MEDICAL & DENTAL
ADMISSION PROGRAM-2021

Dr. Hasib SSMC

BIOLOGY

Lecture : B-06

Chapter 01 : Variety and classification of animals (2nd Paper)

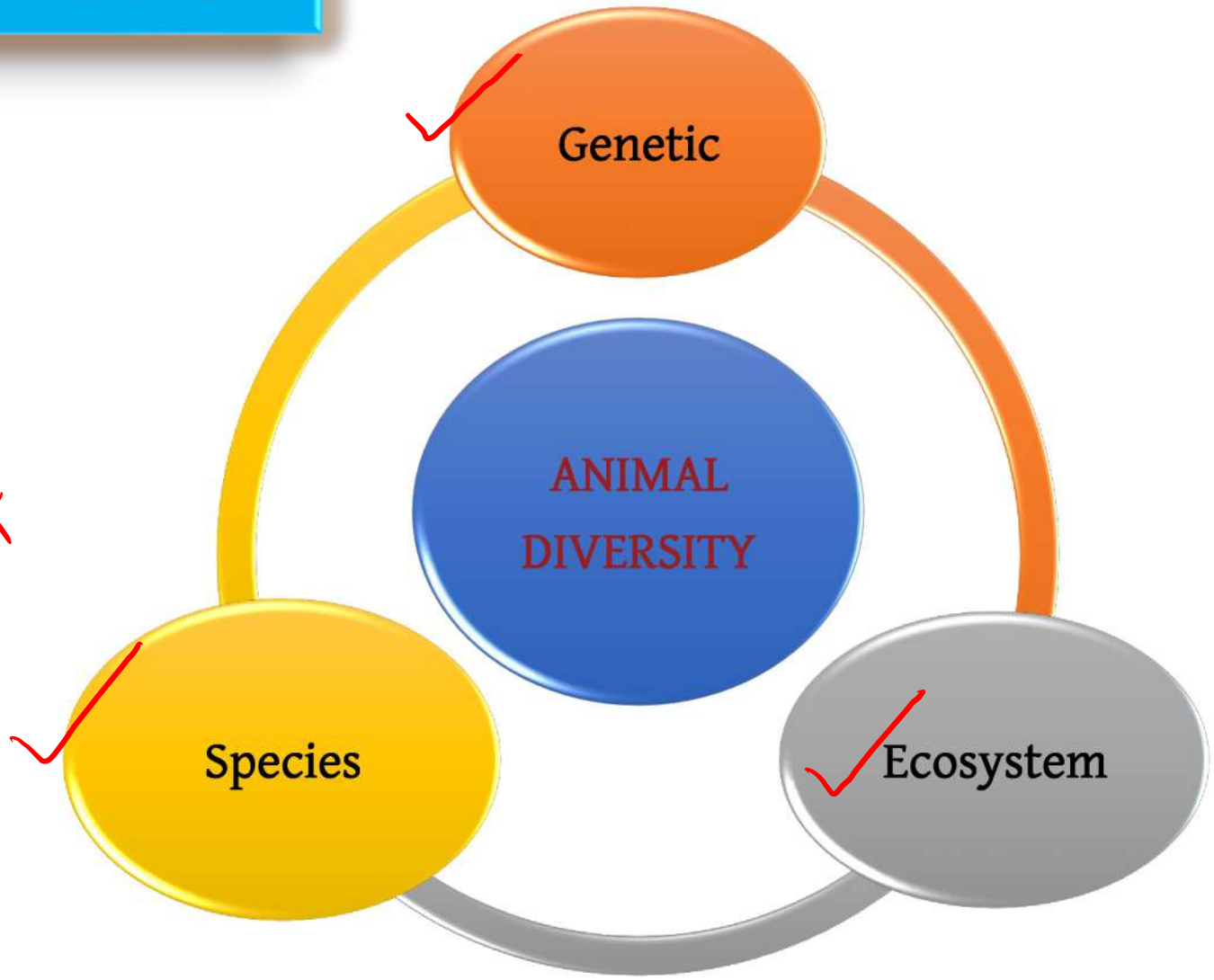
Chapter 02 : Introduction to Animals (Rohu Fish) (2nd Paper)

উন্মেষ
মেডিকেল এন্ড ডেন্টাল এডমিশন কেয়ার
09666775566
www.unmeshbd.com

ANIMAL DIVERSITY & CLASSIFICATION

Importance	Topic	Admission test years	
		Medical & Dental	Others University
✪✪✪	Animal diversity and classification of animal kingdom	MAT: 19-20, 17-18, 14-15, 13-14, 04-05	DU: 18-19; CU: 18-19
✪✪✪	Major phyla of animal kingdom	MAT: 20-21, 18-19, 15-16, 12-13, 03-04, 01-02; DAT: 08-09, 05-06, 03-04	DU: 19-20, 18-19, 17-18, 16-17, 15-16, 14-15, 13-14; RU: 19-20; CU: 19-20, 17-18; KU: 18-19
✪✪✪	Classification of Chordata	MAT: 19-20, 05-06, 03-04; DAT: 18-19, 03-04, 02-03	DU: 19-20, 18-19, 17-18, 16-17; JnU: 16-17
✪	Scientific names	MAT: 13-14	DU: 18-19, 08-09; CU: 17-18, 08-09; RU: 10-11

ANIMAL DIVERSITY



Biodiversity hotspot

MAJOR PHYLA

❖ There are 33 phyla in kingdom Animalia. 9 of them are called major phyla. Rest of them are called minor phyla.

9 Major phyla

24 Minor phyla

- Porifera
- Cnidaria
- Platyhelminthes
- Nematoda
- Mollusca
- Annelida
- Arthropoda
- Echinodermata
- Chordata

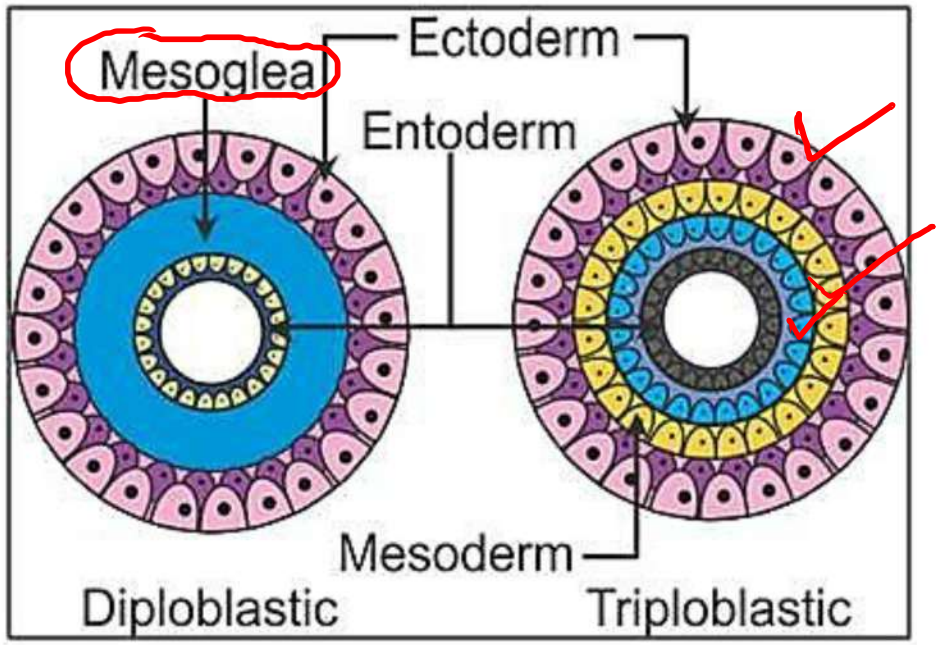
BASIS OF CLASSIFICATION

Basis	Classification	Example
i. Body size	a. Micro-animal	• Protistan germ of fish gill (*Trichodina sp.*).
	b. Macro-animal	• Guinea pig.
ii. Grades of organization	a. Animals of cellular grade of organization	• All animals of phylum Porifera.
	b. Animals of cell-tissue grade of organization	• All animals of phylum Cnidaria.
	c. Animals of tissue-organ grade of organization	• All animals of phylum Platyhelminthes
	d. Animals of organ-system grade of organization	• All other major phyla. Nematode → chordata
iii. Way of living	a. Free living b. Parasite	• Pigeon. • *Fasciola hepatica*

