

**General Classification**  
**Kingdom—Animalia**

2 Branches

↓  
Parazoa  
(Cellular level  
No mouth and digestive cavity)

↓  
Porifera

↓  
Radiata  
(Radial symmetry)

↓  
Protostomia  
(Coelom is schizocoelic, cleavage is spiral  
and determinate)

↓  
Eumetazoa  
(Digestive cavity and differentiation  
of tissues is present)

↓  
2 Divisions

↓  
Bilateria  
(Bilateral symmetry)

2 Subdivisions

↓  
Deuterostomia  
(Coelom is enterocoelic or secondarily  
schizocoelic, cleavage is radial  
and indeterminate)

↓  
Acoelomata  
(No digestive cavity)

↓  
Platyhelminthes

↓  
Annelida

↓  
Echinodermata

↓  
Pseudocoelomata  
(Digestive cavity is pseudocoel)

↓  
Nematheleminthes

↓  
Mollusca (2 Phyla)

↓  
Eucoelomata  
(True coelom)

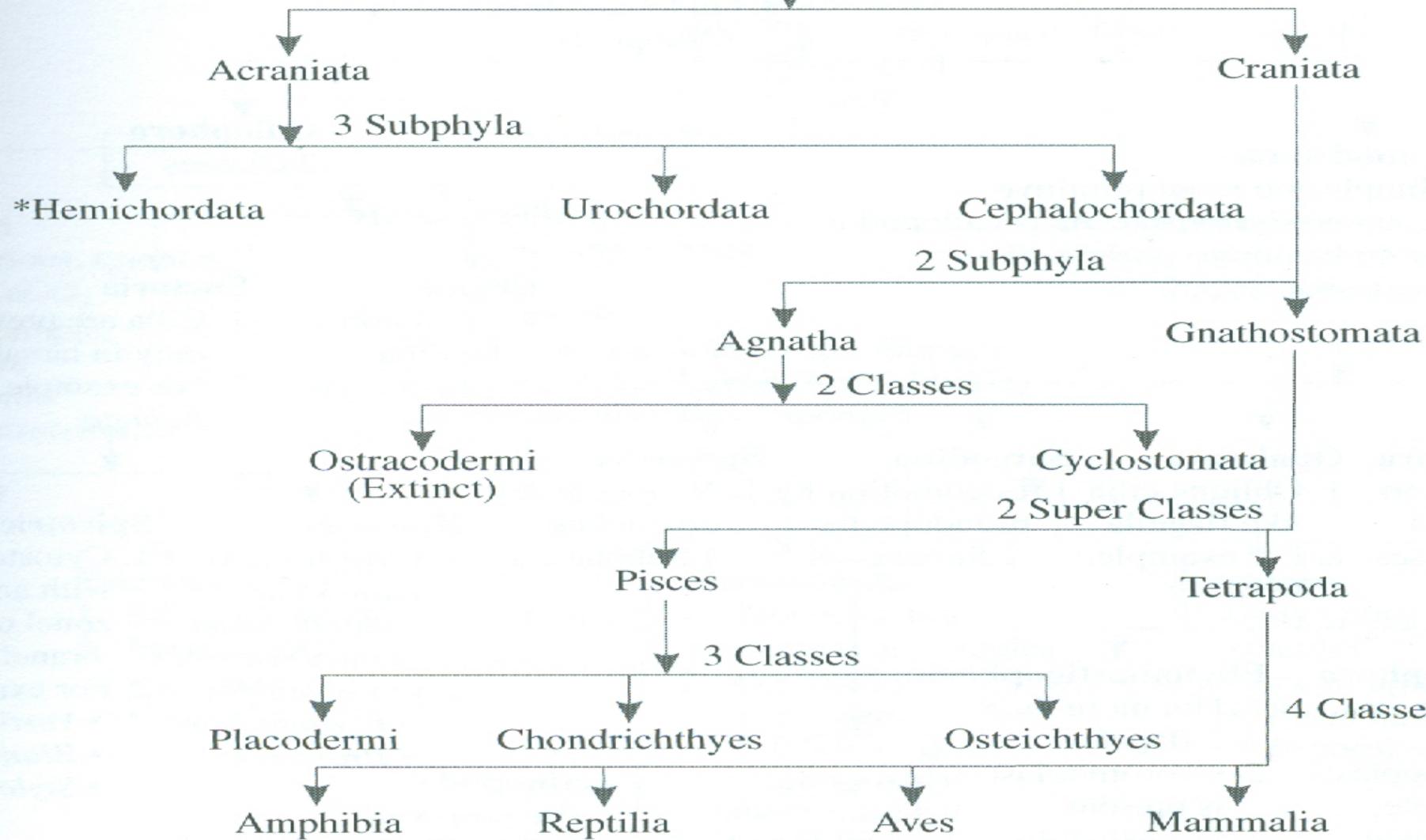
↓  
Arthropoda

↓  
Chordata



## Phylum Chordata

Group



# Protozoa



- - 1. Named by Goldfuss (1820)
  - 2. 50,000 animals species.
  - 3. On locomotion
- 2 Subphyla

# Subpylum Plasmodroma



- 1. Simple and more primitive.
  2. Locomotion by flagella pseudopodia or no locomotory organelles.

4 Classes



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# 4 classes of Subphylum Plasmodroma



## ● Mastigophora

I. Locomotion by flagella.

### Opalinata

1. Oblique cilia like flagella.

2. For example, Opalina.

### Sarcodina

I. Locomotion by pseudopodia.

### Sporozoa

1. No locomotory organelles.



# Subclasses of Class Mastigophora



## ● Zoomastigophora

- I. More than 2 flagella.
2. No chromoplasts.
3. For example,  
*Trypanosoma*.

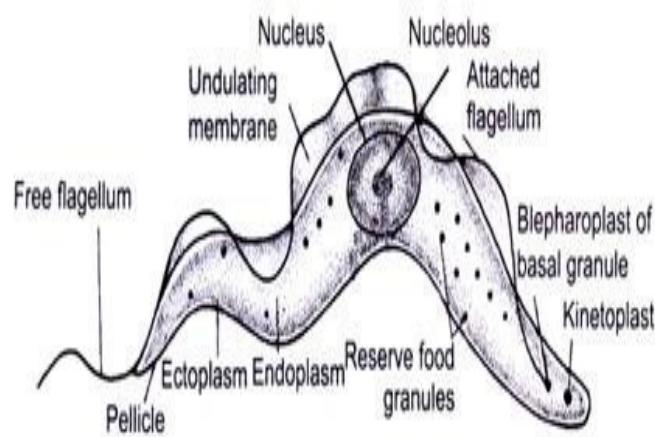
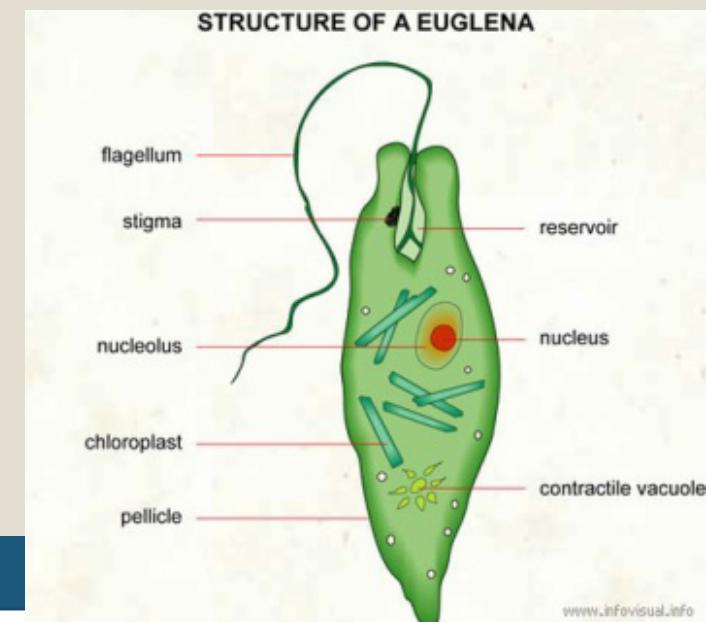


Fig. 9.22 A Trypanosoma

## Phytomastigophora

- I. Not more than 2 flagella.
2. Chromoplast is present.
3. For example, *Euglena*.



