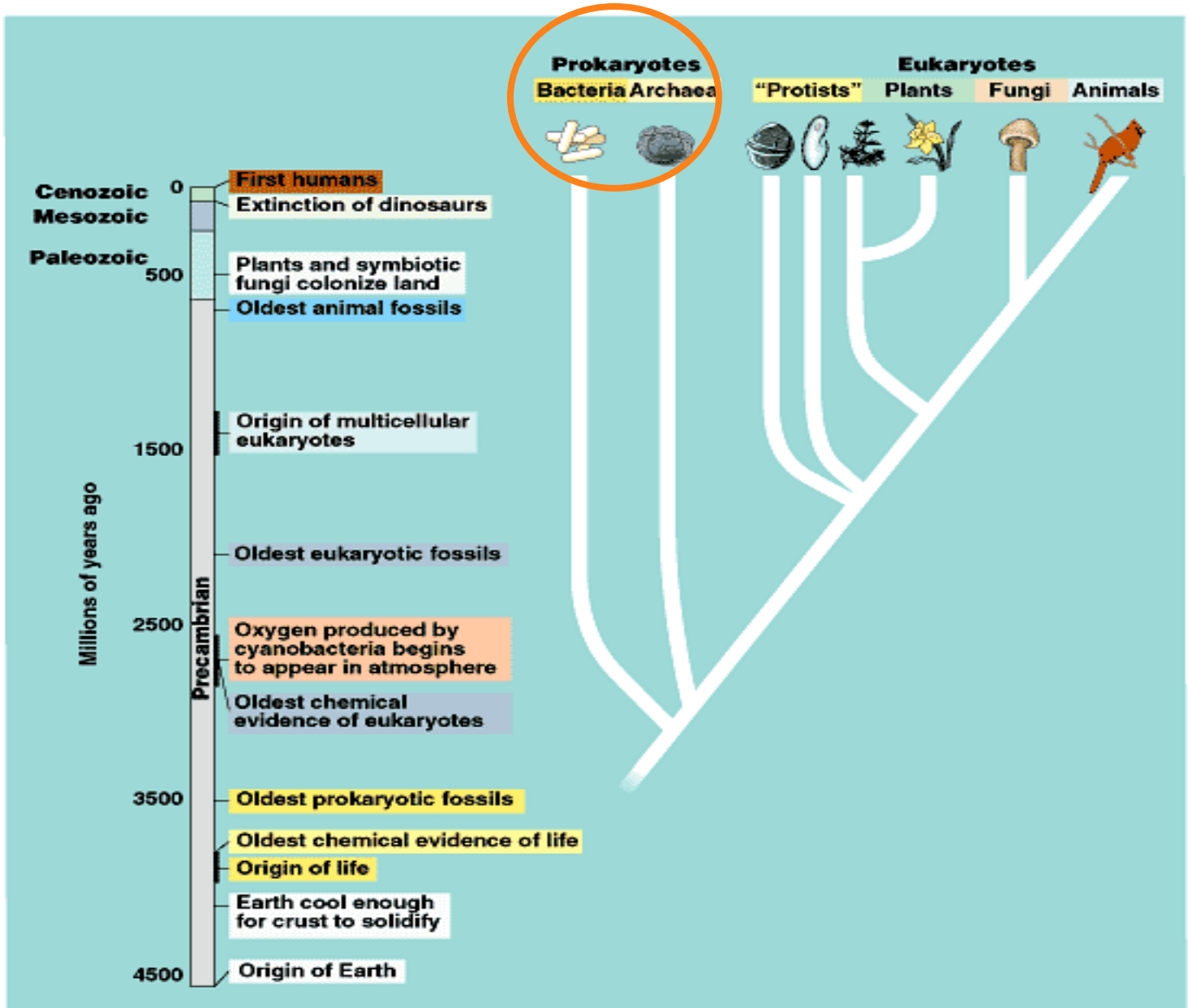
Eubacteria - true bacteria
Archaebacteria - ancient bacteria
Eukaryotes - protists, fungi, plants, animals

5 kingdoms (Whittaker, 1969)

Prokaryotae or Monera
Protista
Fungi
Plantae
Animalia

6 kingdoms

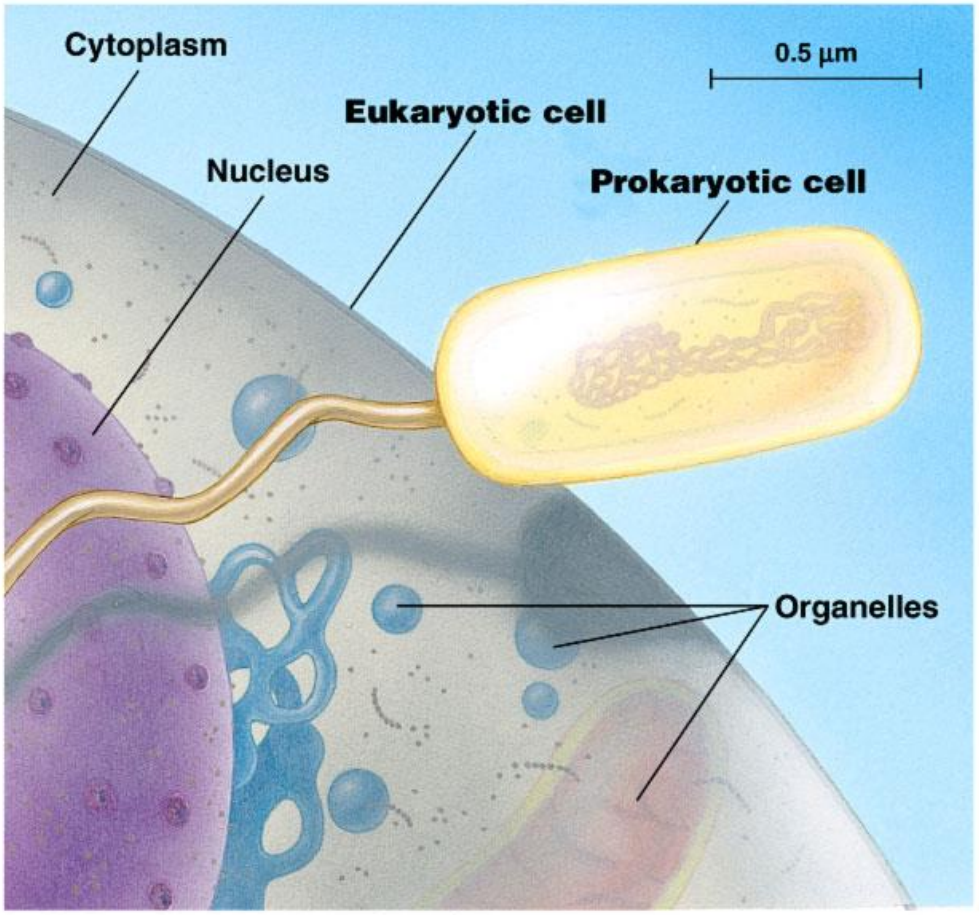
(true bacteria, ancient bacteria, protists, fungi, plants, animals)



Prokaryota & Eukaryota

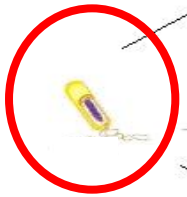
Prokaryota

- nucleus and organelles not formed
- DNA – circular in the cytosol
- unicellular
- ≤ 10 µm (~1 µm)
- Bacteria and Archaea