BASIS OF CLASSIFICATION

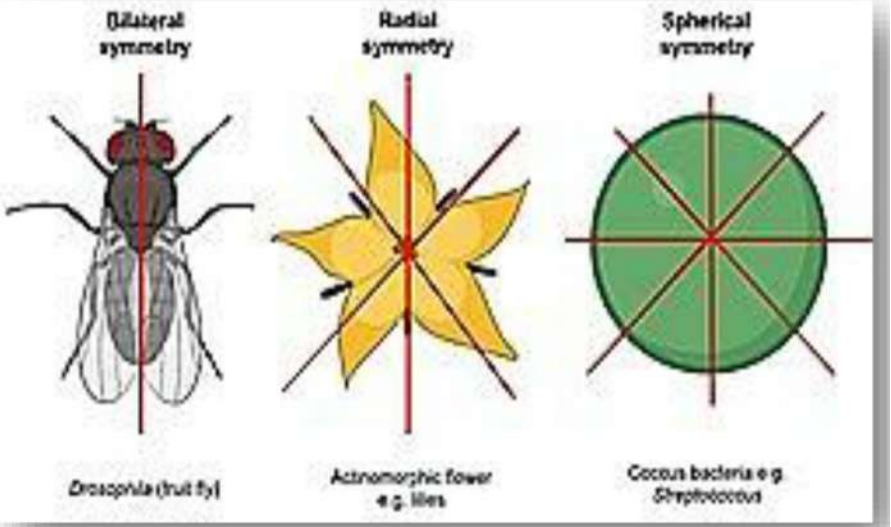
iv. Germ Layer:

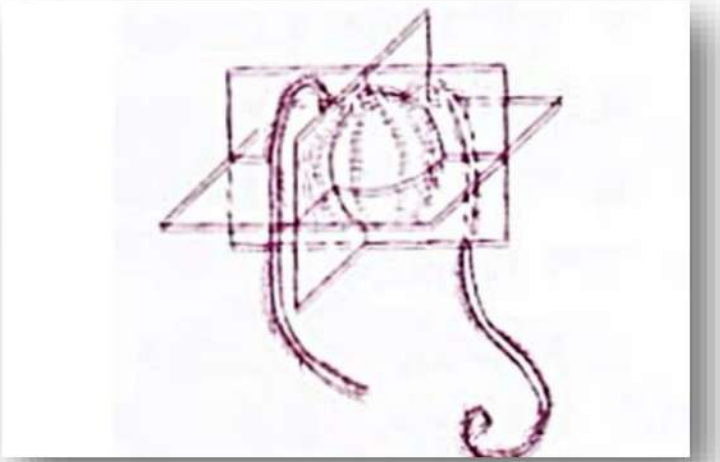
Diploblastic	→	Cnidaria
Triploblastic	→	Platyhelminthes to Chordata



BASIS OF CLASSIFICATION

v. Symmetry	a. Spherical symmetry	• Volvox, Radiolaria, Heliozoa unicellular Protistan animal etc.
	b. Radial symmetry	• *Hydra*, jelly fish, sea anemone etc.
	c. Biradial symmetry	• Ctenophora-like animals (Such as-*Ceoloplana*).
	d. Bilateral symmetry	• Butterfly, frog, human etc.
	e. Asymmetry	• Sponge, apple snail etc.





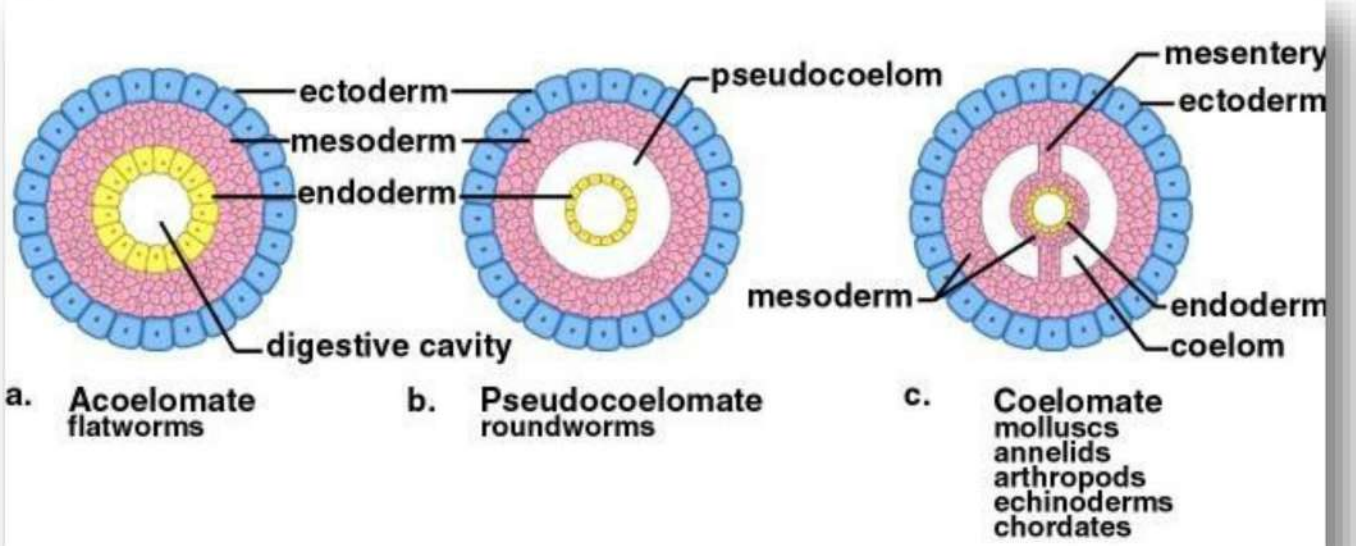
BASIS OF CLASSIFICATION

vi. Coelom :

Mesoderm derived
Peritoneum covered

Acoelomate	→	Porifera to Platyhelminthes
Pseudocoelomate	→	Nematoda, Rotifera, Kinorhycha
Eucoelomate	→	Mollusca to Chordata

সবই true



BASIS OF CLASSIFICATION

Non segmented → Nematoda

vii. Metamerism /Segmentation	a. Homonomous metamere	• Earthworm. / কেঁচো
	b. Heteronomous metamere	• Insects.
viii. Notochord	a. Non chordate	• Hydra, Cockroach etc.
	b. Chordate	• Frog, snake, human etc.
ix. Alimentary canal	a. Parazoa	• Animals of phylum Porifera.
	b. Enterozoa	• All animals from Cnidaria to Chordata.

Internal segmentation: Human

BASIS OF CLASSIFICATION

(x) Cleavage :

1. Radial : Arthropoda
2. Bilateral : Chordata
3. Spiral : Annelida & Mollusca

BASIS OF CLASSIFICATION

(xi) Polarity :

a. Anterior end

b. Posterior end

c. Dorsal end

d. Ventral end

e. Lateral end

(xii) Tagmatization : Arthropoda

BASIS OF CLASSIFICATION

(xiii) Appendages :

(xiv) Planes :

(xv) Vascular System : → Open → closed

(xvi) Skeleton :

POLL QUESTION-01

- Which one is not the example of radial symmetry?

(a) Hydra

(b) Jelly fish

(c) Sea anemone

(d) Ctenophora

DIFFERENT STEPS OF CLASSIFICATION

Kingdom

Phylum

Class

Order

Family

Genus

Species

Taxon

NOMENCLATURE OF ANIMALS

❖ **Binomial nomenclature**

First introduced by Carolus **Linnaeus.**

❖ **Trinomial nomenclature**

First introduced by Ornithologist **Schlegel.**

❖ **Important rules of binomial nomenclature**

a. First part indicates genus and second part indicates species.

b. The name must be Latin or Latinized.

c. The name should be in Italic font if printed.