# 2 subclasses of sarcodina

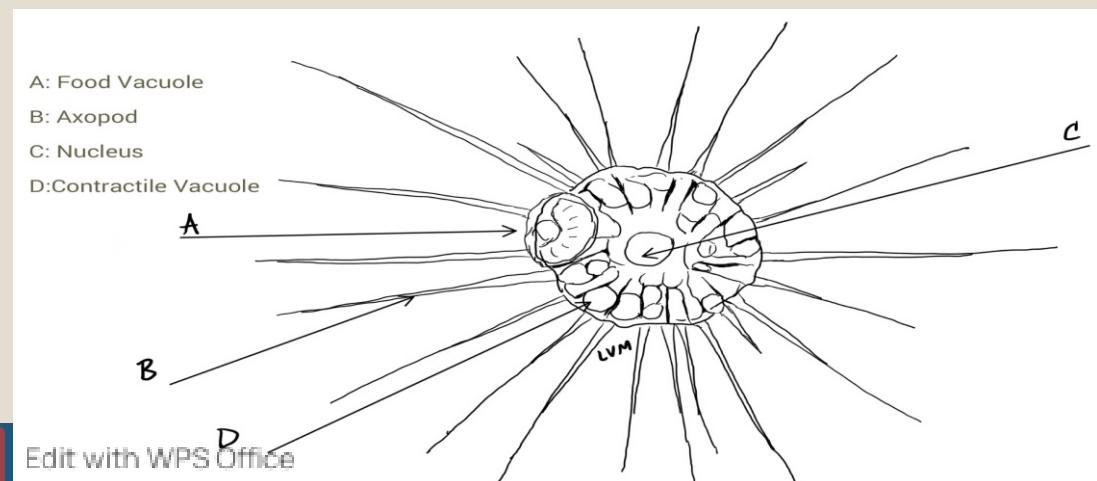


## ● Rhizopoda

1. Pseudopodia
2. Blunt finger-like  
*Lobopodia*
3. For example,
  - *Amoeba*
  - *Entamoeba*

## Actinopoda

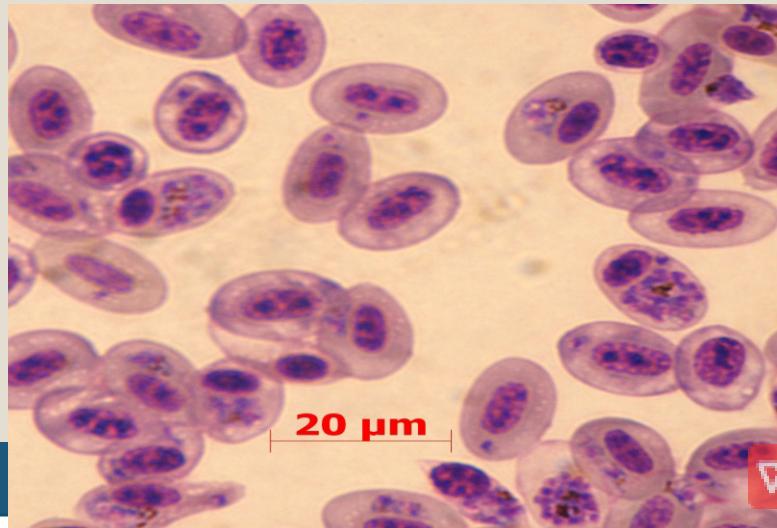
1. Pseudopodia
2. Semipermanent
3. Consisting axial covered with a central filament
4. E.g *Actinophrys*



# Four subclasses of Sporozoa



- Telolsoriadia
  - I. Trophozoite is uninucleate
  - 2. For example,
    - *Plasmodium*
    - Monocystes: *Gregarina*



## Piroplasmea

- I. Blood parasite
- 2. For example, *Babesia*



# Four subclasses of Sporozoa



- **Toxoplasmia**

1. Trophozoite reproduces asexually in which cyst is formed.
2. Intracellular parasite.
3. Spores are not formed.
4. For example, *Toxoplasma*



# Four subclasses of Sporozoa



- **Cnidospora**

1. Trophozoite is multinucleate.
2. Each spore has generally a single sporozoite.
3. For example,
  - *Myxobolus*
  - *Nosema*



# Subphylum Ciliophora



## ● Class Ciliata

I. Locomotion  
by cilia.

## Class Suctoria

I. Cilia are present  
only in larval state.  
2. For example,  
*Ephelo acineta*

# Subclasses of Ciliata



## ● Holotrichia

1. Cytostome is without an adderall zonal or membranelles e.g *Paramecium*, *Prorudon*

## Spirotricha

1. Cystome is with an adderall zonel of membranelles e.g *Vorticella*, *Blanitidium*, *Stylochonia*.

# Porifera



1. Named by E R Grant (1825).
2. Most primitive multicellular animals
3. Blind stock.
4. The interior space of body is called spongocoel.  
3 Classes

# Three (3) classes of Porifera



- **Calcarea**

- I. Calcarious, spicules i.e., CaCO<sub>3</sub>

- 2. For example,

- *Sycon*
    - *Grantia*
    - *Lucosolenia*



# Three (3) classes of Porifera



- **Hexactinellida**

1. Siliceous and triaxon spicules.
2. For example,
  - *Hyalonema* (Glass rope sponge)
  - *Euplectella* (Venus flower basket)
  - *Pheronema* (Bowl sponge)



# Three (3) classes of Porifera

---



- **Demospongiae**

1. May be siliceous but all types of shapes other than triaxon.



# Demospongiae



- **Tetractinellida**
  1. Siliceous and tetraxon spicules.
  2. For example,
    - *Plakina*
    - *Geodia*



- Monaxonida**
  - I. Silicous and monoaxon spicules.
  2. For example,
    - *Spongilla*
    - *Cliona*



# Demospongiae



## ● Keratosa

1. Only spongin fibres spicules.
2. For example,
  - *Euspongia*
  - *Hippospongia*



# Coelenterata



1. Leuckart (1847) coined the term Coelenterat.
2. 9,500 species.
3. Radial symmetry.
4. Diploblastic.
5. Tissue gradation.
6. Alternation of generation.
7. Larva-Planula.  
3 Classes

# Three classes of Coelenterata



## ● **Hydrozoa**

- I. Freshwater or marine.
2. Polyp and medusa.
3. Asexual and sexual reproduction.
4. Polyp is fixed and colonial.
5. Medusa is solitary and free living.
6. Velum is present in medusa.



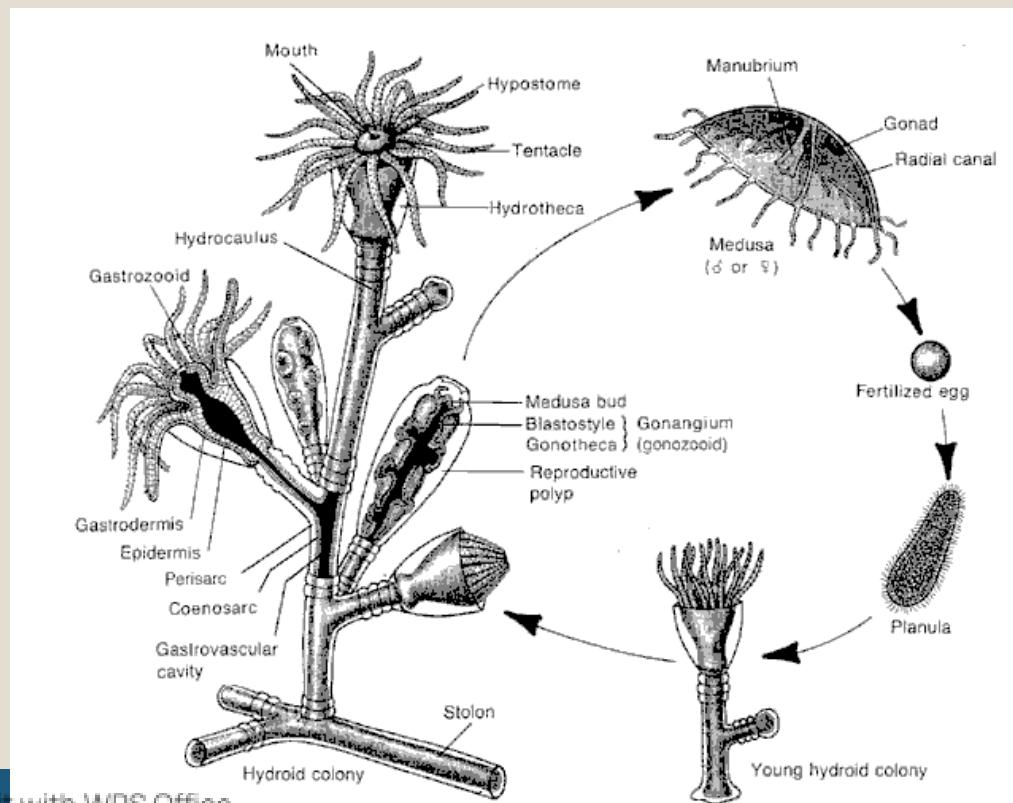
# Hydrozoa cont'd



7. Tentacles of polyp are solid.
8. Gonads are ectodermal in origin.
9. Coelenteron without septa.

10. For example,

- *Hydra*
- *Obelia*
- *Velella*
- *Plumularia*
- *Sertularia*
- *Porpita*
- *Physalia*



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Figure 5-11 Life cycle of *Obelia*, showing structure of hydroid colony. [Adapted from various sources.]