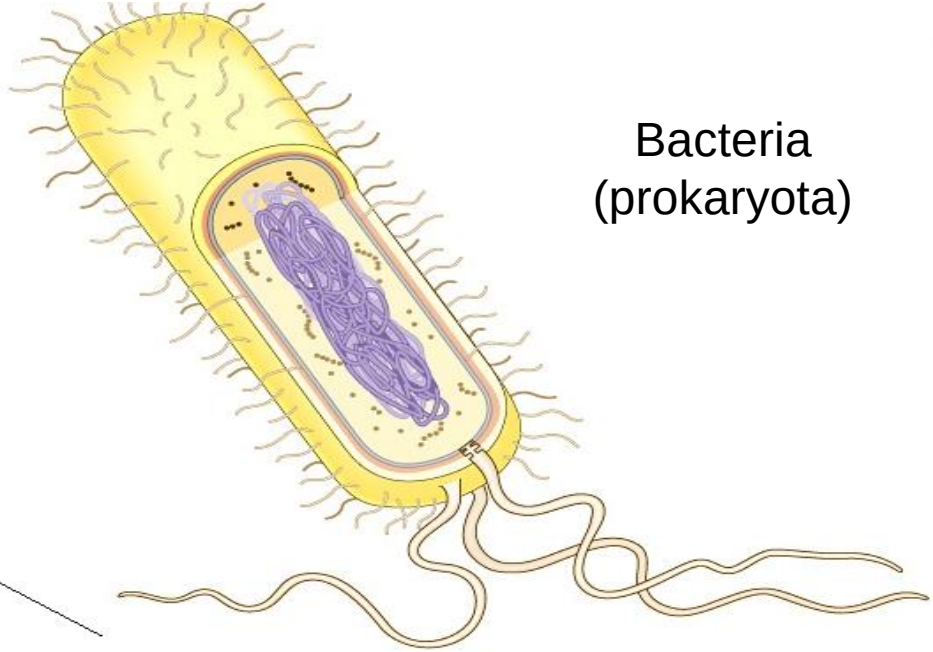


Eukaryota

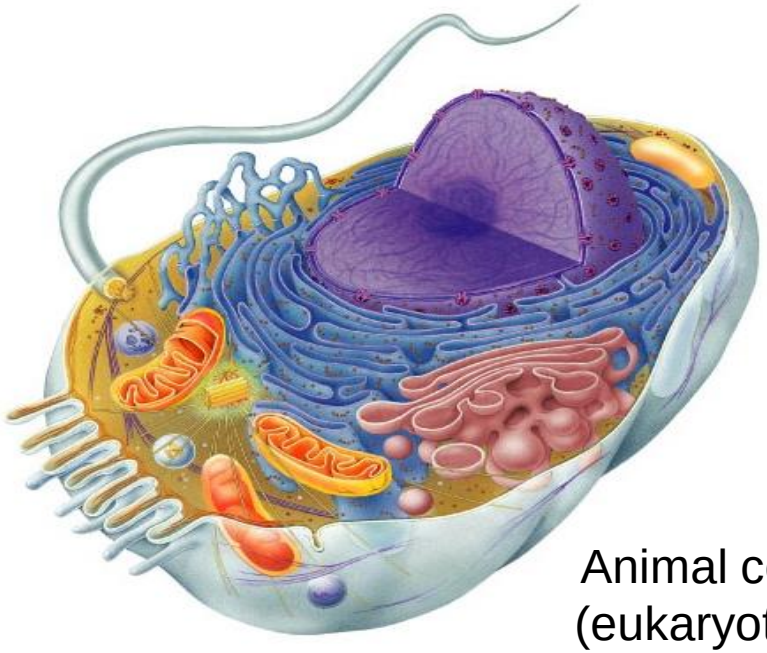
- nucleus and organelles formed
- DNA packed into chromosomes (in nucleus)
- unicellular and multicellular
- ≥ 10 µm



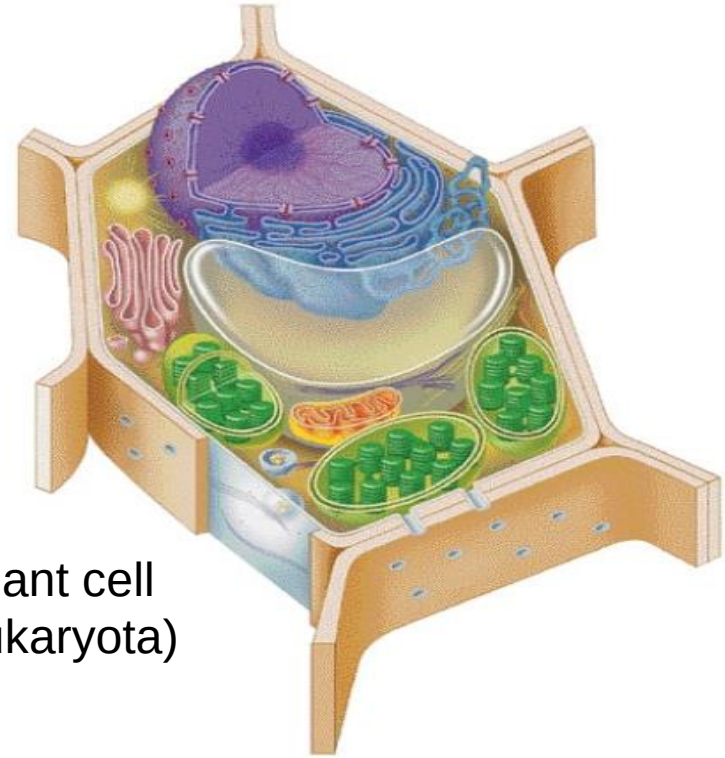
Realistic size ratio



Bacteria
(prokaryota)



Animal cell
(eukaryota)



Plant cell
(eukaryota)

Prokaryota

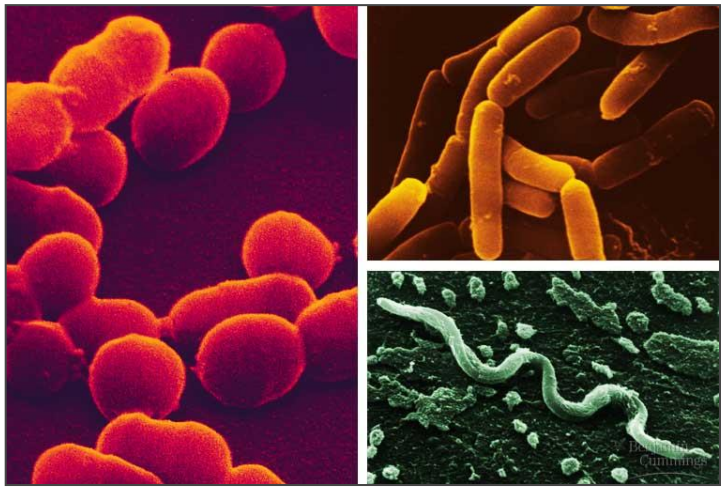
- **kingdoms:**
  1. **Eubacteria (Bacteria)**
  2. **Archaebacteria (Archaea)**

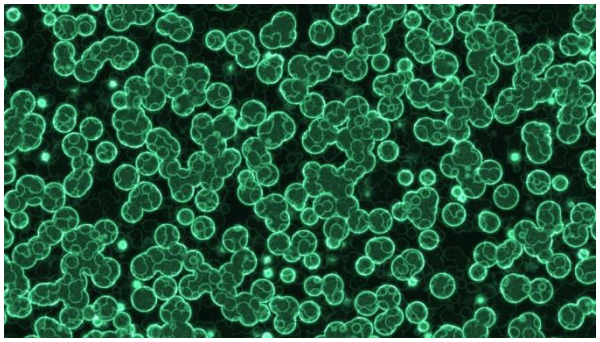
Eukaryota

- **kingdoms:**
  1. **Protista**
  2. **Fungi**
  3. **Plantae**
  4. **Animalia**

Prokaryota

Eubacteria





- “true bacteria” & cyanobacteria

  Heterotrophic (saprophytes & parasites)

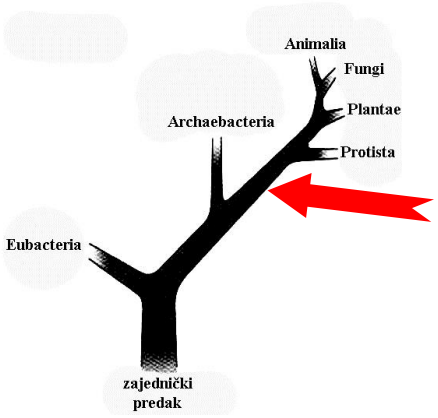
  Autotrophic (photosynthetic & chemosynthetic)

Prokaryota

Archaebacteria

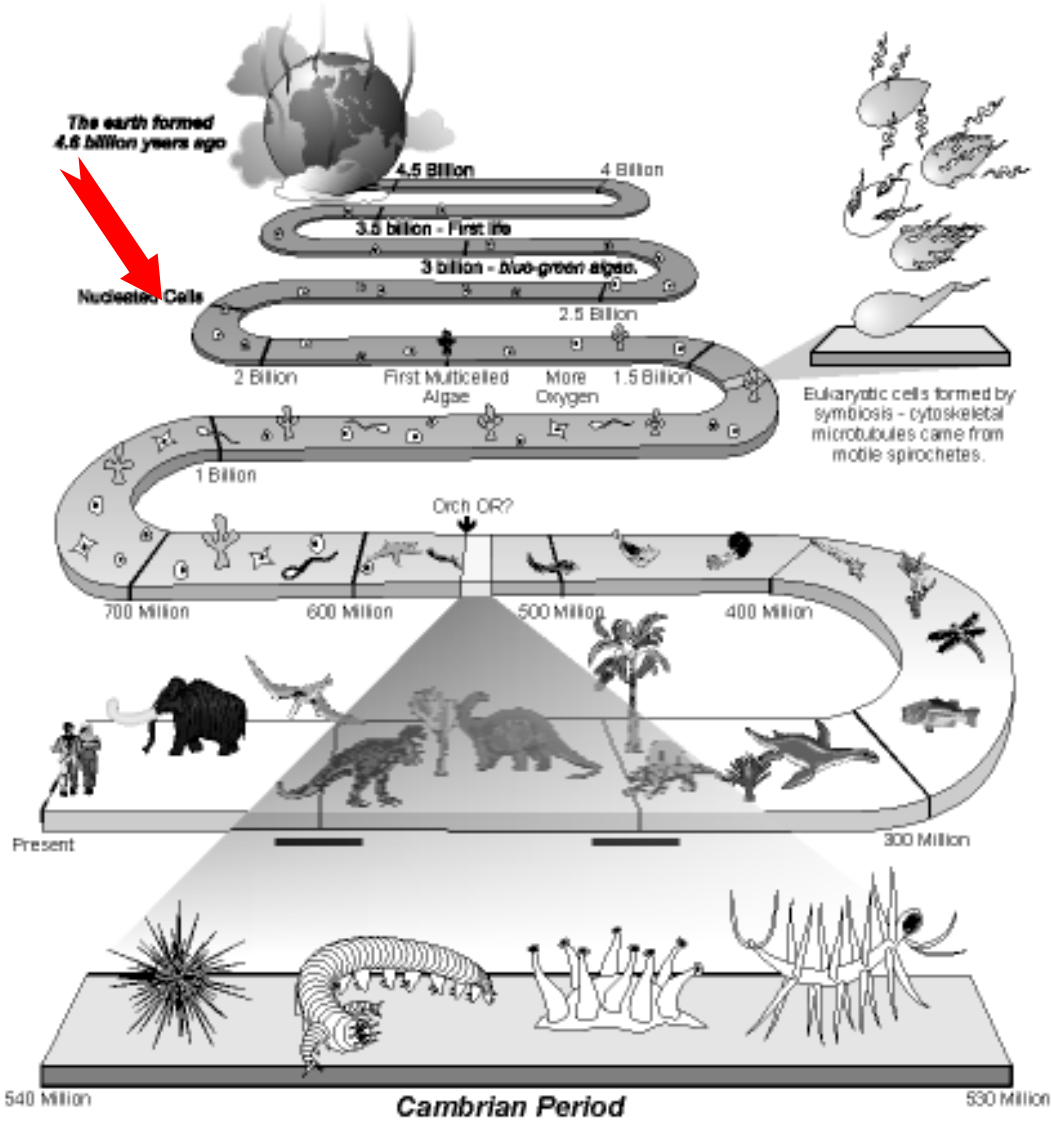
Grow under extreme conditions.