G. S. Subspecies

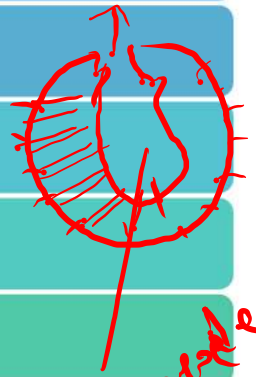
Passer domesticus nilotirus

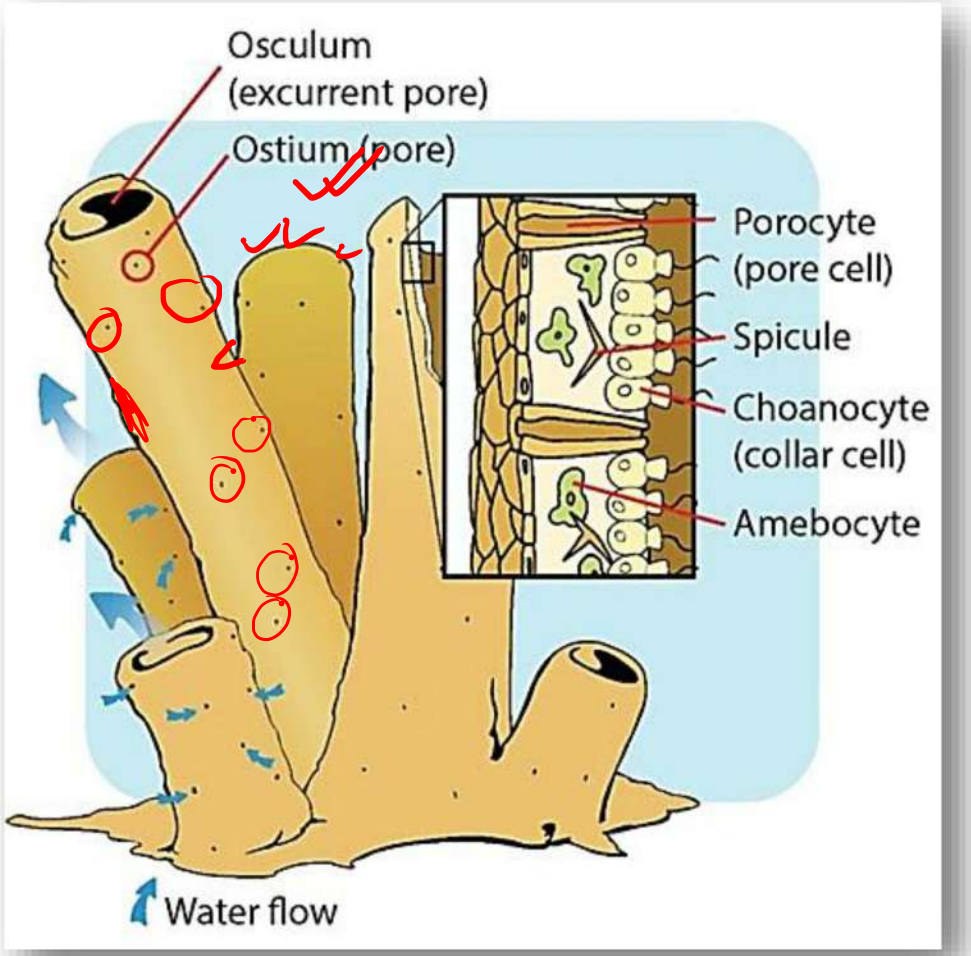
G S S. Sp

PORIFERA

Sponge

- Known as Sponge
- Also known as porous animal
- Cellular grades of organization
- Ostia
- Canal system
- Spicule or Spongin
- Choanocyte — Flagellated cell
- Spongocoel
- Osculum
- Sessile
- Ex. *Scypha gelatinosum (Ciliated sponge)*

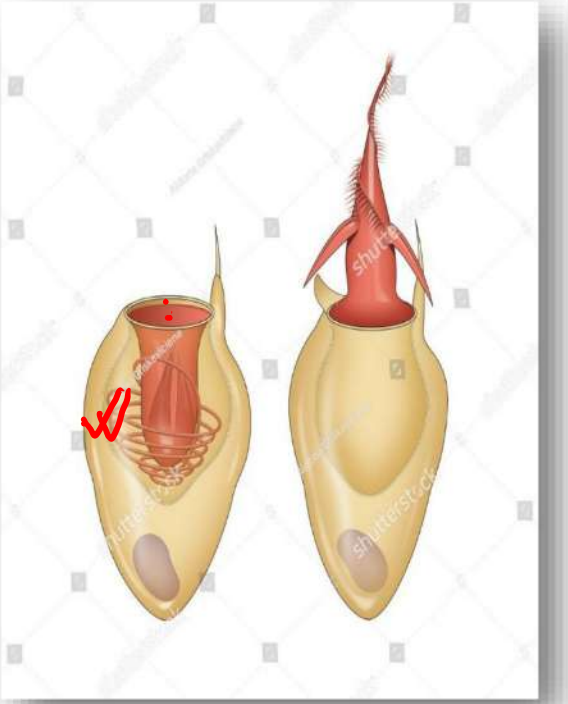




CNIDARIA

Hydra

- Known as Rain forest of sea .
- Cell-tissue grades of organization,
- Radial symmetry
- Diploblastic.
- Nematocysts, cnidocyte
- Coelenteron
- Polyp, medusa — motile sexual reproduction
- Larva: Plannula
- Ex: *Aurelia aurita* (Jelly fish)



PLATYHELMINTHES

Tape worm

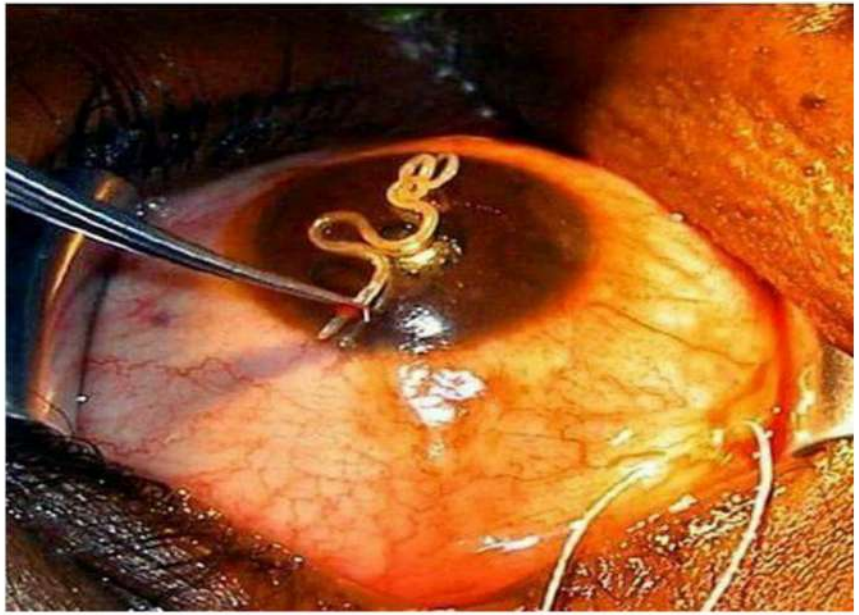
- Known as flat worm or tape worm
- Tissue organ grade of organization.
- Bilateral symmetry
- Triploblastic
- Acoelomate
- The skin is covered with ciliated epidermis or cuticle.
- Sucker, hook
- Flame cell

Flame cell

NEMATODA

Round worm

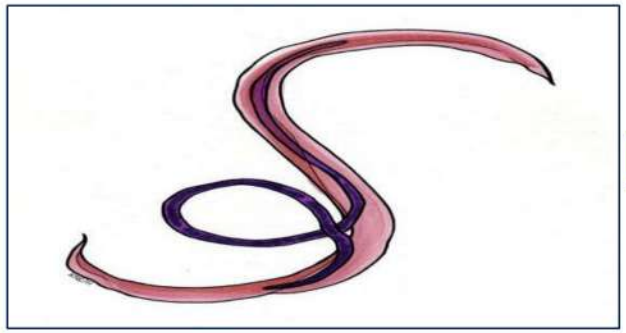
- Known as thread worm or round worm
- Organ-system grade organization
- Bilateral symmetry
- Pseudocoelomate, Triploblastic
- Unsegmented
- The skin is covered with elastin made cuticle.
- Tube within a tube
- Respiratory system and circulatory system are absent
- Sexual dimorphism Male & Female



PLATYHELMINTHES

Taenia saginata

Taenia solium
Tape worm

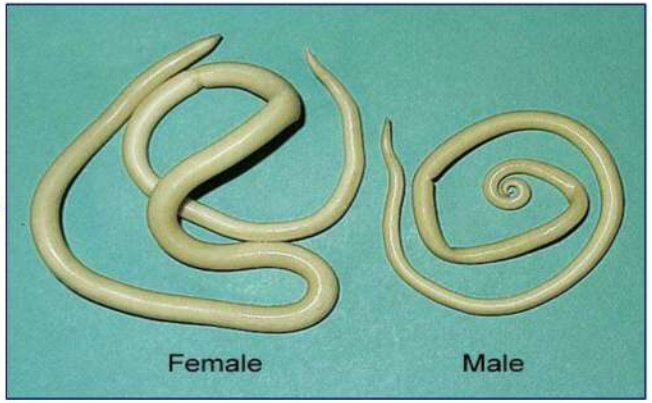


Schistosoma mansoni
Blood worm

Fasciola hepatica
Liver worm

NEMATODA

Ascaris lumbricoides
Round worm



Loa loa
Eye worm

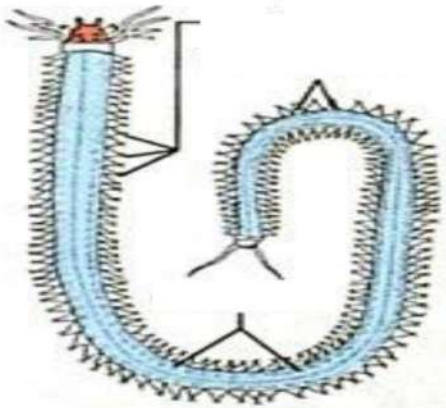
Wuchereria bancrofti
Filaria worm

MOLLUSCA

- 2nd largest phylum
- Bilateral symmetry (except gastropoda)
- Coelomate
- Mantle, shell
- Haemocoel
- Blood contains hemocyanin & amoebocyte.
- Radula (except Bivalvia)
- Respiration occurs through ctenidium or lung or both of them or mantle.
- Ex : *Pila globosa (Apple snail)*

ANNELIDA

- Known as Ring worm
- Bilateral symmetry
- Coelomate
- The skin is covered with cuticle.
- True segmentation
- Setae, parapodia
- Nephridia
- Closed circular system
- Larva: Trochophore
- Ex : *Metaphire posthuma (Earth worm)*



POLL QUESTION-02

- Round worm belongs to which phylum ?