# Three classes of Coelenterata



## ● Scyphozoa (Jellyfish)

1. Marine forms and medusa are well developed.
2. Velum is absent.
3. Mesoglea is well developed.
4. Coelenteron is septet.
5. Gonads endodermal in origin.
6. For example,
  - *Aurelia*
  - *Carybdea*

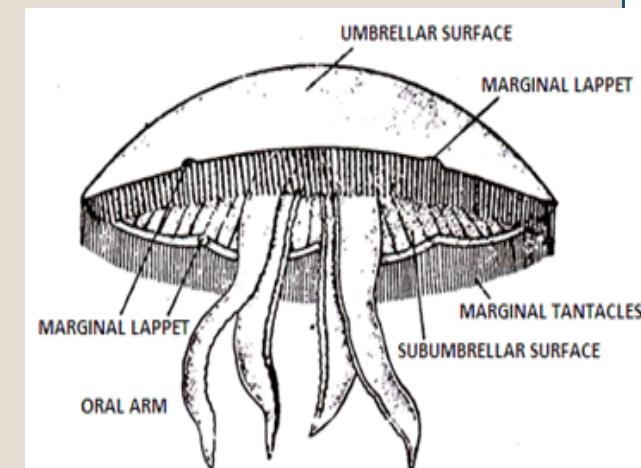


Fig. 169 AURELIA

# Three classes of Coelenterata



## ● Anthozoa or Actinozoa.

1. Polyp only.
2. Oral disc covers mouth.
3. Coelenteron is divided by mesenteries.
4. Gonads are endodermal.
5. Tentacles are hollow.

2 Subclasses

# Two subclasses of Anthozoa



- **Alycyoniaria**  
(Hexacorallia)
  1. 8 mesntry (unpaired)  
8 tentacles
  2. For example,
    - *Alcyonium*
    - *Corallium*
    - *Tubipora*
    - *Pennatula*
    - *Gorgonia*



*Corallium*



*Pennatula*



# Two subclasses of Anthozoa



- **Zoantharia (Octocorallia)**

1. Mesenteries are usually paired and multiples of
2. Tentacles in multiples of six .For example,

- *Adamsia*
- *Metridium*
- *Anemonia*
- *Antipathes*
- *Fungia*
- *Meandrina*
- *Cerianthus*



*Cerianthus*

# Ctenophora



- 1. Eschscholtz (1829) coined the term Ctenophore
- 2. Without nematocyst
- 3. Biradially symmetrical
- 4. Tentacles bear special adhesive cells called lasso cells or colloblast.
- 5. Bioluminescent organisms
- 6. No alteration of generation
- 7. Cydippid larva
- 8. Regeneration common

# Classes of Ctenophora



## • Tentaculata

- I. Tentacles are present
2. For example,
  - *Ctenoplana*
  - *Hormiphora*
  - *Pleurobranchia*
  - *Cestus*



*Ctenoplana*



*Pleurobranchia*

## Nuda

- I. Tentacles are absent
2. For example,
  - *Beroe*



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# Platyhelminthes



- 1. Gegenbauer (1858) proposed the term.
- 2. Minot (1876) spelled the phylum as Platyhelminthes 10,000–15,000 species.
- 3. Triploblastic
- 4. Dorsoventrally flattened, Bilaterally symmetrical.
- 5. Coelom filled with parenchyma (A kind of connective tissue).
- 6. Mesoderm forms reproductive organs.
- 7. Cuticular covering.
- 8. Organ grade of body organization.
- 9. Digestive system is incomplete (Anus absent).
- 10. Bisexual (Monoecious).
- 11. Excretion by flame cells.
- 12. Nervous systems is ladder-like.

# Three classes (3) of Platyhelminthes



## ● Turbellaria

- I. Mostly free living.
2. Ciliated cellular or syncitial epidermis.
3. Provided with mucus cells.
4. Ribbon-like covered and rod- like bodies called rhabdites.
5. For example, *Convoluta*.



# Three classes (3) of Platyhelminthes



## ● Trematoda

1. Ecto-endoparasite.
2. Suckers and sometimes hooks are present.
3. Cilia are absent (except larval stages).
4. Body is covered with cuticle.
5. Life cycle is simple or complicated.
6. For example, *Fasciola*.

# Three classes (3) of Platyhelminthes

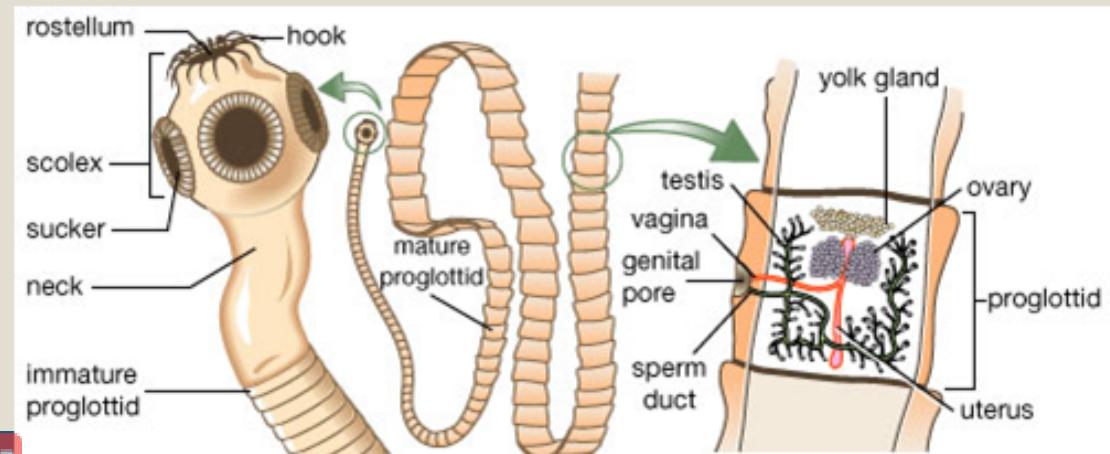


## ● Cestoda

1. Exclusively endoparasite.
2. Epidermis, rhabdites and cilia are absent.
3. Body is ribbon-like and covered with thick cuticle.
4. Embryo is hooked.

For example,

## ● *Taenia*



# Aschelminthes

- 1. Name proposed by Grobben (1910).
- 2. Organ grade of body organization.
- 3. Bilateral symmetry.
- 4. Cuticle-Scleroprotein.
- 5. Muscle-Only longitudinal.
- 6. Pseudocoel
- 7. Digestive tract is complete.
- 8. Respiratory and circulatory systems are absent.
- 9. Separate sex (Usually males are shorter than females)