Thermophiles – Heat
Halophiles – Salt
Pressure-tolerant
Acidophiles – pH
Methanogens - use hydrogen gas to reduce carbon dioxide to methane.

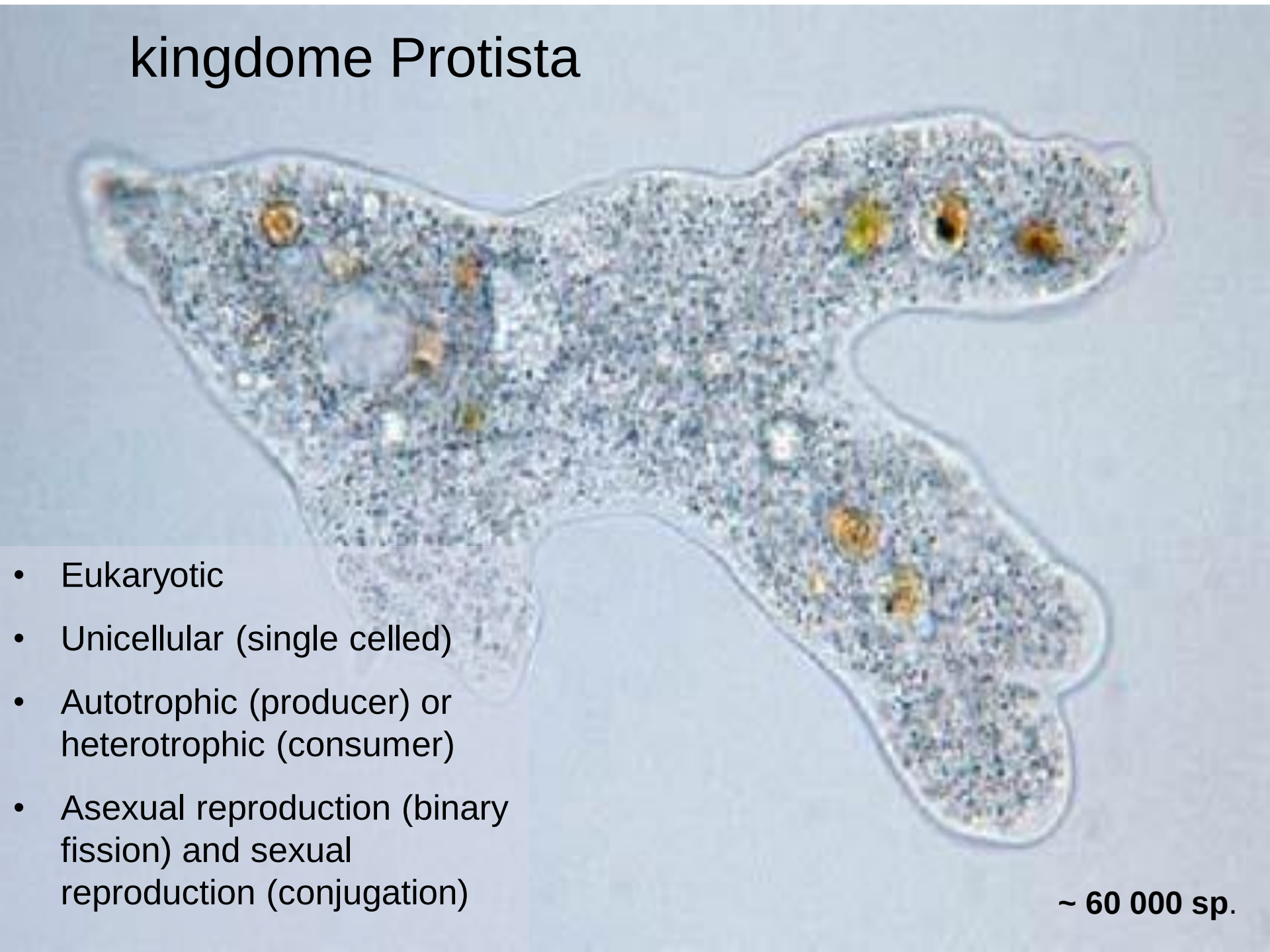


Evolution “into” the “protista”

- Eukaryota from prokaryota (similar to Archebacteria) before 1.6 – 2.1 bil. years
- Modern Protista represent the first eukaryotes



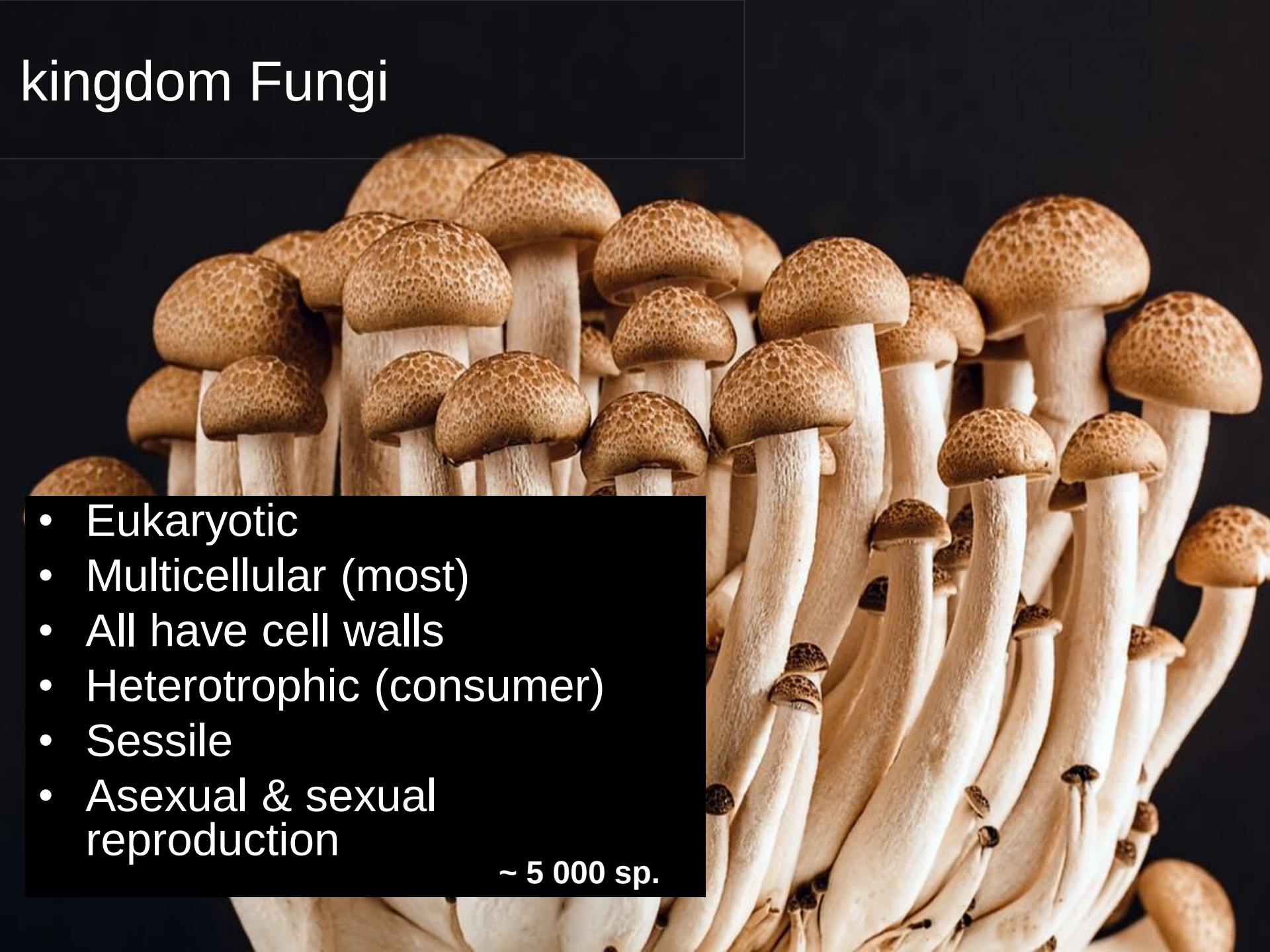
kingdome Protista



- Eukaryotic
- Unicellular (single celled)
- Autotrophic (producer) or heterotrophic (consumer)
- Asexual reproduction (binary fission) and sexual reproduction (conjugation)