(a) Protozoa

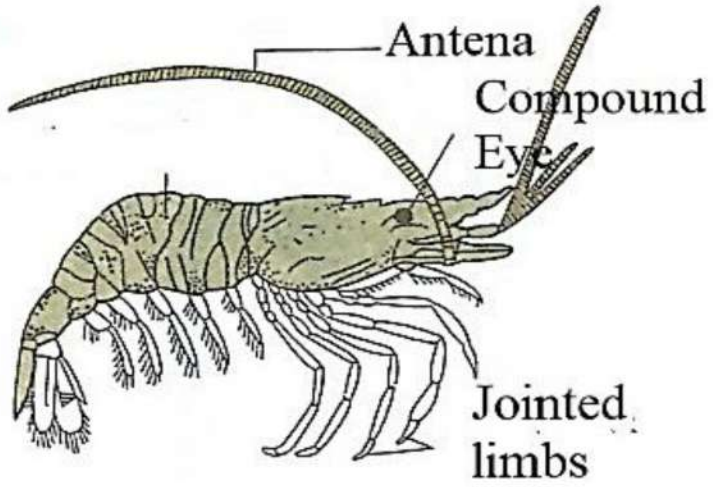
(b) Nematoda

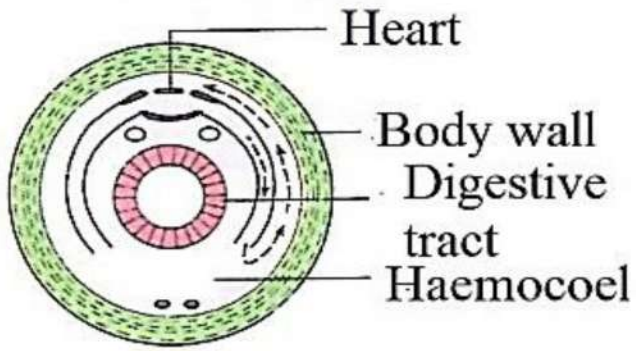
(c) Platyhelminthes

(d) Annelida

ARTHROPODA

- Largest phylum of animal kingdom
- Jointed limbs
- Bilateral symmetry
- Segmentation
- Tagmata
- One or two pairs of antenna
- One pair of compound eyes
- Chitin made exoskeleton
- Haemocoel
- Mouth parts
- Open circulatory system
- Excretory organ: Malpighian tubule
- Metamorphosis
- Ex : *Periplaneta americana* (Cockroach)



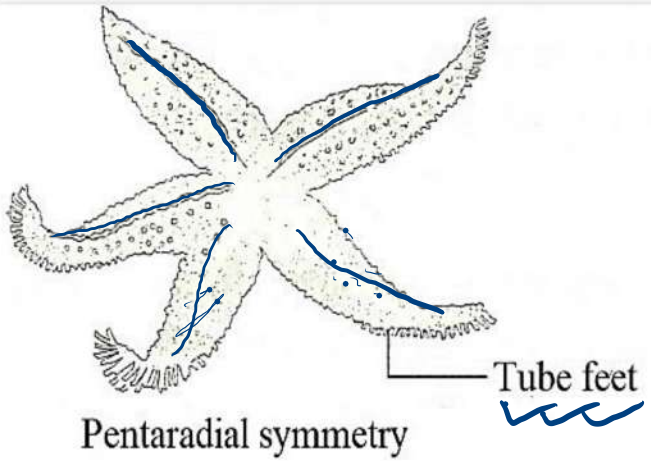


Arthropoda

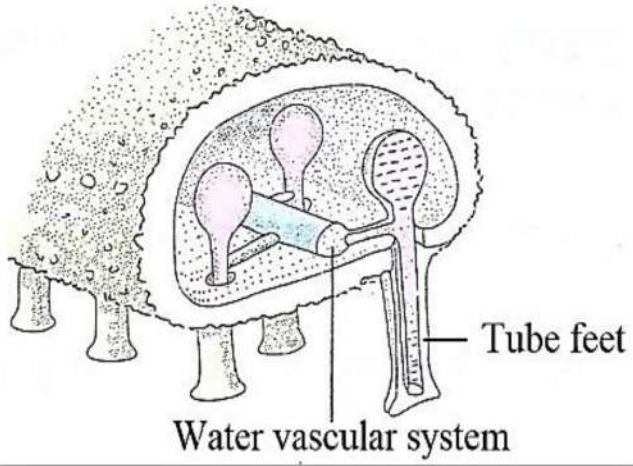
ECHINODERMATA

Star fish

- Pentaradial symmetry, larva shows biradial symmetry
- Exoskeleton: spine & pedicellariae
- Oral and aboral plane. 5 ambulacral grooves are present in oral plane
- Water vascular system
- Tube feet. It helps in locomotion & respiration
- Blood circulatory system absent. Instead haemal & perihaemal system present
- Respiration: gills, respiratory tree, tube feet
- Excretory organ absent
- Ex : *Asterias rubens* (Sea star)

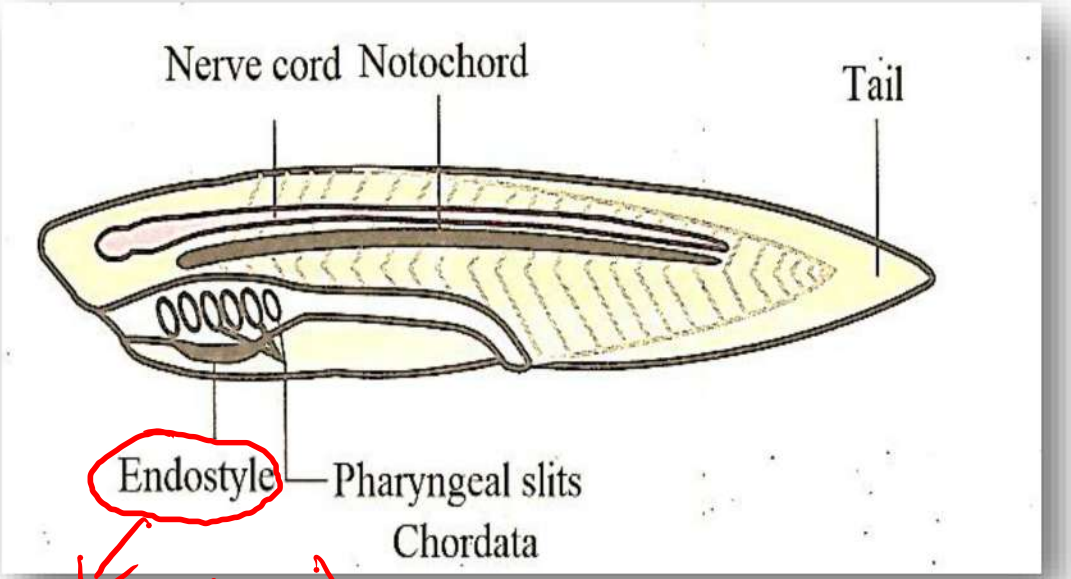


Pentaradial symmetry



CHORDATA

- ✓ Notochord, vertebral column
- ✓ Nerve cord- brain- spinal cord
- ✓ Gill slits
- ✓ Endostyle
- ✓ Closed circulatory system, portal system present
- ✓ Heart is located ventrally
- ✓ Segmentation is limited to body wall, brain and tail.