# Six (6) classes of Aschelminthes



## ● Rotifera

1. Ankrior end with celtiary disc or corona (wheel).

2. For example,

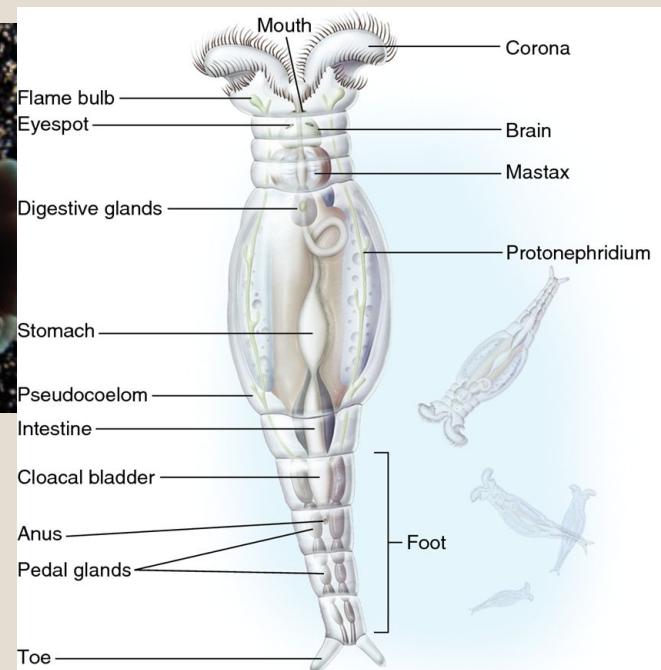
☒ *Hydatina*

☒ *Branchiosus*

☒ *Philodina*



*Hydatina*



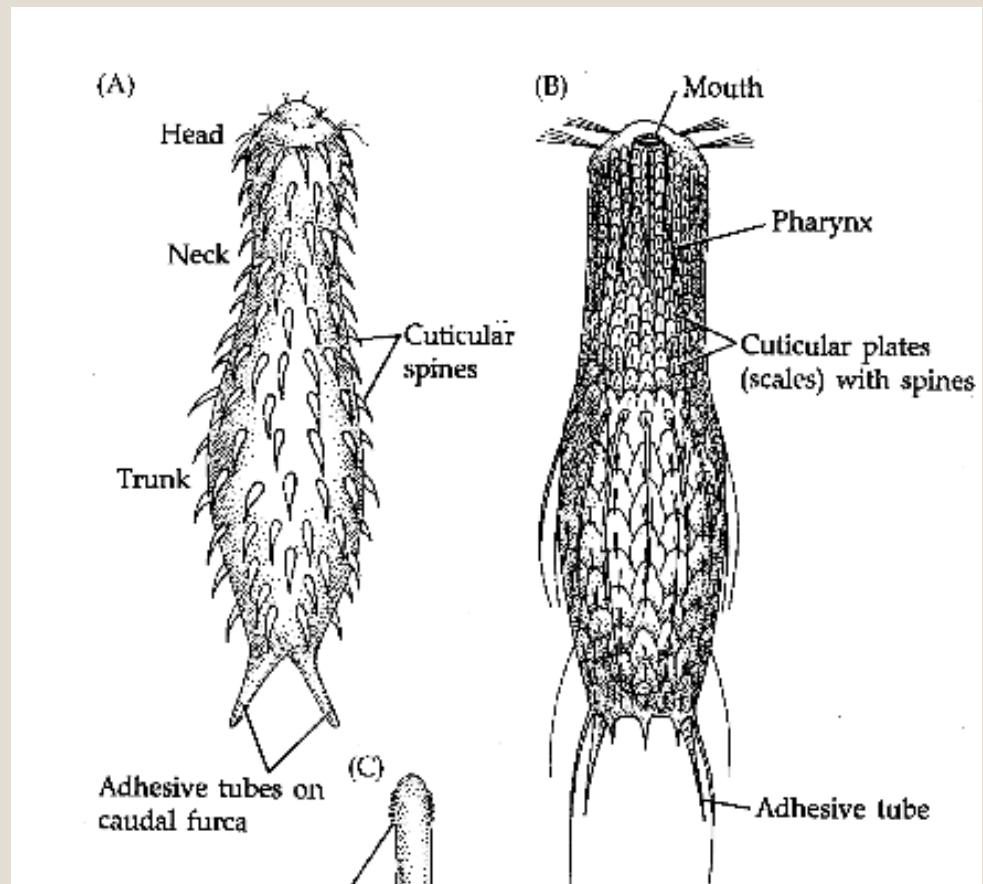
*Philodina*

# Six (6) classes of Aschelminthes



## ● Gastrotricha (Stomach hair)

1. Corona is absent.
2. For example,
  - ☒ *Chaetonotus*
  - ☒ *Lepidodermella*

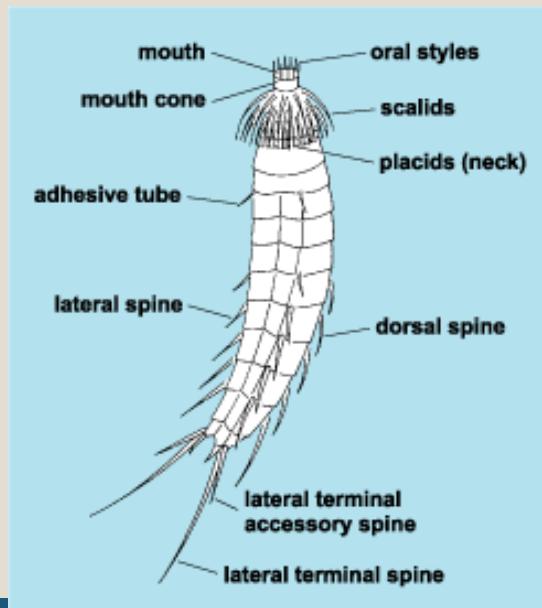


# Six (6) classes of Aschelminthes



## ● Kinorhyncha

- I. Development is indirect.
2. For example, *Echinoderes*



# Six (6) classes of Aschelminthes

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- **Nematomorpha**  
**(Thread shaped)**

1. Adult with digestive tract degenerated and non-feeding.
2. Juvenile parasite of grasshopper, crickets and other insects.
3. For example,
  - ☒ Gordius
  - ☒ Nectonema



# Six (6) classes of Aschelminthes



- **Priapuloidea**

I. L H Hyman included even priapuloidea in Aschelminthes, but this has found to be a truly Coelomate group in which body cavity is lined by nucleated peritoneum.

2. For example, *Priapus*

- \* Phasmid - A pair of unicellular caudal sensory pouches.

- \* Eutely - Number of cells constant particularly in nervous system

# Class Nematoda



## Aphasmida

1. Phasmid is absent
2. No excretory canal
3. Caudal adhesive gland is present
4. For example,
  - ⊗ *Anticoma*
  - ⊗ *Enoplus*



# Class Nematoda



## ● Phasmida

1. Phasmid is present.
2. Excretory canal is present.
3. Caudal adhesive gland is absent.
4. For example, *Ascaris*, *Ancylostoma*.



# Annelida



- 1. Similar rings or segments-Metameres or somites; Homonomous metamerism
- 2. Development of true coelom
- 3. Nephridia is well developed
- 4. Capable of complete regeneration
- 5. Cephalisation firstly appeared

# Annelida cont'd



- 6. Mesoderm is not solid
- 7. Polychaetae and oligochaetae term given by Grube (1851)
- 8. Pair appendages are not jointed
- 9. Only group which uses chaetae as locomotory organ
- 10. The phylum Annelida was established by Lamarck (1801)



- **Polychaeta**

- I. All marine
2. Somites are many
- 1 Clitellum is absent

# Polychaeta (2 Subclasses)



- **Errantia**

1. Numerous and similar somites
2. For example, *Nereis*



- **Sedentaria**

1. Dissimiliar somites and parapodia
2. For example, *Chaetopterus*



# Classes cont'd



## ● Archiannelida

1. Exclusively marine
2. Setae and parapodia are generally absent
3. External segmentation is not well marked
4. Trochophore larva
5. For example,

Polygordius



*Polygordius jouinea*



# Class Oligochaeta



1. Mostly terrestrial without parapodia
2. Clitellum is present
3. Testes anterior to ovary

# Oligochaeta (4 Orders)

- **Plesiopora**

For example, *Nais* and *Tubifex*

- **Plesiopora prosotheca**

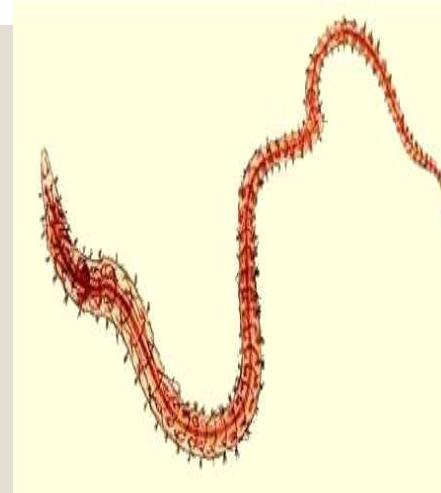
For example, *Enchytraeus*

- **Prosopora**

For example, *Lumbriculus*

- **Opisthophora**

For example, *Pheretima*



# Class Hirudinea



1. Freshwater and marine
2. Setae, parapodia and tentacles are absent
3. Fixed number of segments (33)

# Hirudinea (4 Orders)



- **Acanthobdellida**

For example, *Achanthobdella*

- **Rhythobdellida**

For example, *Glossiphonia*

- **Gnathobdellida**

For example, *Hirudo*

- **Pharyngobdellida**

For example, *Dina*



*Glossiphonia*



*Hirudo*



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# Arthropoda



- One million species
- Von Siebold (1845)
- 80 percent of all known animals
- Bilaterally symmetrical and metamerically segmented
- Body is covered with cuticle
- True coelom is reduced to haemocoelom

# Arthropoda cont'd

- Stripe muscle
- Open circulatory system, artery opens into sinuses
- Excretion by green glands or malpighian tubules
- Excretory products-Urates, ammonia, Amines, Guanine
- Compound eyes with mosaic vision
- 7 Subphyla