~ 60 000 sp.

kingdom Fungi



- Eukaryotic
- Multicellular (most)
- All have cell walls
- Heterotrophic (consumer)
- Sessile
- Asexual & sexual reproduction

~ 5 000 sp.

kingdom Plantae

- Eukaryotic
- Multicellular
- All have cell walls
- Autotrophic (producer)
- Sessile
- Asexual & sexual reproduction

~ 250 000 sp.

kingdom Animalia

- Eukaryotic
- Multicellular
- No cell wall
- Heterotrophic (consumer)
- Capable of movement
- Asexual & sexual reproduction

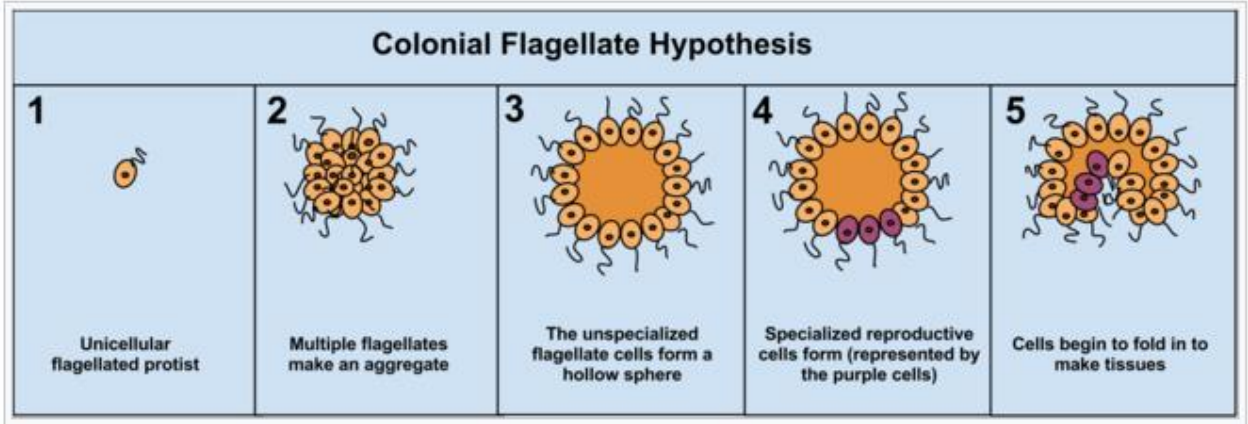
~ 1 000 000+ sp.

Multicelular animals

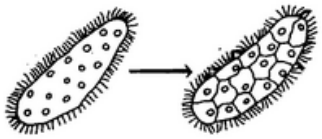
Developed ~700 MYA from some of singlecelled animals (Protista)

- Different theories:

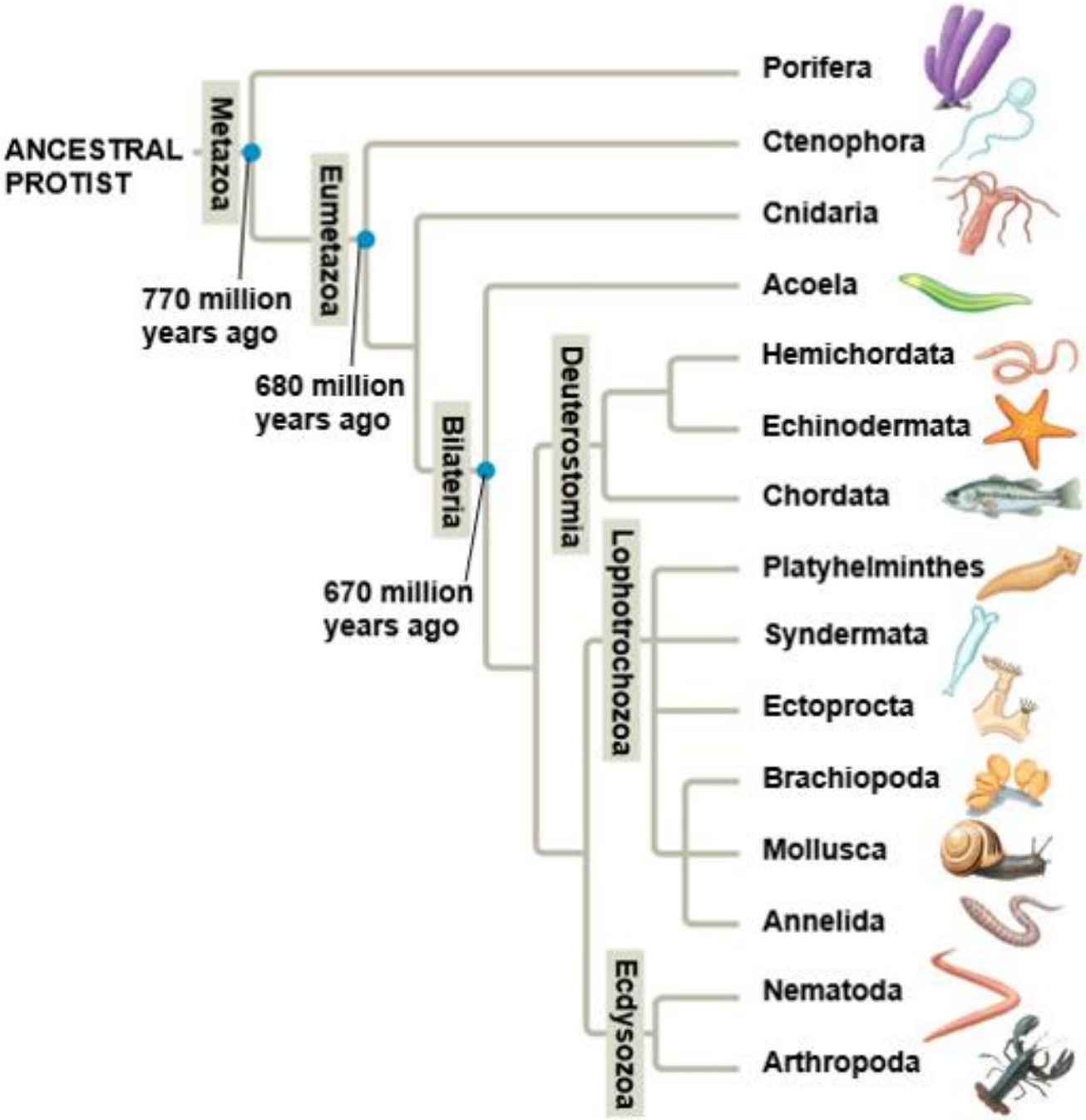
1. The colonial theory (Haeckel 1874)
• common ancestor was colonial flagellate (Protista)