Thyroid gland

Chordata

- Urochordata
  1. Ascidiacea
  2. Thaliacea
  3. Larvacea
- Cephalochordata
- Vertebrata
  - Cyclostomata
    1. Myxini
    2. Petromyzontida
  - Gnathostomata
    1. Chondrichthyes
    2. Actinopterygii
    3. Sarcopterygii
    4. Amphibia
    5. Reptilia
    6. Aves
    7. Mammalia

Hag fish

Lamprey

CHONDRICHTHYES

Scale
Caudal fin
Endoskeleton

- ✓ Placoid scales
- ✓ Cartilaginous endoskeleton
- ✓ 5-7 pairs of gill slits
- ✓ Heterocercal caudal fin
- ✓ Mouth opening and nostrils are ventrally placed
- ✓ □□: *Scoliodon laticaudus (Dog fish)*

ACTINOPTERYGII

96% Fishes

- ✓ Cycloid or ptenoid scales. In some cases scales absent
- ✓ Endoskeleton is made of bones
- ✓ 1 gill slit on either side of head covered by operculum.
- ✓ Homocercal caudal fin
- ✓ Swim bladder পটকা
- ✓ Ex : *Tenualosa ilisha* (Hilsha)

SARCOPTERYGII

- ✓ Ganoid scales.
- ✓ Endoskeleton is made of bones
- ✓ 1 gill slit on either side of head covered by operculum.
- ✓ Diphycercal caudal fin
- ✓ Capillary rich swim bladder
- ✓ Ex: *Latimeria Chalumnae* (West Indian ocean coelacanth)

AMPHIBIA

- ✓ Smooth, moist, glandular skin
- ✓ Ectothermic Cold blooded
- ✓ Two front legs have four toes each, while the back legs have five toes each. But claw is absent.
- ✓ 3 chambered heart- 2 atrium and 1 ventricle.
- ✓ Embryonic stage aquatic, adults are aquatic or terrestrial.
- ✓ Larva respire through gills, adults respire through lung, skin, oral mucous membrane
- ✓ Ex: *Hoplobatrachus tigerinus* (frog)

REPTILIA

- ✓ Body covered with epidermal scales or plate/ dry/ no gland
- ✓ Each leg has five toes with claw.
- ✓ Heart incompletely divided into 4 chambers.
- ✓ Respiratory organ: Lung
- ✓ Eggs covered with leathery or calcium-containing shells.
- ✓ Extra embryonic membrane present in embryo
- ✓ Ex : *Naja naja* (Cobra)

AVES

- ✓ Body covered with epidermal feather
- ✓ Elongated "S" shaped neck
- ✓ Forelimbs are modified to wing
- ✓ Each jaw is modified to beak
- ✓ Bones are pneumatic
- ✓ Air sacks are connected with lung
- ✓ Heart has 4 chambers- 2 atria & 2 ventricles
- ✓ 1st endothermic class Warm blooded
- ✓ Ex : *Columba livia* (Pigeon)

MAMMALIA

- ✓ Sweat gland and sebaceous gland are present in skin
- ✓ Body covered with epidermal hair (except whale)
- ✓ Possess mammary glands which are functional in female
- ✓ Pinna is present in external ear. Middle ear has 3 small bones
- ✓ Body cavity divided into thoracic and abdominal cavity by fleshy diaphragm
- ✓ Nucleus absent in mature RBC
- ✓ Heart has four chambers
- ✓ Endothermic
- ✓ *Ex :Panthera tigris* (Tiger)

T
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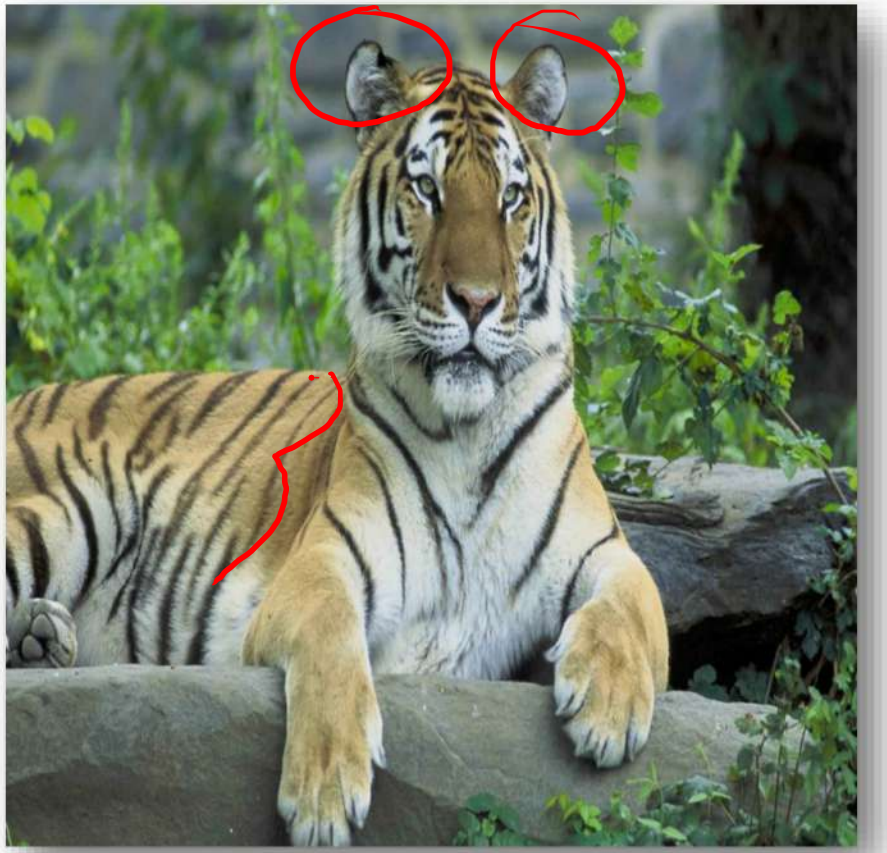


POLL QUESTION-03

- Which of the following one is reptile ?

(a) *Naja Naja*

(b) *Columba livia*

(c) *Latimeria Chalumnae*

(d) *Hoplobatrachus tigerinus*

Rohu fish

Importance	Topic	Admission test years	
		Medical & Dental	Others University
✪	General Introduction	DAT: 16-17	DU: 16-18, 14-15
✪✪	External Structure	MAT: 18-19,16-17, 15-16	RU: 19-20; CU: 18-19, 17-18
✪	Blood Circulatory System	DAT: 18-19	CU: 17-18; KU: 16-17
✪	Respiratory System	-	JnU: 16-17
✪	Reproductive System & life cycle	MAT: 17-18	-

Rohu fish

Phylum: Chordata

Sub-phylum: Vertebrata

Class: Actinopterygii

Order: Cypriniformes

Family: Cyprinidae

Genus: *Labeo*

Species: *Labeo rohita*

Info about Rohu Fish

Major carp	• Rohu, catla and mrigel.
Minor carp	• Batta, ghonia etc.
Growth	• Under normal conditions, they grow upto 35-45 cm (1-1.5 ft) long and weigh 700-800 gm in hatchery within a year.
Survival temperature	• Rohu fish can't survive at a temperature below 14°C.
Habitat	• Fresh water of ponds, rivers, lakes and estuaries. • Halda river is called natural gene bank rich 'fish mine'.