# Subphyla Onychophora



- Terrestrial
- Primitive
- Numerous pairs of stumpy legs
- For example, *Peripatus*
- Presently Onychophora has been given the status of a separate phylum



# Subphyla Tardigrada



- 1. Aquatic
- 2. 4 pairs of stumpy and unjointed legs
- 3. For example,  
*Water bear*



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# Subphyla Pantostornida (Linguatulida)



1. Parasite
2. No circulatory and respiratory organs
3. For example, *Linguatula*



# Subphyla Trilobita



1. Extinct
2. For example, *Trilobites*



# Subphyla Chelicera



1. Terrestrial and predaceous
2. Body-2 parts
3. Cephalothorax is unsegmented
4. Abdomen is segmented

# Subdivision of Chelicerata



## Merostomata

1. Marine
2. Compound eye
3. 5 or 6 pairs of abdominal appendages modified as gills
4. Spike-like telson



# Subdivision of Chelicerata



- Arachnida
- 1. Terrestrial simple eyes
- 2. Cephalothorax with 6 pairs of appendages including 4 pairs of walking legs
- 3. For example, *Scorpion, Spider, Ticks Mites*

# Subclasses of Merostomata

## ► Xiphosura

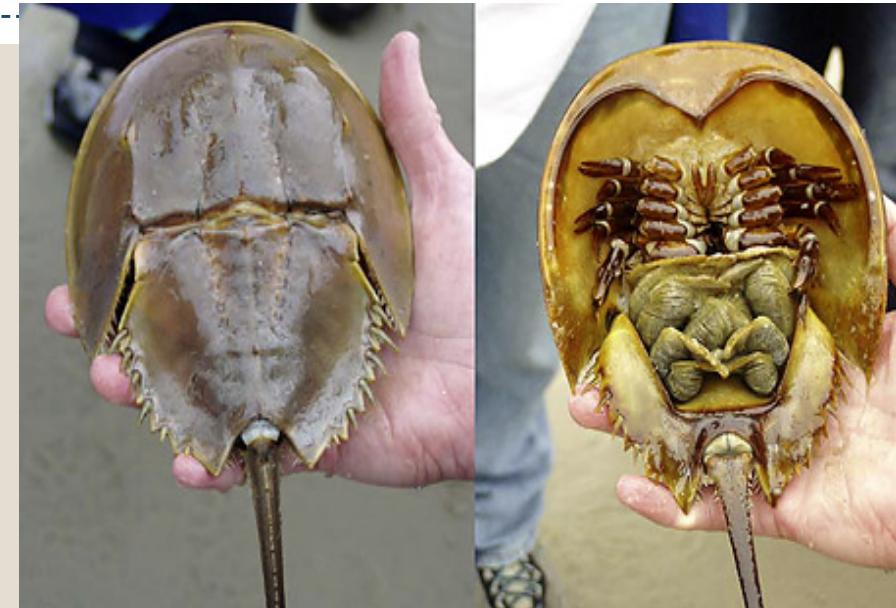
For example,

Limulus

## ► Eurypterida

For example,

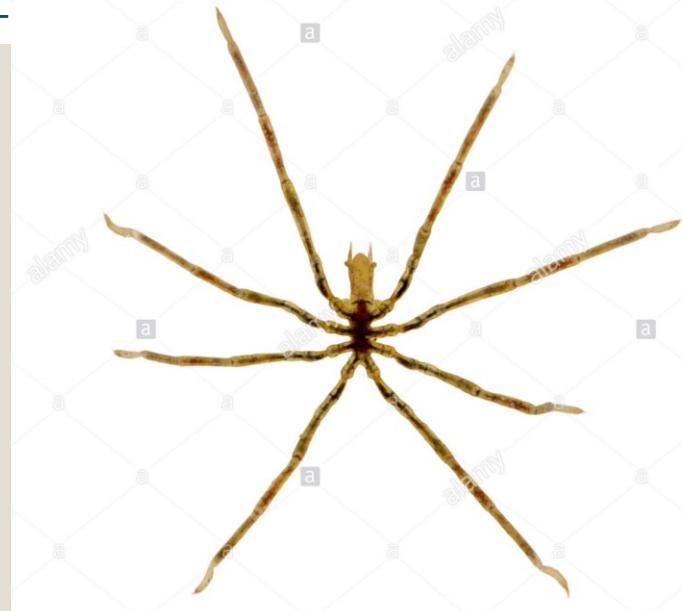
Eurypterus



# Subphyla Pentopoda (Pycnogonida) sea spider



- 1. small marine
- 2. Spider-like animal
- 3. Vestigial stomach
- 4. eyes
- 5. for example, *Nymphon*, *Pycnogonum*



a alamy stock photo

EHRJM6  
www.alamy.com

*Nymphon*

# Subphyla Mandibulata



- 1. Terrestrial, freshwater, marine
- 2. Body of 2 divisions; Cephalothorax and abdomen or 3 divisions; Head, trunk and abdomen
- 3. Respiration by gills or trachea
- 4. Excretion by glands or malpighian tubules

# Subdivision of Mandibulata



## Payropoda

1. Heart and trachea are absent
2. Eyes are lacking
3. For example, *Pauropus*

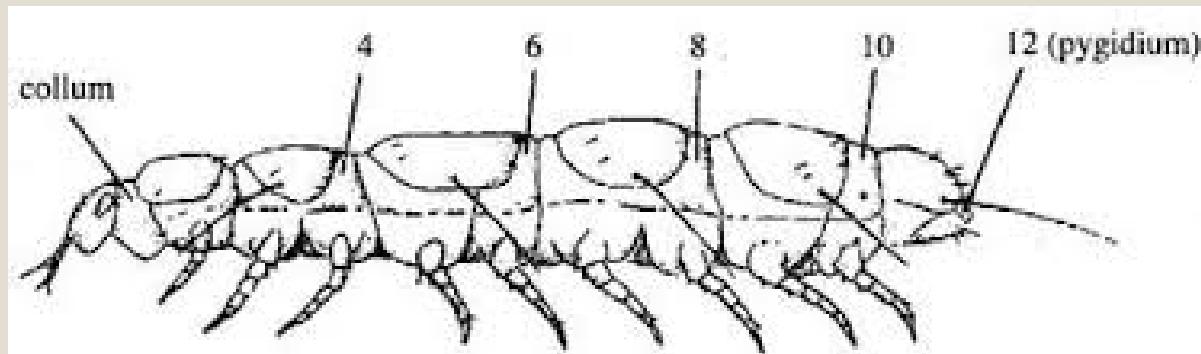


Fig. 1.116 : *Pauropus* (lateral view).

# Subdivision of Mandibulata



## Crustacean

- 1. Cuvier (1800)
- 2. Mostly aquatic and gills breather
- 3. Head with 2 pairs of antennae and 3 pairs of jaw
- Compound eye
- Respiration by gills or body surface
- Excretion by antaenal glands
- For example, *Crabs*, *Palaemon*, *Sacculina*

# Subdivision of subphyla Mandibulata



## Myriapoda

- 1. Lettreille (1796)
- 2. Terrestrials air breather
- 3. pair of antennae
- 4. pairs of jaws
- 5. More than 2 pairs of legs
- 6. For example, *Scolopendra*,  
*Centipedes*, *Millipedes*



# Subdivision of subphyla Mandibulata



## Insecta

- Terrestrial and aquatic
- Respiration by trachea
- Body of 3 distinct regions (Head thorax and abdomen )
- 1 pair of antennae
- 3 pairs of jaws



# Subdivision of subphyla Mandibulata (Insecta)



- 3 pairs of walking legs
- 1 or 2 pairs of wings
- Excretion by malpighian tubules
- For example, *Bees*, *Cockroach coccus*,  
*Lepisma*

# Subdivision of subphyla Mandibulata



- **Sympala**
- 1. Eyes are lacking
- 2. Antennae present
- 3. For example, *Scutigerella*

# Mollusca



- 1. Term used by Jonston (1650)
- 2. Mostly marine, few freshwater (10,000 species)
- 3. Body made of 4 parts-Head, visceral mass, foot and mantle
- 4. Gastropods become asymmetrical due to torsion
- 5. The body coelom is reduced to pericardial cavity

## Mollusca cont'd



6. Respiratory organs consist of one to many comb-like gills or ctenidia at the base of which an olfactory organ osphradium is present
7. Heart is composed of four atria and one ventricle; blood is red, blue, green or colourless and respiratory pigment is usually haemocyanin which contains copper pigment

## Mollusca cont'd



8. Digestive system is well developed
9. Sensory organs are tentacles and eyes on the head and lithocytes in the foot
10. Larva is trochophore called veliger