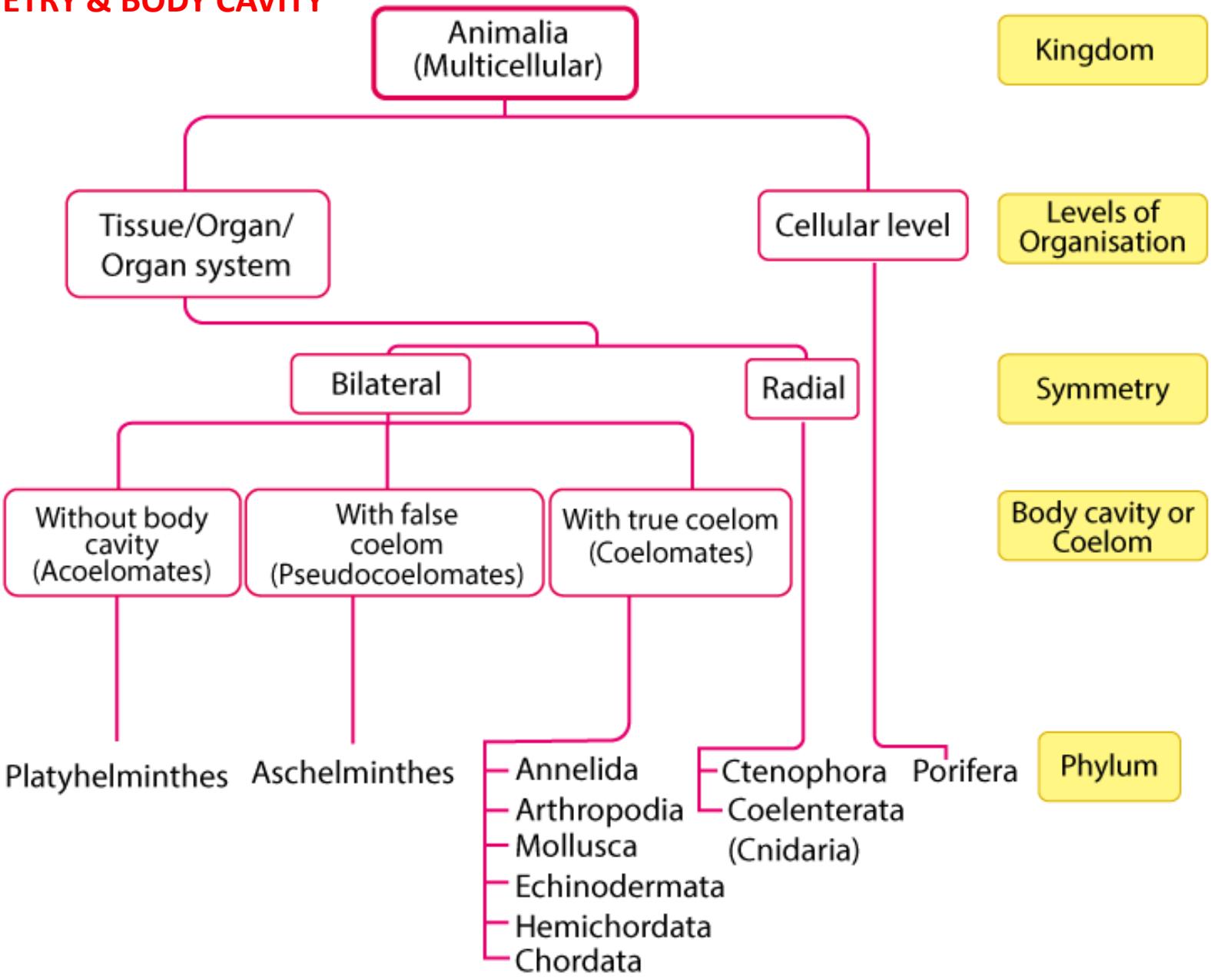
2. The cellularisation (syncytial) theory (Hadži 1953 & Hanson 1977)
• ancestor developed from **multinuclear Protista**



3. **Polyphyletic theor**y – evolved independently from different ancestors


ANCESTRAL PROTIST
Metazoa
Eumetazoa
Bilateria
Deuterostomia
Lophotrochozoa
Ecdysozoa
770 million years ago
680 million years ago
670 million years ago
Porifera
Ctenophora
Cnidaria
Acoela
Hemichordata
Echinodermata
Chordata
Platyhelminthes
Syndermata
Ectoprocta
Brachiopoda
Mollusca
Annelida
Nematoda
Arthropoda

SYMMETRY & BODY CAVITY

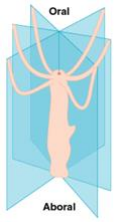


No. OF GERMINAL LAYERS & BODY CAVITY

No tissues:
PARAZOA
Porifera

Tissues differentiated:
EUMETAZOA

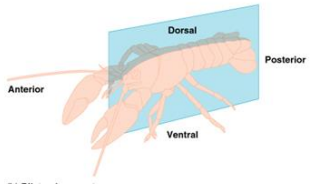
Diploblastic



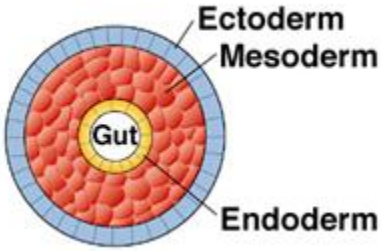
2 germinal layers
(ectoderm and endoderm)
Radial symmetry
Cnidaria
Ctenophora

Triploblastic

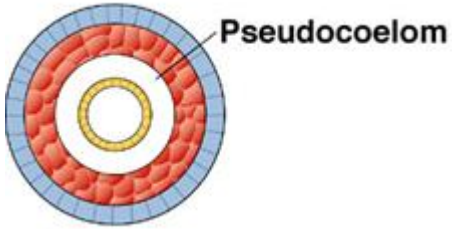
3 germinal layers
(ectoderm, mesoderm and endoderm)
Bilateral symmetry



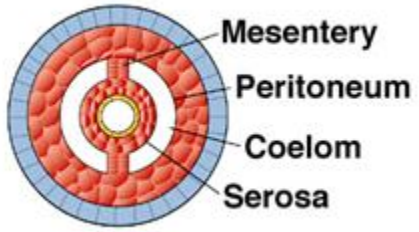
Acoelomata
protostomic
Platyhelminthes
Nemertina