Shape and structure

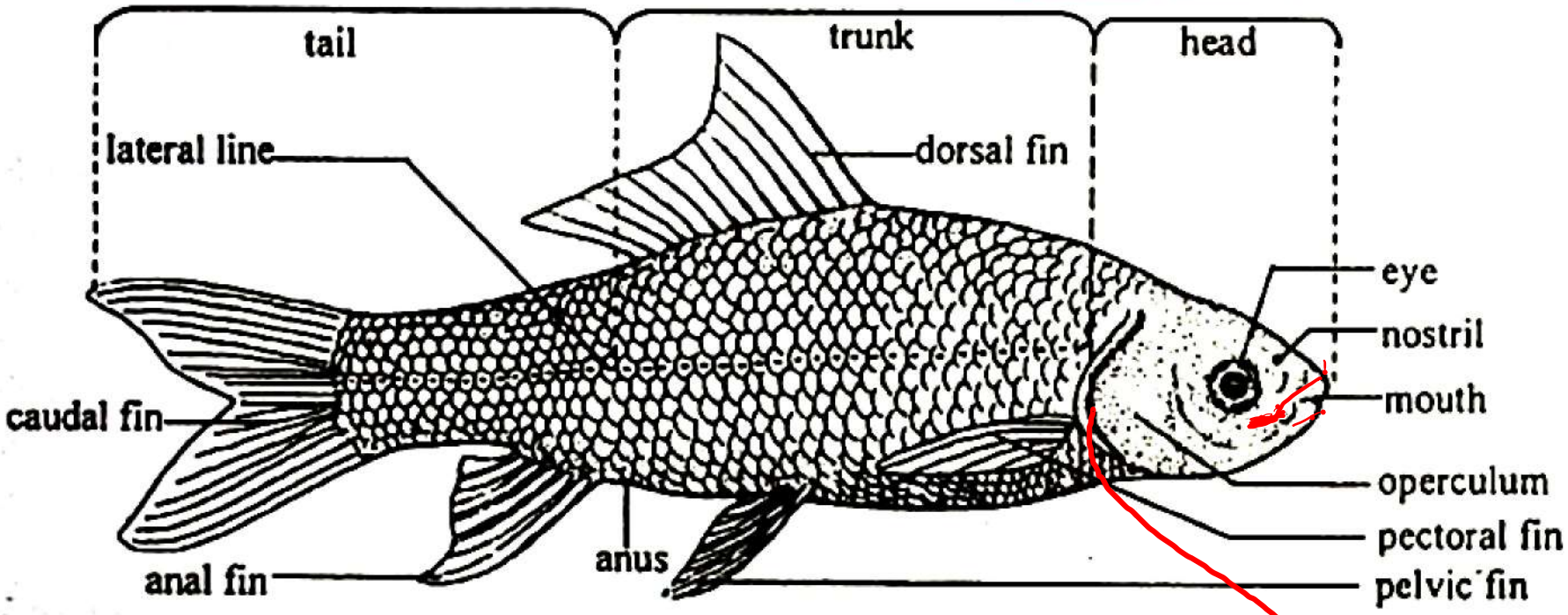


Fig 2.3.1 External feature of Rohu fish

Branchiostegal

Shape and structure

Body of rohu fish can be divided into 3 parts: head, trunk and tail

Head-

- a pair of small and soft maxillary barbels.
- no scale on head
- Lower margin of operculum has a thin branchiostegal membrane

Shape and structure

Trunk –

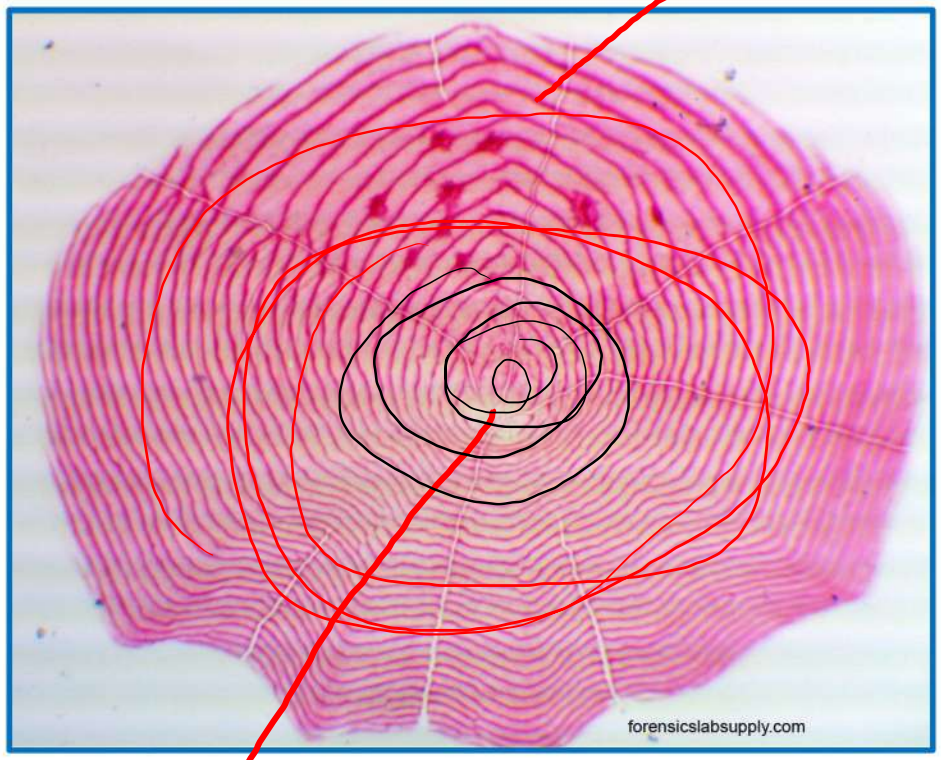
Five types of fins are found in rohu fish -

a. Dorsal fin: 15-16 fin rays.
b. Pectoral fin: 17-18 fin rays.
c. Pelvic fin: 9 fin rays.
d. Anal fin: 6-7 fin rays.
e. Caudal fin: 19 fin rays.

It has homocercal caudal fin at the tip

Scales of Rohu fish

- Main protective organ of fish
- Cycloid scales
- Center of the dorsal scales is reddish and
- the edges are blackish
- scales occur more during spring and summer
- Focus is the centre of layers of scales
- The elevated parts of scales are called circulus or growth line



Circulus

Focus

Blood circulatory system : Heart

Chambers	• Two in number- one atrium and one ventricle. • There is a sub-chamber named sinus venosus
Structure	• The ventricle opens in the front into bulbus arteriosus. • There is no conus arteriosus in the heart of rohu fish. Instead, there is a structure named bulbus arteriosus which is basically the widened root of ventral aorta.It is not a part of the heart.
Special information	• CO_2 rich blood circulates through the heart in a single direction so it is called single circuit blood flow. • Only CO_2 rich blood circulates through the heart, so this heart is called 'venous heart'.
Direction of blood flow	• Sinus venosus→ Atrium→ Ventricle→ Bulbus arteriosus→ Gills.

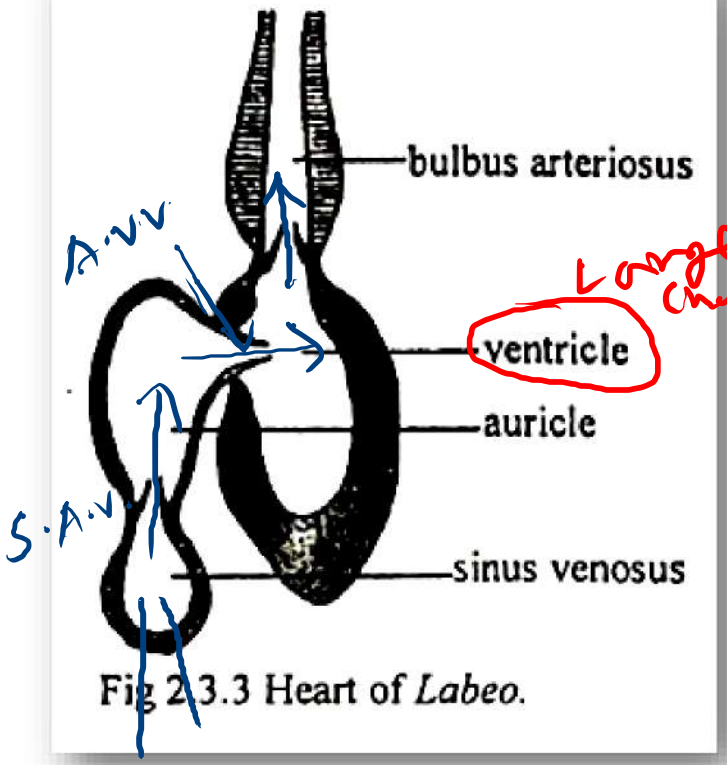


Fig 23.3 Heart of *Labeo*.

Valves of Rohu fish

CO_2

- Valves
  - (i) Sino-atrial valve → Between sinus venosus and atrium
  - (ii) Atrio-ventricular valve → Between atrium and ventricle
  - (iii) Ventriculo- bulbus valve → Between ventricle and bulbus aorta

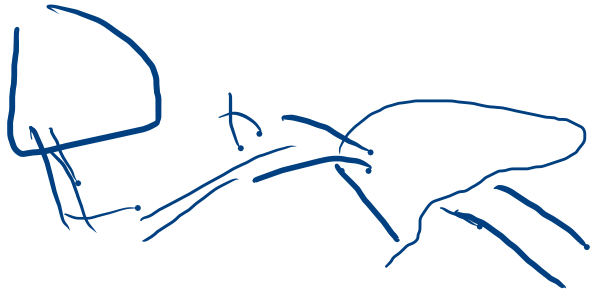
Arterial system

Afferent branchial artery	• 4 pairs of arteries enter 4 pairs of gills. • Carry CO_2 rich blood from the heart to gills.
Efferent branchial artery	• Four pairs of efferent branchial arteries originated from four pairs of gills. • Carry blood from gills to different parts of the body.
Special arteries	• **1**st efferent branchial artery is extended as ophthalmic artery. • 1st and 2nd efferent branchial arteries on each side form 'lateral aorta'. • Two lateral aorta from both sides unite together posteriorly into dorsal aorta. • Lateral aorta and carotid artery from both sides unite together to form circulus cephalicus.