- 6 Classes

# Class Monoplacophora

1. Internal metamerism

2. Foot sole like

3. For example, *Neoplina*

## Order Aplacophora

1. Specialised worm-like

2. Shell is absent

3. For example,

## *Chaetoderma*

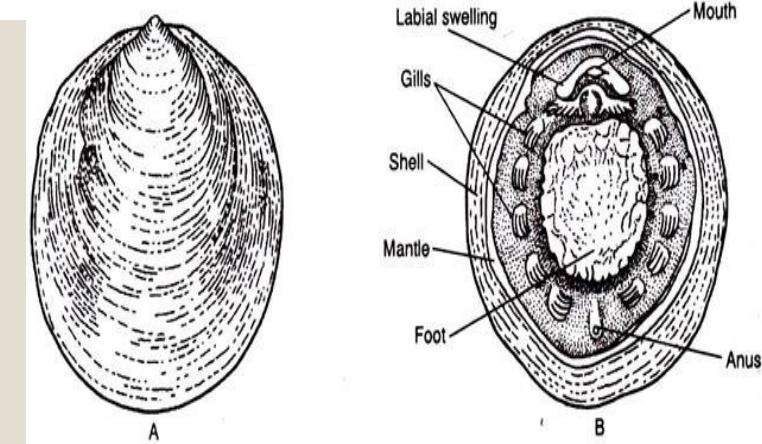


Fig. 16.2: External features of *Neoplina*. A. Dorsal view. B. Ventral view.



# Order Polyplacophora



1. Shell of 8 broad plates
2. For example;



*Chiton*



*Chaetopleura*



## Class Amphinura

1. Marine
2. Do not undergo torsion

## Class Scaphopoda

1. Marine
2. Known as tooth or tusk shell
3. Eyes and gills are absent



# Class Scaphopoda cont'd



4. Univalved shell and mantle is bilateral
5. Bilaterally symmetry
6. For example; *Dentalium*

## Class Gastropoda

1. Marine
2. Fresh water or terrestrial
3. Asymmetrical
4. A pair of tentacles and eyes
5. Shell is univalved, often spiral or conical
6. 1 or 2 gills



# Class Gastropoda



## Subclass Prosobranchia

1. Mantle cavity opens anteriorly
  2. Visceral torsion-180°
  3. Head with 1 pair of tentacles
- 3 Orders



# Prosobranchia



## Order Archaeogastropoda

1. Bilateral symmetry of mantle with 2 ctenidia, 2 auricle and 2 nephridia
2. Nervous system is not concentrated
3. For example, *Patella*



# Prosobranchia



## Order Mesogastropoda

1. 1 ctenidium
2. 1 auricle
3. 1 nephridium
4. Nervous system is more concentrated
5. For example, *Pila*



## Order Neogastropoda

1. 1 ctenidium
2. 1 auricle
3. 1 nephridium
4. Nervous system is highly concentrated
5. For example, *Murex*



# Subclass Pulmonata



1. Anterior mantle cavity vascularised as a lung
  2. Gills are absent
  3. Head with 1 or 2 pairs of tentacles
  4. 1 pair of eyes
- 2 orders

## Order Stylommatophora

1. Terrestrial (in moist places)
2. 2 pairs of invaginable tentacle with eyes at tip of hind pair
3. For example, *Helix*

# Pulmonata



## Order Basommatophora

1. Freshwater and marine
2. Head bears one pair of non- invaginable tentacles with eye at base
3. For example, *Lymnea*

# Subclass Opisthobranchia



1. Mantle cavity opens posteriorly
  2. Shell is reduced, internal or absent
- 2 orders

# Class Opisthobranchia



## Order Tectibranchia

1. Head with mantle
2. Thin shelled
3. For example, *Aplysia*

## Order Nudibranchia

1. Shell, mantle and true gill are absent
2. For example, *Doris*



# class Pelecypoda or Bivalvia

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1. Don't undergo torsion
2. Body is bilaterally compressed with no distinct head and without pharynx, jaw, radula and tentacles
3. Shell is bivalved
- 4 Orders

# 4 ORDERS OF PELECYPODA



## Protobranchia

1 Primitive members in which gills are posteriorly placed

2 adductor muscles

- For example, *Nucula*



# 4 ORDERS OF PELECYPODA



## Filibranchia

1. Gill filaments long folded with ciliary connections between lamellae of each demi branch
  - 2 adductor muscles but anterior may be reduced or absent
- For example, *Mytilus*

# 4 ORDERS OF PELECYPODA

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## Eulamellibranchia

1. Gill filaments folded and lamellae of each demibranch united by firm tissue junction
- 2 unequal sized adductor muscles
3. For example, *Unio*

# 4 ORDERS OF PELECYPODA



## Septibranchia

1. Gills modified into horizontal muscular portion between inhalant chamber and suprabranchial cavity
2. For example, *Cuspidaria*



# Class Cephalopoda



1. All marine and free swimming
2. Body is elongated dorsoventrally and bilaterally symmetrical
3. A distinct head bearing large eyes, radula and jaws
4. Shell is external or internal

# Cephalopoda Cont'd



5. Circulatory system is closed
6. Foot is modified into arms or tentacles attached to the head and the siphon

3 Subclasses



# SUBCLASS OF CEPHALOPODA



## Nautiloidea (Tetrabranchia)

1. External shell is coiled or straight
2. Tentacles many and without suckers
3. 2 pairs of gills and 2 pairs of nephridia
4. Ink gland is absent
5. For example, *Nautilus*

# SUBCLASS OF CEPHALOPODA

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## Coeloidea (Dibranchia)

1. Shell is internal reduced or absent
2. A few tentacles (8-10) bear suckers
3. I pair of gill and one pair of nephridia
4. Ink gland and chromatophores are present
5. 2 Orders

# Coeloidea (Dibranchia)



## Order Decapoda

1. Body is elongated with lateral fins
2. 2 long and eight short arms
3. For example, *Sepia*



# Coeloidea (Dibranchia)



## Order Octapoda

1. Body is elongated with no fins
2. 8 equal arms
3. Shell is absent except *Agronauta*
4. For example, *Octopus*



# SUBCLASS OF CEPHALOPODA



## Ammonoidea

- Extinct
- For example, *Ammonites*



# Echinodermata



1. (5,500) species.
2. Phylum was mentioned by Leuckart (1847).
3. The term 'Echinodermata' was suggested by Jacob Klein (1788).
4. Exclusively marine.
5. Symmetry bilateral in larvae but radial in adults.

# Echinodermata cont`d



- 6. No distinct head or brain.
- 7. No organs for excretion.
- 8. Sinuses form 3 specialised systems, viz., water vascular, haemal and perihemal system; later two are concerned with blood circulation.
- 9. Sinuses are the part of endocoelom  
3 Subphyla

# Subphylum Crinozoa



I. Both mouth and anus on the upper surface.

## Class Crinoidea

1. Spines, madreporite and pedicellariae are absent.
2. In some species stalk is present (e.g., Sea Lilies) and in others stalk is absent. (e.g., Feather Stars)
3. For example,

Antedon



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# Subphylum Echinozoa

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1. Without stalk
  2. Mouth usually on the lower surface
- 2 Classes



# Echinozoa



## ● Class Holothuroidea

- I. Body is not divided into arms
2. Mouth anterior and anus posterior
3. Mouth is surrounded by many hollow tentacles
4. Respiratory trees, help in respiration and excretion





- 5. Madreporite is absent.
- 6. Larva-Auricularia.
- 7. For example,  
Cucumaria



# Echinozoa



## Class Echinoidea

1. Body is not divided into arms. It looks like a spiny ball.
2. Mouth at the lower pole and covered by 5 strong and sharp teeth forming masticatory apparatus called Aristotle's lantern.
3. Anus is present.