Pseudocoelomata
protostomic
Aschelminthes



Coelomata



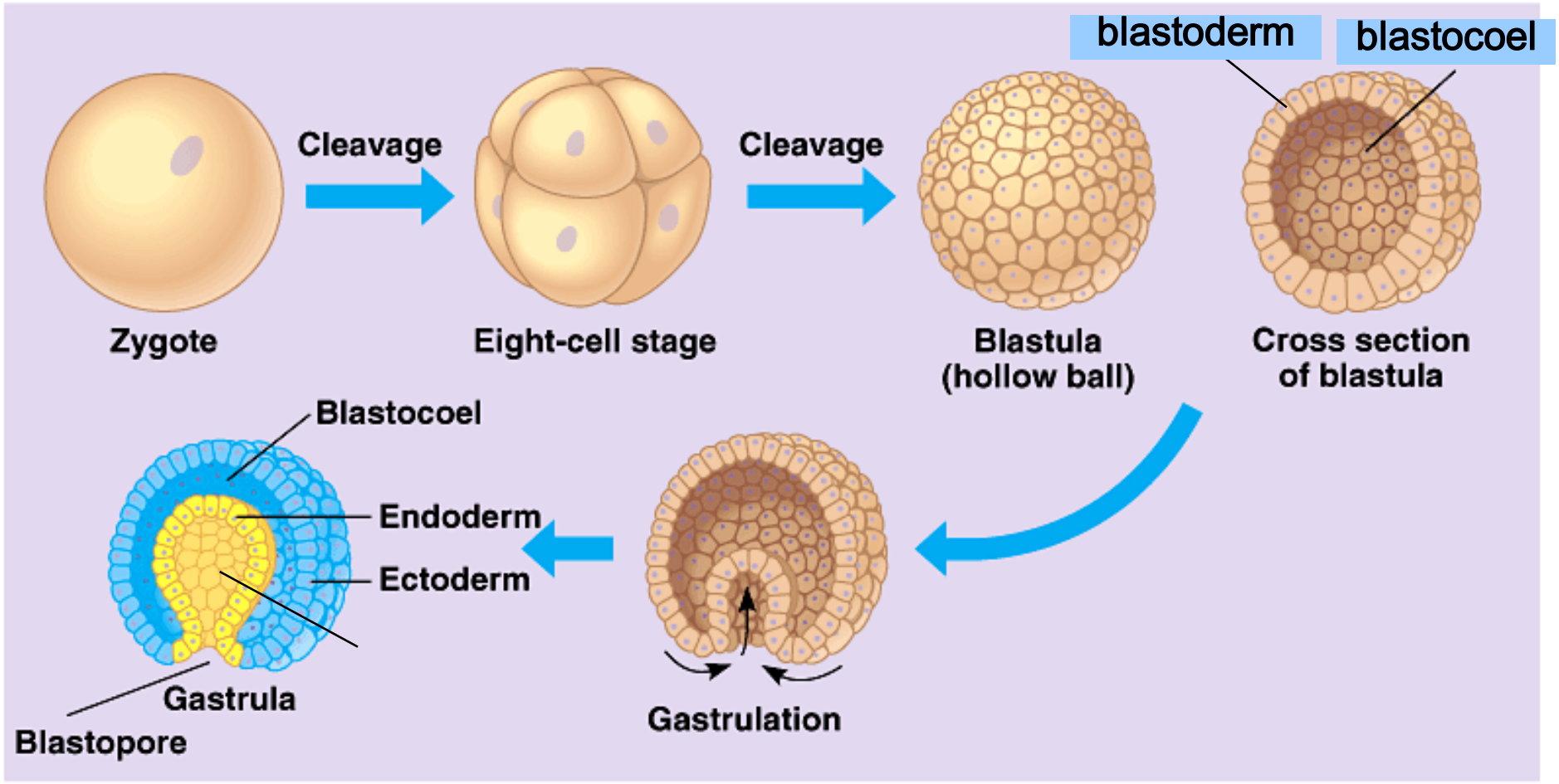
<u>protostomic</u>

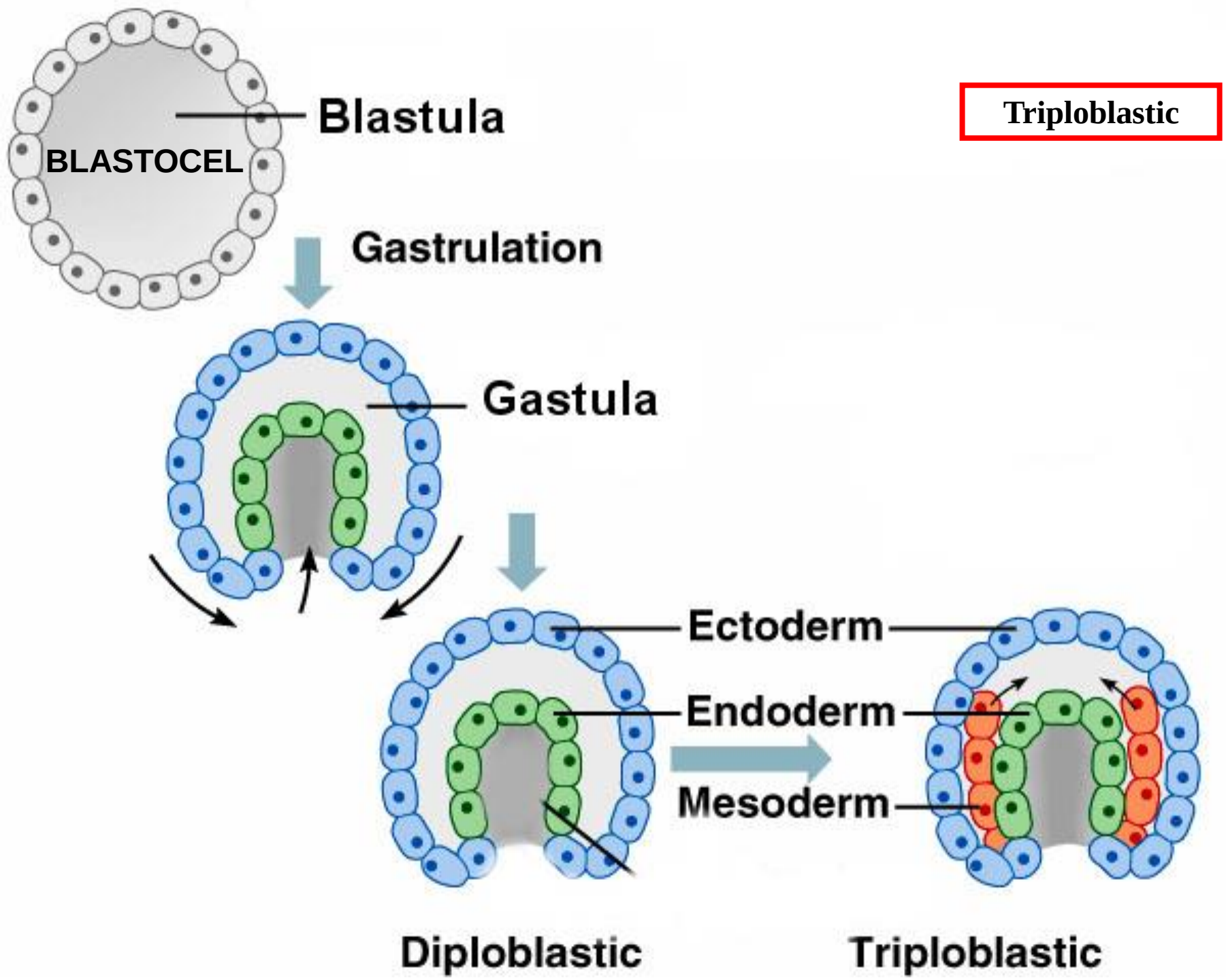
Mollusca
Arthropoda
Annelida
etc..

<u>deuterostomic</u>

Echinodermata
Chordata
etc....

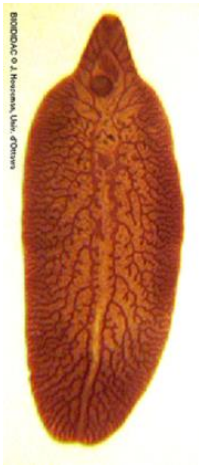
Diploblastic

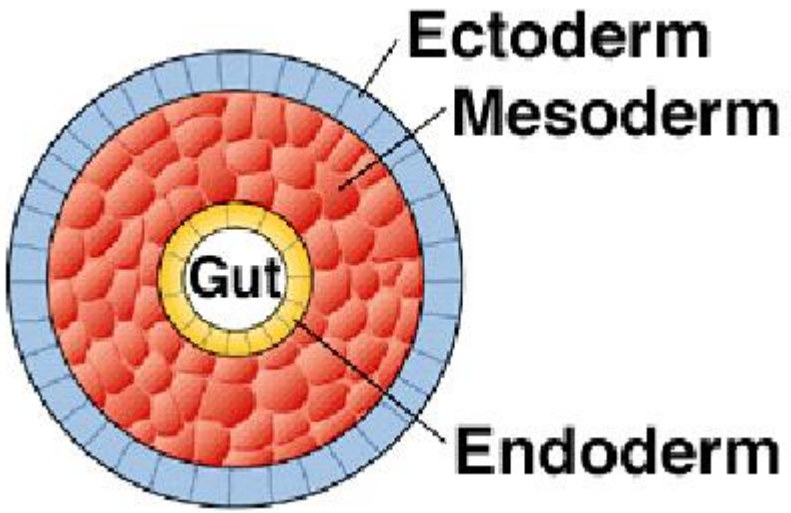




Triploblastic

TRIPLOBLASTIC ACOELOMATA



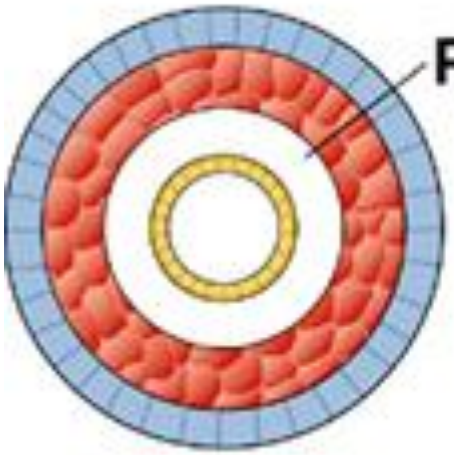


ACELOMATA - Platyhelminthes,
- Nemertina

No body cavity

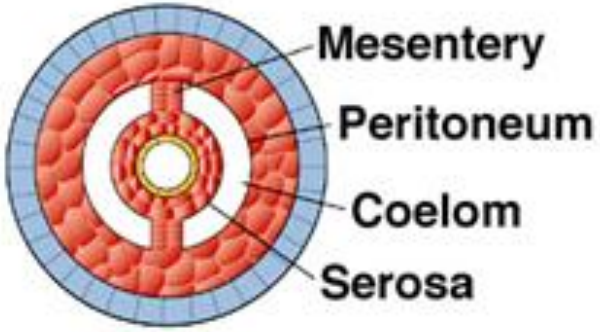
TRIPLOBLASTIC PSEUDOCOELOMATA

No real body cavity



serves as a hydrostatic skeleton against which the muscles can work, making movement more efficient than in acoelomates.

TRIPLOBLASTIC COELOMATA real body cavity

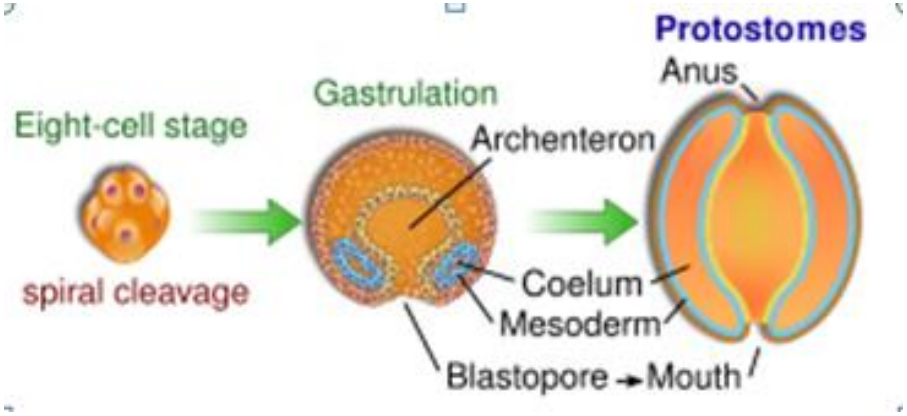


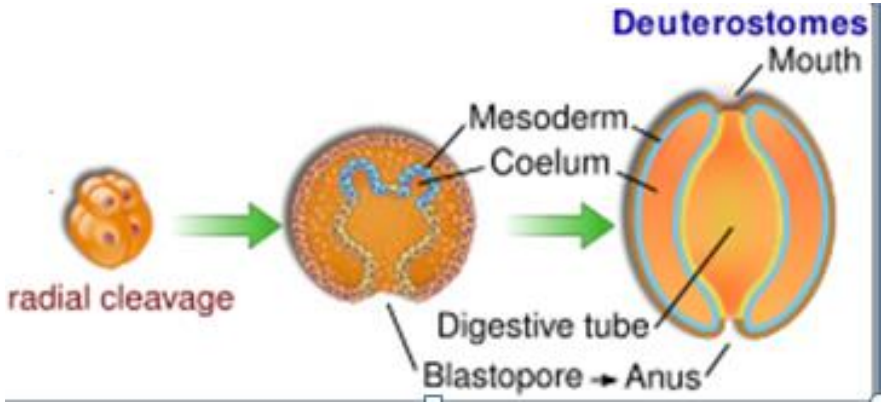
Echinodermata – "Spiny skin"