Venous system

(a) Systemic venous system	• A pair of anterior cardinal veins, a pair jugular veins and a pair of posterior cardinal veins form the systemic venous sytem. • Ductus Cuvieri collects blood and conveys to sinus venosus.
(b) Portal venous system	• Formed of hepatic portal system and renal portal system.

Port : বন্দর



Poll Question: 4

- Which one is the largest heart chamber of Rohu fish ?

(a) Atrium

(b) Ventricle

(c) Sinus venosus

(d) Bulbus arteriosus

Respiratory System

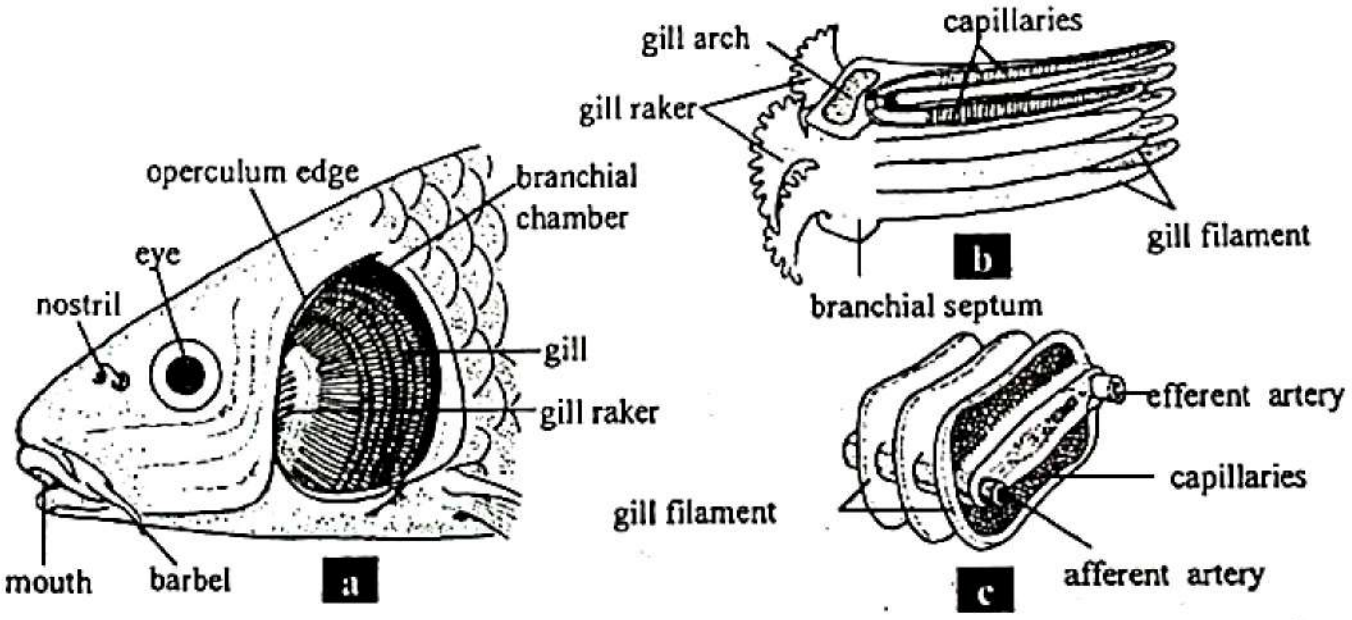
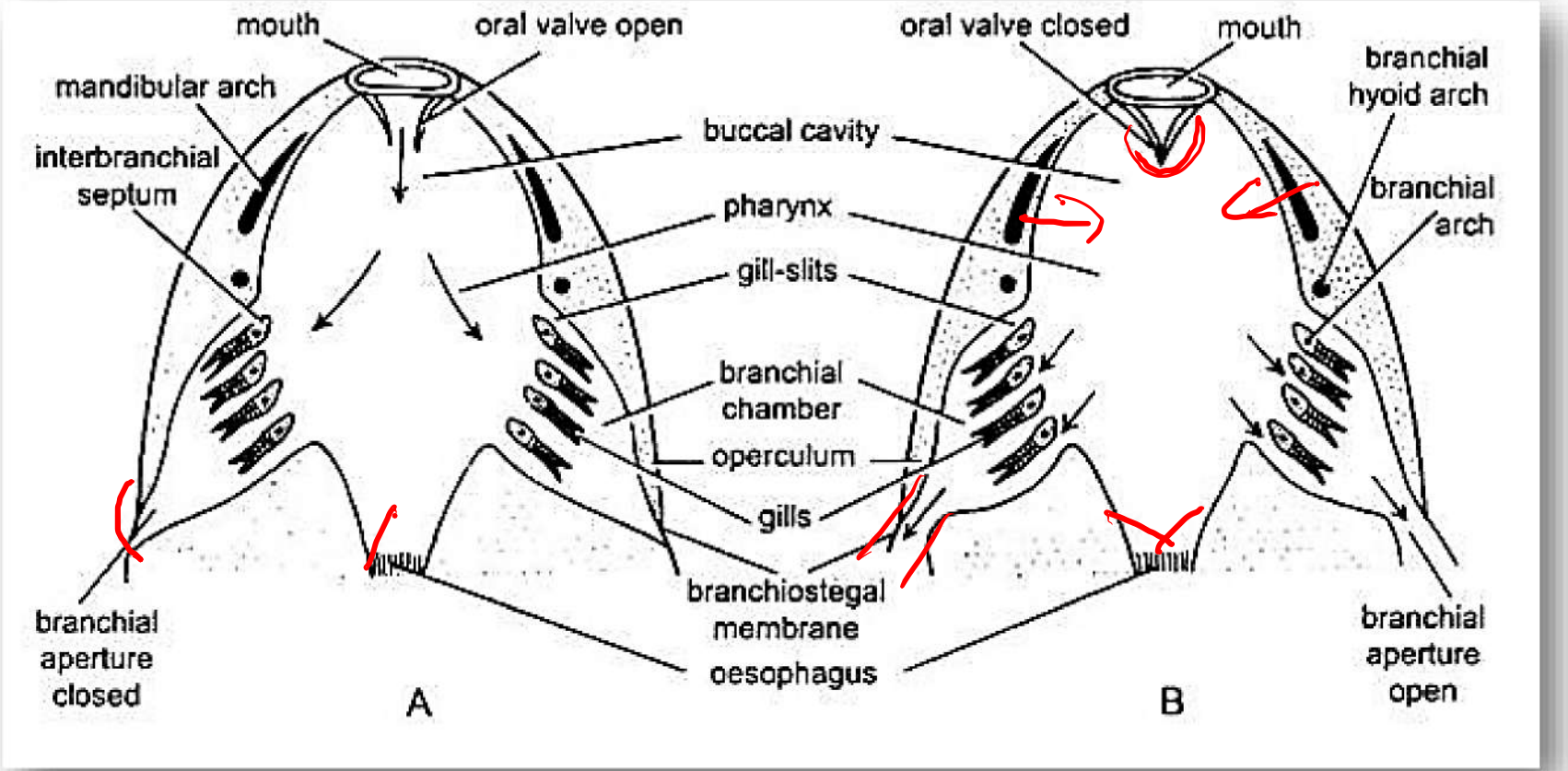


Fig 2.3.6 (a) Gill in branchial chamber, (b) Part of a gill and (c) blood supply of gill of *Labeo*