# Subphylum Asterozoa



- 1. Free moving or arms are strongly developed
- 2. Madreporite aboral
- 2 Classes



# Asterozoa



## ● Class Ophiuroidea

1. Arms are branched
2. Mouth in the centre of the upper surface
3. Anus and pedicellariae are absent
4. Larva-Ophiopluteus
5. For example,  
Ophiura (Brittle star)



# Asterozoa



## ● Class Asteroidea

1. Arms are never branched
2. Mouth in the centre of the lower surface
3. Skin contains spines and pedicellariae
4. Larva-Bipinnaria
5. For example,

Asterias (Starfish)



# Phylum Chordata



- Phylum Chordata
- (2 Groups Acraniata and Craniata)
- Acraniata (without brain or brain box  
(All marine))



# Subphylia of chordata



## Hemichordata

1. Body is divided into proboscis, collar and trunk
2. No tail
3. Perforated pharynx
4. Subepidermal nerve cord



# Subphyla of chordata cont`d



## Urochordata

1. Body is enclosed in a test
  2. Tail is present
  3. Notochord present only in tail
  4. Perforated pharynx
- 3 Classes



# Subphyla of chordata cont`d



## Cephalochordata

1. Body is divided into tail and trunk
2. Hollow dorsal nerve cord
3. Notochord persistent and extends from anterior to posterior end
4. Atrium is present
5. Burrowing
6. For example, •Branchiostoma • Asymmetron



# Class of Hemichordata



## Planetosphaeroidea

- 1.L-shaped alimentary
- 2.Extensively branched
- 3.For example, Planctosphaera



# Class of Hemichordata



## Enteropneusta

1. Proboscio is large
2. Alimentary canal-straight
3. Free living and burrowing
4. For example , *Balanoglossus*

# Class of Hemichordata



## Pterobranchia

1. Short canal
2. U shaped
3. Sessile and colonial
4. For example, Cephalodiscus



# Classes of Urochordata

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## Larvacea

1. Test is temporary and mucilaginous
2. Tail persists in adults
3. Atrium is absent
4. 2 gill slits
5. Solitary, free living and pelagic
6. For example, Oikopleura , Appendicularia

# Class of Hemichordata cont`d



## Asciidiacea

- I. Test is thick, permanent and made up of cellulose- like tunicin
- 2.Tail test in adult
- 3.Atrium is present
- 4.Many gill slits
- 5.Colaonia and sedentary
- 6.For example, Herdmania •Ciona •Molgula

# Class of Hemichordata



## Thalicea

1. Test is permanent with circular muscle band
2. Tail-less adult
3. Atrium persists
4. Complex organ of budding-Colonial and pelagic
5. For example, •Salpa •Pyrosoma •Doliolum

# Craniata (with brain and brain box)



## **Subphylum Agnatha**

- I. Without jaws
- 2. Paired appendages are absent

## **Subphylum Gnathostomata**

- 1. With jaws
- 2. Paired appendages are present



# Classes of Agnatha



## Class Ostracodermi

1. Extinct
2. Armoured fishes
3. Large Scales .For example, Cepha/aspis , Cyclostomata
- 1.Suctorial mouth
- 2.5-16 pairs of gills
- 3.Larva-arnmocoete
- 4.Skin with scales
- 5.For example, •Myxine •Petromyzon

# Classes of Agnatha



## Class Cyclostomata

- 1.Suctorial mouth
- 2.5-16 pairs of gills
- 3.Larva-arnmocoete
- 4.Skin with scales
- 5.For example, •Myxine •Petromyzon



# Subphylum Gnathostomata



## Super Class Pisces

- 1.Cold blooded and aquatic
  - 2.Heart with 1 atrium and ventricle
  - 3.Two pairs of cranial nerves
  - 4.Gills are never more than 7 pairs
- 4 Classes



# The four Classes of Pisces



## 1. Placodermi

- I. Extinct
2. Body is covered with bony plates
3. Paired fins
4. For example Climatius



# The four Classes of Pisces

## Osteichthyes



1. Endoskeleton is bony
2. Body is covered with cycloid or ctenoid scales
3. Four pairs of gills
4. Gills are covered with operculum
5. Air bladder is present
6. Internal nares are absent

# Osteichthyes cont'd



7. Spiral valve is absent in the intestine

8. Oviparous (except Guppies)

9. For example, Labeo, Catla, Exocoetus, Diodon, Syngnathus and Remora

# The four Classes of Pisces

## Choanichthyes

- 1..Endoskeleton is bony
  - 2..Internal nares are present
- 2 Subclasses (a) Crossopterygii For example, Latimaria



# Choanichthyes



## b) Dipnoi

I. Gills are covered with operculum

- 2. Air bladder is modified into lungs
- 3. Pectoral and pelvic fins are lobed
- 4. Internal nares are present
- 5 For example, Protopterus , Neoceratodus and Lepidosiren

# Super class Tetrapoda



1. . Heart with 2 atria and 2 ventricles
2. Basically terrestrial
3. Endoskeleton is mainly bony
4. Nasal chambers are present
5. Respiration by lungs
6. Double circulation of blood

# Super class Tetrapoda



- It has been divided into 4 Classes on the basis of habit, habitats, body temperature and characteristics of skin, skeleton, limbs, heart, eggs, etc.



# Reptilia



- 1. 6,500 species living and extinct
- 2. Poikilothermal
- 3. First land vertebrae
- 4. Skin with epidermal horny scales
- 5. Endoskeleton is biny
- 6. Skull is monocondyllic

## Reptilia cont'd



- 7. Pentadactyl limbs
- 8. 12 pairs of cranial nerves
- 9. Eggs are hard-shelled and megalecithal
- 10. Embryo is surrounded by protective membranes called amnion and allantois
- 11. Origin- Mesozoic era

# Aves



- 1. 9,000 species
- 2. stenothermal or endothermal
- 3. First air vertebrae
- 4. Skull is monocondylic
- 5. Bones are pneumatic
- 6. Sternum is very large
- 7. Keel bone remains attached with the sternum

## Aves cont'd



- 8. Double respiration occurs due to the presence of air sacs
- 9. Heart is four chambered; only right systemic arch persists
- 10. Eyes contain pectin

# Mammalia

- 1. 4,000 species
- 2. Presence of hair on skin and mammary glands.
- 3. Teeth are heterodont, diphyodont
- 4. Skull is dicondylic
- 5. Vertebrae is acoclosus
- 6. Neck has 7 cervicals vertebrae
- 7. Jaw suspension craniostylic

# Amphibia

1. 3,400 species (Amphibious)
2. Poikilothermal
3. Skin-scales, soft and moist
4. Respiration by lungs and gills
5. Skull is dicondylic with two occipital condyles for articulation with the vertebra column



# Amphibia cont'd

6. Heart is 3 chambers with truncus arteriosus
7. RBC's are nucleated and biconvex
8. Both renal and hepatic portal systems are present
9. 10 pairs of cranial nerves
10. Development is external

# SIX ORDERS OF AMPHIBIA



- LABYRINTHO-DONTAL OR STAGOCEPHALIA
- 1. Oldest or earliest amphibian
- 2. All extinct
- 3. For example, *Seymouria*

# Phyllospondyli



- 1. Extinct
- 2. For example, *Branchiosaurus*



# Lepospondyli



- 1. Extinct
- 2. for example, *Dipolocaulus*



# Salientia (Anura)



- 1. No tail and gills in adult
- 2. Skull is small
- 3. Lesser number of bones
- 4. Reduced number of vertebrae
- 5. For example, *Bufo*

# Urodela



- 1. Body is divided into head, trunk and tail
- 2. limbs are almost equal
- 3. Girdles cartilaginous
- 4. Tadpole resembles adult
- 5. No metamorphosis
- 6. for example, *Ambystoma*

# Gymnophiona (Apoda)



- 1. No eyelids
- 2. Eyes are rudimentary or covered by skin
- 3. Tail is very short or absent
- 4. Burrowing and limbless
- 5. males have copulatory organ
- 6. For example, *Ichthyopis*

# Reptilia



1. 6,500 living and extinct species
2. First land vertebrate
3. Poikilothermal ( Endothermal)
4. Limbs are pentadactyl and digits are provided with claws
5. Skin with epidermal horny scales and without glands

# Reptilia Cont'd

- 6. Skull is monocondyllic
- 7. 12 pairs of cranial nerves
- 8. Males with copulatory organ (except Sphenodon)
- 9. Eggs are hard-shelled and megalecithal
- 10. Embryo is surrounded by protective membranes called amnion and allantois



# Reptilia (6 Subclasses)

## ● Anapsida

- 1. Roof of the skull is complete and no fossae

3 orders ( 2 extinct and 1 living)

## ● Order Chelonia (Living)

- 1. Body is dorsally covered by a hard carapace and ventrally by plastron
- 2. Head, limbs and tails are covered by scales
- 3. Quadratojugal bone is immovable
- 4. Jaws are horny without teeth



# Reptilia (6 Subclasses) cont'd



- **Archosauria**

1. 5 Orders (1 Extinct and 4 Existing)

- **Order Crocodilia**

1. Largest living reptile
2. Fresh water predatory forms
3. Vertebrae\_amphi-coelous or procoelous
4. Quadrate immovable



# Order Crocodilia cont'd



1. Heart is completely 4 chambered
2. Urinary bladder is absent
3. Oviparous
4. For example, *Crocodilus* and  
*Gavialis*