protostomic **deuterostomic**

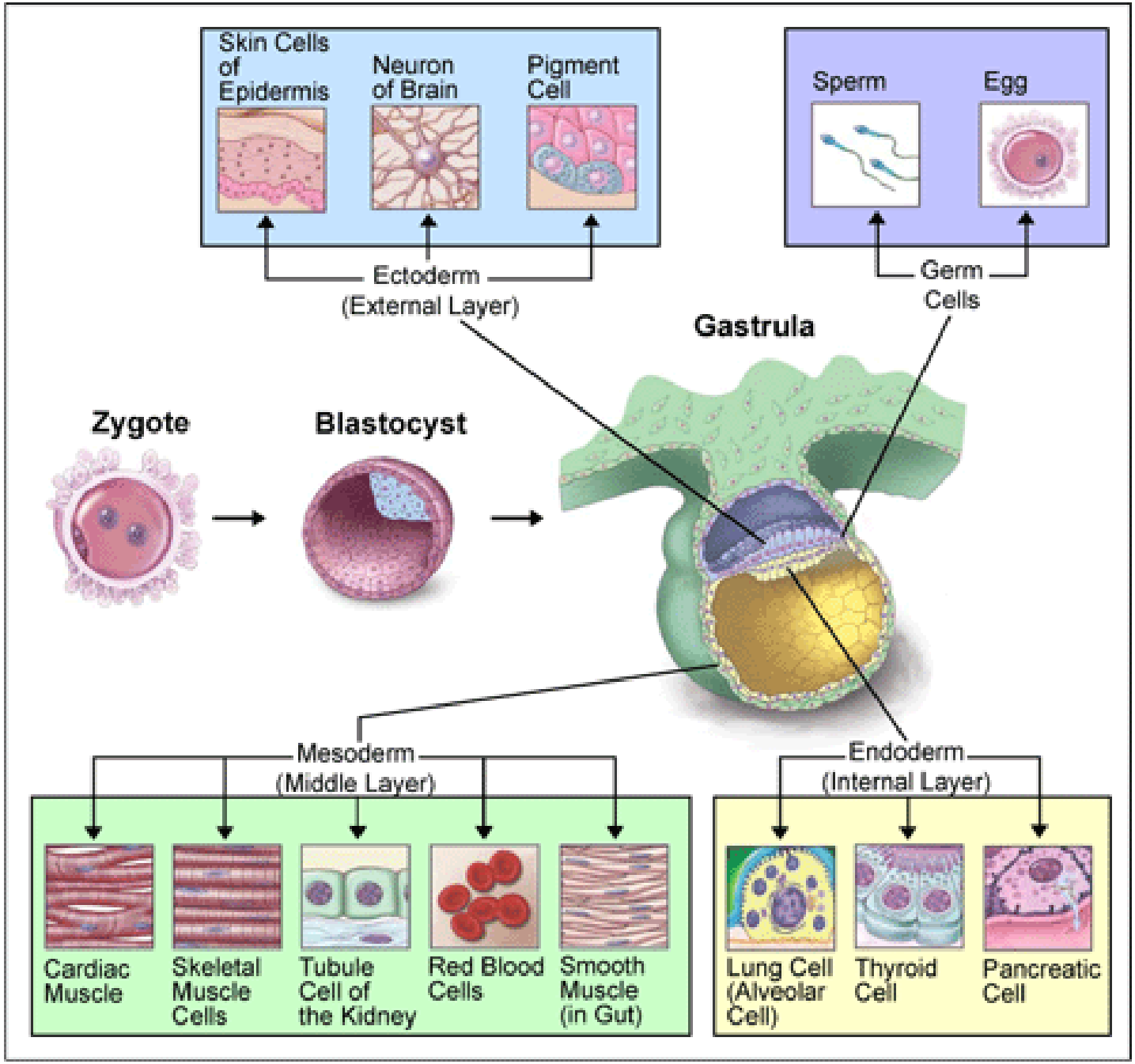
Mollusca
Arthropoda
Annelida
etc..

Echinodermata
Chordata
etc....





Differentiation of cells during embryonal development



- Zoology (grč. *zoon* – animal; *logos* - science)

- Morphology – body shape
  - Anatomy – structure of the body
  - Histology – body tissues
  - Citology – cells

- Embriology – development of organism

- Physiology – different processees in the body

- Phylogeny – evolutionary relation among different taxa (morphology, genetics, anatomy, embiology….)

- Etology – animal behaviour
- Biosociology – coopertion amnog animals
- Parasitology - parasites
- Zoogeography – animals' distribution on the Planet

Different animal groups:

- Nematology – parasitic roundworms (nematods)
- Malacology – mollusks
- Entomology - insects
- Ichtiology - fish
- Herpetology – amphibians and reptiles
- Ornithology - birds
- Mammalogy – mammals
- Astacology – freshwater crayfish

- Molecular biology – on the molecular level
- Bioethic – moral questions
- Genetic - study of genes, genetic variation, and heredity in organisms
- Ecology - relationships between living organisms and their environment
- Evolution - change in the heritable characteristics of biological populations over successive generations
- Astrobiology – if there is life elsewhere in space

Zoological nomenclature

- nomenclature (lat. *nomen*-name*; calare*-call by name) – language of zoology
- Some strict rules - International Code of Zoological Nomenclature (ICZN)
- Scientific names are in Latin (or Latinised)
- Karl Linné (Carolus Linnaeus) – started

- Binomial nomenclature is a binomial system of naming a species
- name of ***Genus*** and ***species***

Hydra *oligactis* – brown hydra

(genus) (species)

The whole name, only first time in the text

Anodonta cygnea

later

A. cygnea

If species is not known

Anodonta **sp.**

sp. (abbreviation from species) never in italic

Locus typicus – place where species was found for the first tie

Holotype – the specimen that was used for species description

Rule of priority – if more names, the first name published is the right one, the rest are synonyms (since 1758 (Systema Naturae, 1758))

Nomen oblitum – name is forgotten if it was not (as synonym) used for > 50 years

Homonyms – if the same name was given to 2 (or more) different species

Baileya australis (Grote, 1881) (moth)

Baileya australis Rydb. (a desert marigold)

After name – author and year of description

Vulpes vulpes Linnaeus, 1735

If species change position (different genus, genus name changed) – author in brackets

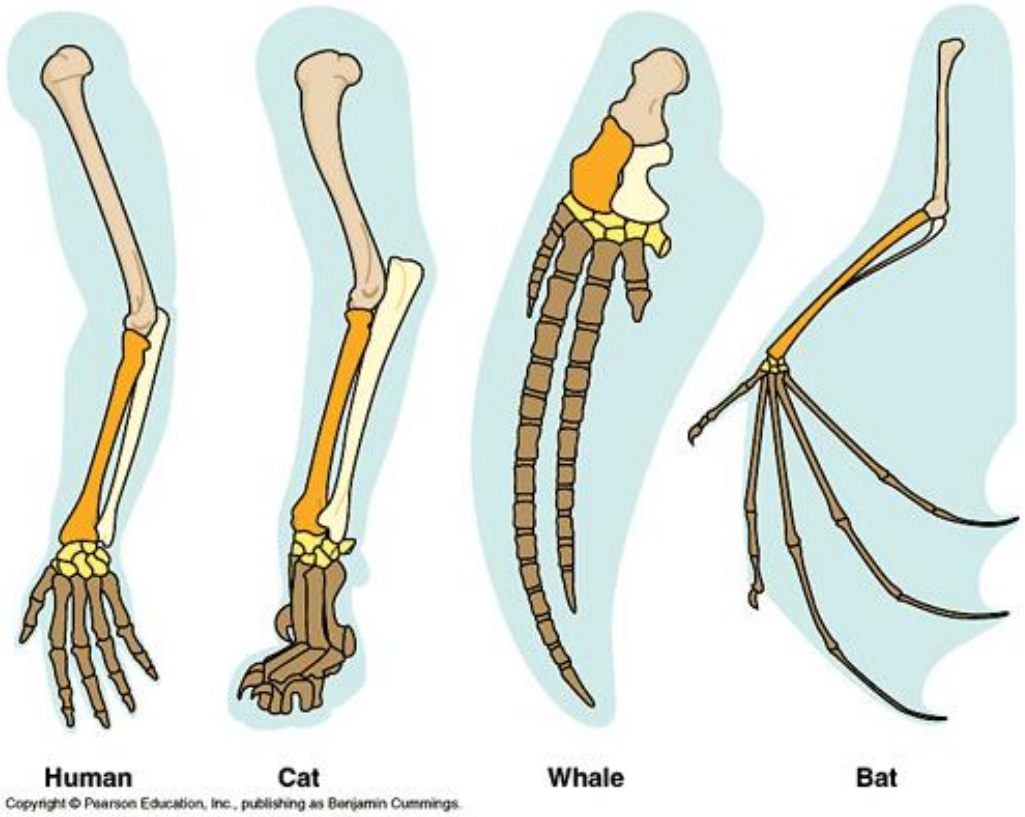
Radix labiata (Rossmassler, 1835)

Subspecies – 3 names

Fagotia daudebartii acicularis (Ferussac, 1823)