The posterior border of operculum has a thin branchiostegal membrane

The respiration of rohu fish occurs in two steps- inspiration and expiration

Respiratory Process



Air Bladder

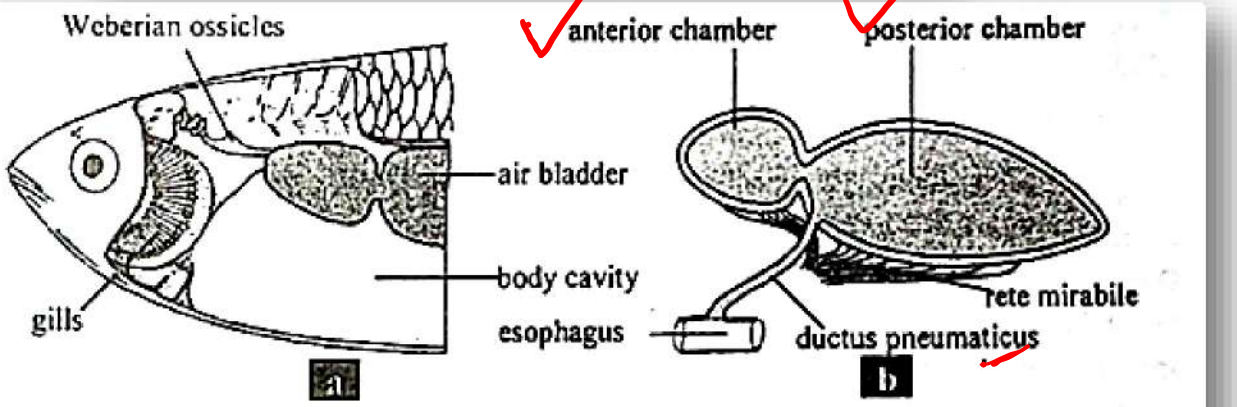
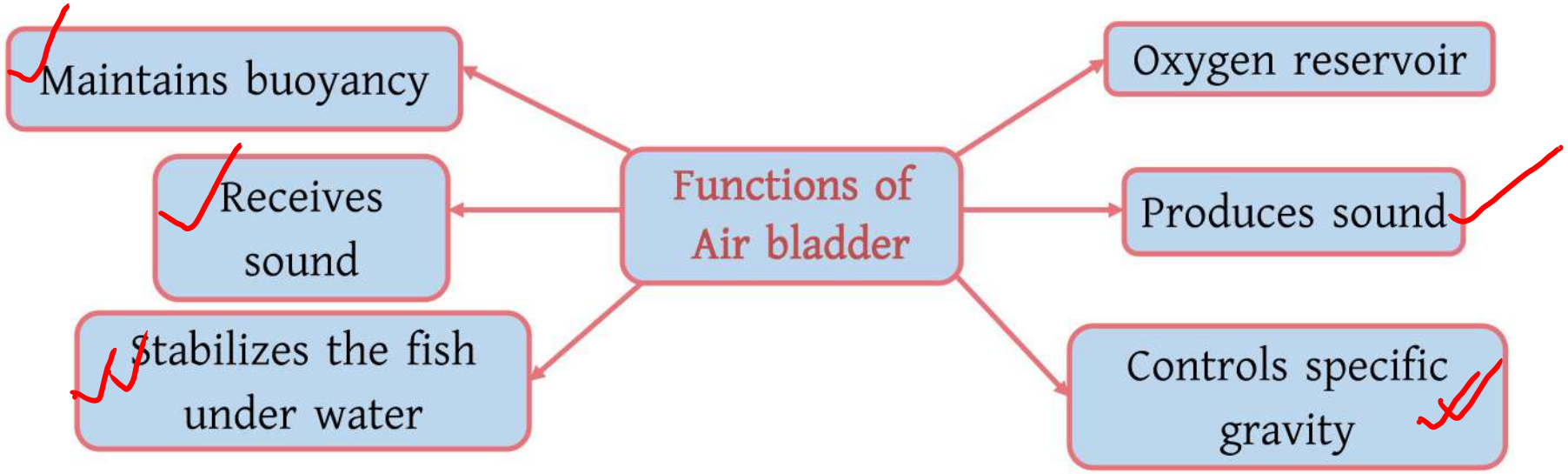


Fig 2.3.8 (a) Position and (b) Structure of air bladder of *Labeo*.

Chamber	• Anterior chamber is connected to the oesophagus by pneumatic duct. • Pneumatic duct is attached to the Weberian ossicles of inner ear.
Color	• Like a shinny white sac.
Gases found	• Oxygen, Nitrogen and carbon dioxide are also present.
Structure	• The epithelial covering of anterior chamber forms a unique red-colored gas gland. • In this gas gland, retia mirabilia is formed by numerous closely packed capillaries.

N_2 O_2 CO_2

Air Bladder


Functions of Air bladder
Maintains buoyancy
Receives sound
Stabilizes the fish under water
Oxygen reservoir
Produces sound
Controls specific gravity

Reproductive system and life cycle of Rohu fish

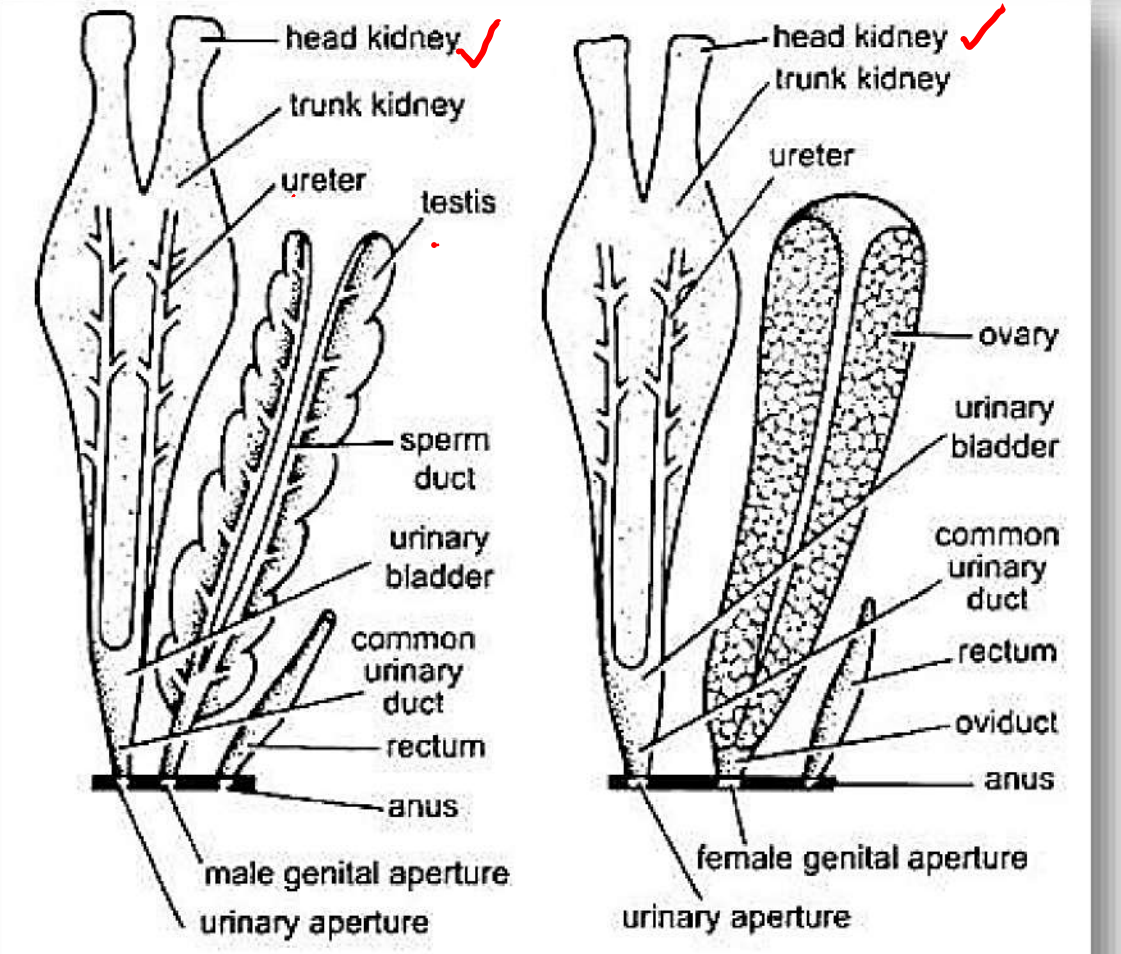


Fig. 15.14. *Labeo*. Urinogenital organs. A–Male; B–Female.

Reproductive system and life cycle of Rohu fish

Testes	• Male fish has one pair of testes. • The testes are suspended in the body wall by peritoneal fold called mesorchium.
Ovaries	• Female fish has one pair of ovaries. • The ovaries are suspended in the body wall by peritoneal fold called mesovarium.
Number of eggs produced	• The fish can lay down 1-4 lakh eggs for every kg of body weight.
Age	• Rohu fish is ready for breeding at the age of two years.
Period	• They become ready for breeding at the month of June-July.
Egg	• Fertilized eggs are large, spherical, reddish in color, heavy and with sticky covering.
Larva	• Eggs are hatched after 15-18 hours and larva comes out. These larval are called egg hatching or spore hatching. After 72 hours larval stage is terminated. • After 96 hours mouth of larva becomes well developed and starts to take foods. Yolk sac becomes atrsphied and this stage is known as fingerling

Life cycle of Rohu fish

Time period	Changes
12 hours	• Eyes begin to blacken because of chromatophores.
24 hours	• Gill arch becomes visible in larva.
36 hours	• Pectoral fins and lower lip are clearly visible in larva.
48 hours	• Becomes 6-6.4 mm long and air bladder is seen.
72 hours	• Larval stage ends.
96 hours	• Yolk sac almost disappears and it is known as fingerlings.
5 days	• Fry is about 8-8.5 mm long.
10 days	• Fry becomes 15-18 mm long.
15 days	• Minnow becomes 23 mm long.

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