# Reptilia 6 Subclasses cont'd



- Euriapsida (Extinct)
- Synapsida (Extinct)
- Ichthyosayria (Extinct)



# Reptilia 6 Classes cont'd



## ● Lepidosauria

1. Temporal region of skull with two pairs of temporal fossae
2. 3 Orders (1 Extinct and 2 living)

## ● Order Rhynchocephalia (Living)

1. Solitary existing species
2. Nocturnal, sluggish and burrowing
3. Males without copulatory organs
4. Eggs hatch in about 13 months



# Lepidosauria cont'd



5. For Example, *Sphenodon*
  6. Native name-Tautara called – Living Fossil
- **Order Squamata**
    1. Mostly terrestrial, some aquatic
    2. Periodically moulting
    3. Lower jaw is attached to the skull by a movable quadrate, on either side; hence the mouth can open widely

# Squamata cont'd



4. Teeth are fused with jaw
  5. Vertebrae are procoelus
  6. Males with double eversible copulatory organs
  7. Cloacal aperture transverse slit-like
- Squamata has 2 suborders

# Squamata Cont'd



## ● Lacertilia

1. Girdles are well developed
2. Brain box is incomplete in the front
3. Halves of the lower jaw is fused together in the front
4. Sternum, tympanum and urinary bladder are present
5. For example, *Hemidactylus*, *Varanus*, and *Heloderma* (Only poisonous lizard)

# Squamata Cont'd



- **Ophidia**

1. Limbs, sternum, tympanum, pectoral girdle and urinary bladder are usually absent
2. Brain box is complete in the front
3. Immovable eyelids
4. Tongue- Bifid; serves as a sensory organ
5. Left lung is smaller or absent
6. For example; *Hydrophis*, *Python* and *Naja*

# Aves



1. 9,000 living and extinct species
2. First flying vertebrate
3. Stenothermal
4. Skull is monocondylic
5. Sternum is very large
6. Sacral vertebrae fused to form synsacrum
7. Heart is 4 chambered; only right systemic arch persists

# Aves cont'd



8. RBCs are nucleated
9. Lungs are connected by large air sacs which help in respiration and making them light
10. Females usually with a single left ovary and oviduct
11. Preen or uroopygial gland is present at the root of the tail
12. Endoskeleton is ossified and without epiphysis

## Aves cont'd



13. Vertebrae are heterocoelous.  
Opisthocoelous in Penguins and Gulls
14. Cervical vertebrae are numerous
15. Syrinx is present which contains  
vocal cords
16. Ribs are double headed
17. Acetabulum is perforated

# Aves cont'd



18. Renal portal system is vestigial
  19. Middle ear contains a single ossicle
  20. Eggs are megalecithal
  21. Cleavage is metroblastic
  22. Oviparous
  23. Parental care is well developed
- Aves has 2 Subclasses

# Aves subclasses



## ● Archaeornithes

1. Extinct
2. For example, *Archaeopteryx*

## ● Neornithes (Modern birds)

1. Post-Jurassic birds
2. Sternum with keel

Neornithes has 4 Super Orders



# Neornithes Superorders

## ► Impennae



1. 1 Order

- Order Sphenisciformes

- 1. Webbed feet

- 2. For example, *Aptenodytes* and *Penguins*

- Ratitae or Palaeognathae

- Carinatae

- Odontognathae

- 1. Extinct- Upper cretaceous bird

- 2. Jaw bears teeth

Odontognathae has 2 orders



# Odontognathae (2 Orders)



## ● Hesperornithi Formes

1. Large flightless marine birds
2. Teeth are pleurodont
3. Vertebrae are amphicoelous
4. Sternum is without a keel
5. For example, *Hesperornis* and *Baptornis*



# Odontognathae (2 Orders) cont'd



- **Ichthyornithiformes**

1. Flying marine birds
2. Sternum is with well-developed keel
3. For example, *Icnithyornis*

# Ratitae or Palaeognathae (7 Orders)

- Flightless and toothless birds
- Wings are vestigial
- Oil gland is absent (except in Tinamus and Kiwi)
- Tail is vertebrae free
- Pygostyle is small or free
- Syrinx is lacking



# Orders of Palaeognathae



**Struthioni formes** , For example,  
*True Ostriches*

- **Rheiformes**, For example, *Darwin's Rhea*
- **Casauriformes**, For example, *Cassowaries and Emu*
- **Apterygiformes**, For example, *Kiwi*



# Orders of Palaeognathae cont'd

- **Dinornithiformes**, For example, *Moas*
- **Aepyornithiformes**, For example, *Giant Elephant birds of Africa and Madagascar*
- **Tinamiformes**, For example, *Tinamous*



# Super Order 4 - Neognathae (Carinatae)

- Small-sized flying birds
- Oil gland is present
- Skull is neognathous
- Quadrate is double-headed
- Pygostyle is present
- Males without copulatory organ
- Young are altricial
- Distributed all over the world

6 Groups



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# Arboreal Birds

## 4 Orders

(a) Passer forms, For example,  
*Sparrows, Crows*

(b) Pici forms, For example, *Wood  
peckers*

(c) Coloumbiformes, For example,  
*Pigeons, Doves*

(d) Psittaciformes, For example, *Parrot*



# Terrestrial Birds



2 Orders

(a) Galliformes, For example,  
*Red jungle fowl & Quail*

(b) Cuculiformes, For example,  
*Cuckoo, Crow- pheasant*

# Swimming and Diving Birds (6 Orders)

- (a) Anseriformes, For example, *Geese, Ducks*
- (b) Coraciiformes ,For example, *Great hornbill*
- (c) Gaviiformes,For example, *Loons*
- (d) Columbiformes, For example, *Grebes (Diving birds)*
- (e) Procellariiforms, For example, *Albatrosses*
- (f) Pelecaniformes, For example, *Pelicans*

# Shore and Wading Birds (3 Orders)



- (a) Charadriformes ,For example,  
*Sand piper*
- (b) Ciconiformes, Long-legged birds,  
For example, *Heron*
- (c) Gruiformes ,Crane-like wading  
birds, For example, *Common eoot*

# Part of Ratitae or Palaeognathale



## Aerial Birds

Micropodiformes  
e.g Swift and Humming  
birds

Caprimulgiformes  
e.g Goat suckers



# Birds of Prey( 2 orders)



(a) Falconiformes, For example,  
*Kites, Vulture, Eagle*

(b) Strigiformes, For example,  
*Owl*

# Mammals



## ● characteristics

- Highly-developed members of the animal kingdom
- Presence of hair on skin and mammary glands
- Teeth are heterodont, diphyodont and thecodont
- A dome-shaped diaphragm is present
- Skull is dicondylic



# Prototheria



- Primitive mammals
- Corpus callosum is absent
- Pinnae are absent
- Cloacal aperture is present
- Females lack uterus and vagina
- Oviparous

# Prototheria cont'd



## 3 Infraclasses

- (a) Eotheria-Extinct
- (b) Allotheria-Extinct
- (c) Ornithodelphia
- Existing prototherians  
    1 Order-Monotremata  
    For example, *Echidna*



- Advanced mammals
- Viviparous
- Mammary gland with teats
- Pinnae are present
- 3 Infraclasses



## I Order

- (a) Marsupialia
- Pouched mammals
- Teeth are monophyodont
- Brain is without corpus callosum
- Females with paired uterus and vagina, For example, *Kangaroos*

# Eutheria

- Most advanced mammals
- Teats, brain and corpus callosum are well developed
- Uterus and vagina are unpaired



# The living orders of infraclass Eutheria are

Insectivora For example, Hedgehog, Mole

Dermoptera For example, Flying Lemur

Chiroptera For example, Bat



# The living orders of infraclass Eutheria are:



- Edentata For example, Arboreal sloth
- Pholidota For example, Pangolin

# The living orders of infraclass Eutheria are:



- Rodentia (Largest order), For example, House mouse  
Lagomorpha For example, Rabbit, Hare
- Carnivora For example, Tiger, Cat, Seal, Walrus

# The living orders of infraclass Eutheria cont'd

- Cetacea, For example, Blue whale
- Sirenia, For example, Sea cow



Blue whale



Sea cow

# The living orders of infraclass Eutheria are:



- Tubulidentata, For example, Aardvark
- Proboscidea, For example, Elephant
- Hyracoidea, For example, Conies



Aardvark



Coney

# The living orders of infraclass Eutheria are:



- Perissodactyla, For example, Horse, Zebra, Rhinoceros
- Artiodactyla, For example, Pigs, Camels, Ox, Hippopotamus
- 



# The living orders of infraclass Eutheria are:



- Primates, For example, Lemur, Humans, Chimpanzee, Gibbon