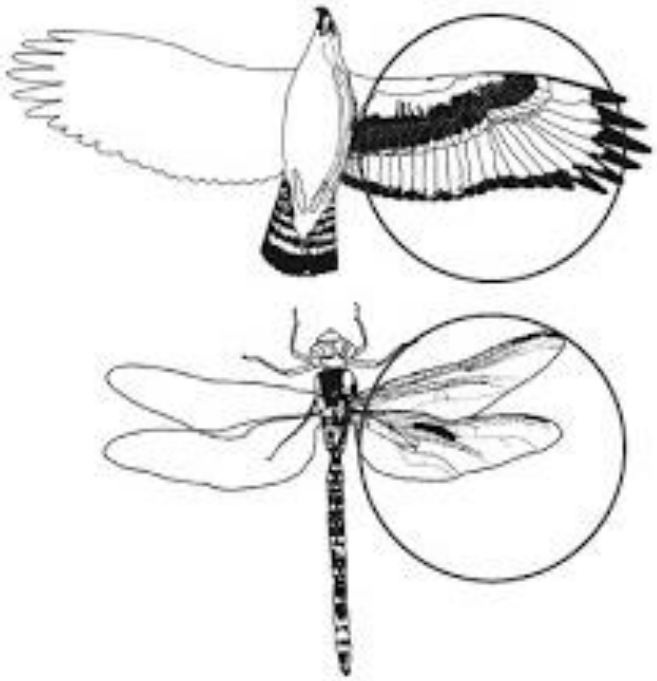
Homologous organs

Same origin - different function



Analogous organs

Different origin, same function



- Systematics – study of the diversification of living forms, both past and present, and the relationships among living things through time
- includes:
  - Taxonomy

    is the scientific study of naming, defining and classifying groups of biological organisms based on shared characteristics
  - Classification

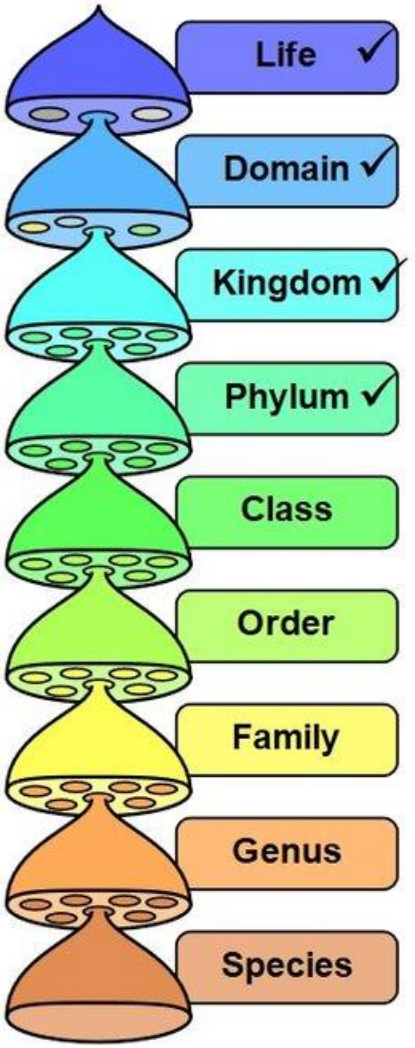
    naming and putting into relation groups of organisms
  - Nomenklaturu

Taxon – group of organisms sharing the same ancestor

Categories in systematic:

Regnum/kingdom	Animalia
phylum	Arthropoda
class	Crustacea
order	Decapoda
family	Astacidae
genus	*Austropotamobius*
species	*torrentium*

Stone crayfish

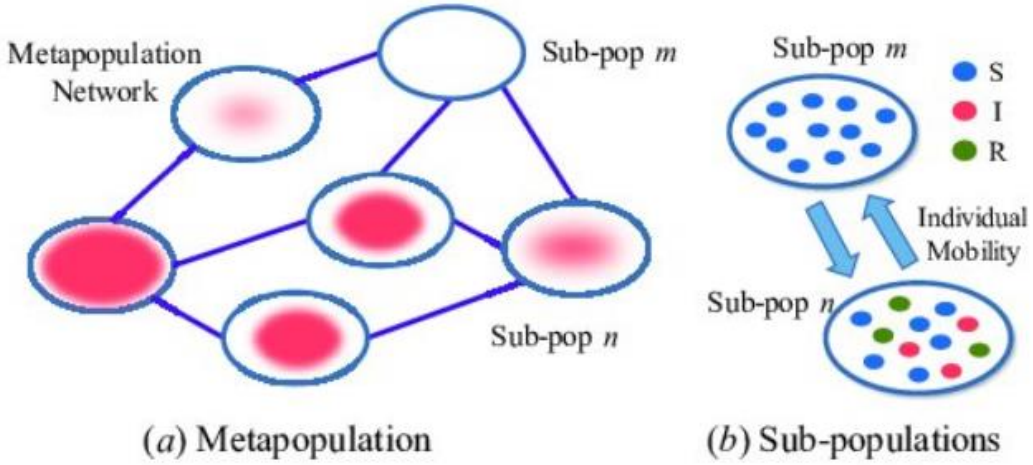


Population

- is the number of organisms of the same species that live in a particular geographic area at the same time, with the capability of interbreeding

- Dem (subpopulation) – part of population in a small area

- Metapopulation – group of subpopulations (dems)

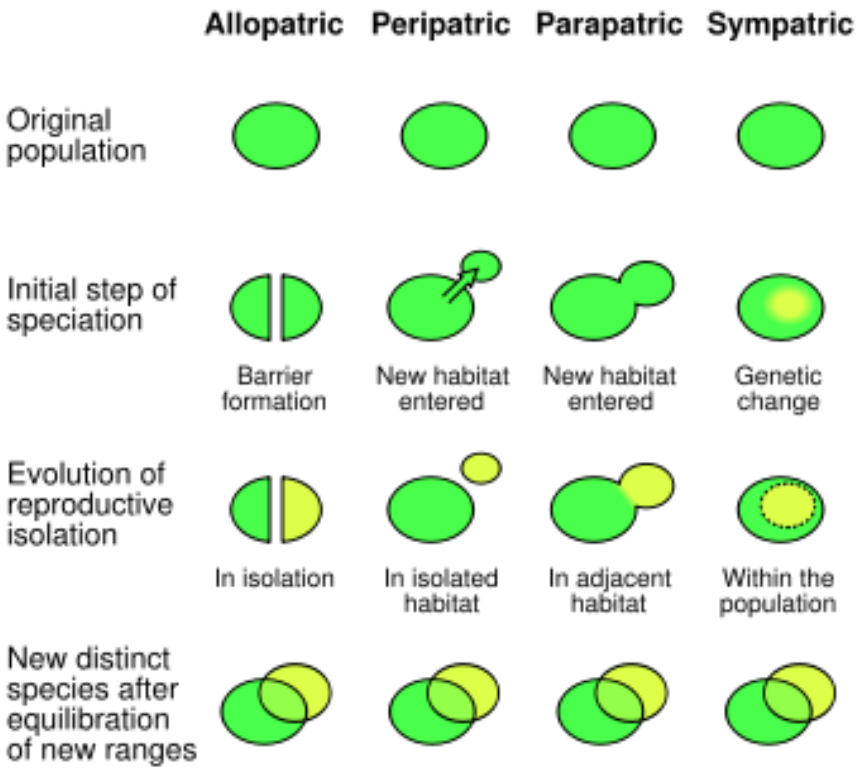


Species

- Biological definition

  a group of organisms that can reproduce with one another in nature and produce fertile offsprings (Mayr, 1969)

- Speciation – process of species development
  - allopatric
  - sympatric
  - Parapatric
  - Peripatric



Different mechanisms of isolation

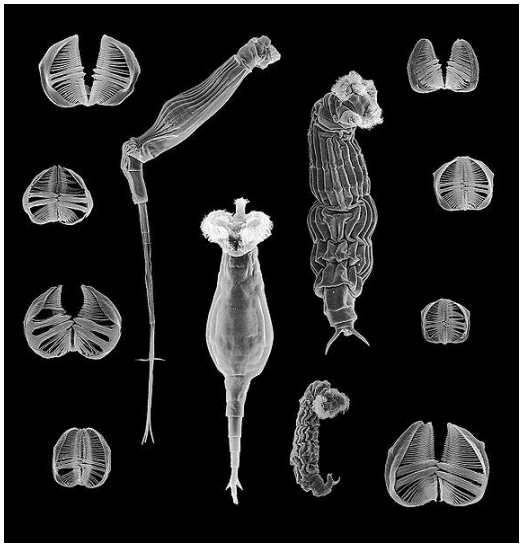
- Before mating
  - Geo isolation
  - Time isolation (different time of mating)
  - Different behaviour
  - Difference in reproductive organs' anatomy
  - Different chemical receptors and pheromones

- After mating – (hybridisation – hybrids)
  - Zygote/ embrio does not survive
  - Hybrids are incapable to live
  - Hybrids are sterile

- sibling species – reproductively separated, morphologically similar (undistinguishable) (frequent in insects)

Willow flycatcher (left) and Alder flycatcher (right).
Photo: Powdermill Nature Reserve

- Agamospecies – taxa that reproduce asexually or parthenogenetically are clones (all identical)
- Bdelloidea (Rotifera) – no males for 250 mil. years



Bdelloidea