

Maa Bharti P.G. College, Kota



Department of Zoology
Bachelor of Science (B. Sc.) Part-III
Subject: Zoology
File: Chordata

Submitted By:
Pallavi Sharma

| S.No. | Experiment Description | Experiment Date | Submission Date | Remarks / Signature |
|-------|--|-----------------|-----------------|---------------------|
| 1. | Study of museum specimens: Sub-phylum class Vertebrata | | | |
| | • Petromyzon | | | |
| | • Acipenser | | | |
| | • Amia calva | | | |
| | • Lepidosteus | | | |
| | • Labeo rohita | | | |
| | • Clarius | | | |
| | • Anguilla vulgaris | | | |
| | • Exocoetus | | | |
| | • Hippocampus | | | |
| | • Echinosis | | | |
| | • Protopterus | | | |
| | • Ichthyophis | | | |
| | • Hyla | | | |
| | • Chelone | | | |
| | • Sphenodon | | | |
| | • Draco | | | |
| | • Eryx | | | |
| | • Hydrophis | | | |
| | • Archaeopteryx | | | |
| | • Ornithorhynchus | | | |

| S. No. | Experiment Description | Experiment Date | Submission Date | Remarks / Signature |
|--------|--|-----------------|-----------------|---------------------|
| | • <u>Macropus</u> | | | |
| 2) | <u>slides: Permanent slides</u> | | | |
| | • External features - Rohu | | | |
| | • Male & female urogenital system | | | |
| | • Diagram - Inner ear | | | |
| | • Diagram - Human eye | | | |
| 3) | <u>Mammalian Histology:</u> | | | |
| | • Rabbit: | | | |
| | a. T.S of Pancreas, T.S of Testis, T.S of Ovary, T.S passing through Bone, T.S of spinal chord | | | |
| 4) | <u>Chick & Frog slides</u> | | | |
| | • Frog: V.S through Blastula, Gastrula, whole mount tadpole larva, | | | |
| | • Chick: whole mount 18 hrs of incubation & 72 hrs of incubation | | | |
| 5) | <u>Osteology:</u> | | | |
| 1. | Skull of Frog, Rabbit, Veranus & Fowl | | | |
| 2. | Pectoral Girdle. | | | |
| 3. | Pelvic Girdle (respectively). | | | |

Sub-phylum:

VERTEBRATA →

Phylum - Chordata
 Group - Craniata
 Subphylum - Vertebrata
 Division - Agnatha
 Class - Cyclostomata
 Order - Petromyzontia
 Genus - Petromyzon
 Species - marinus

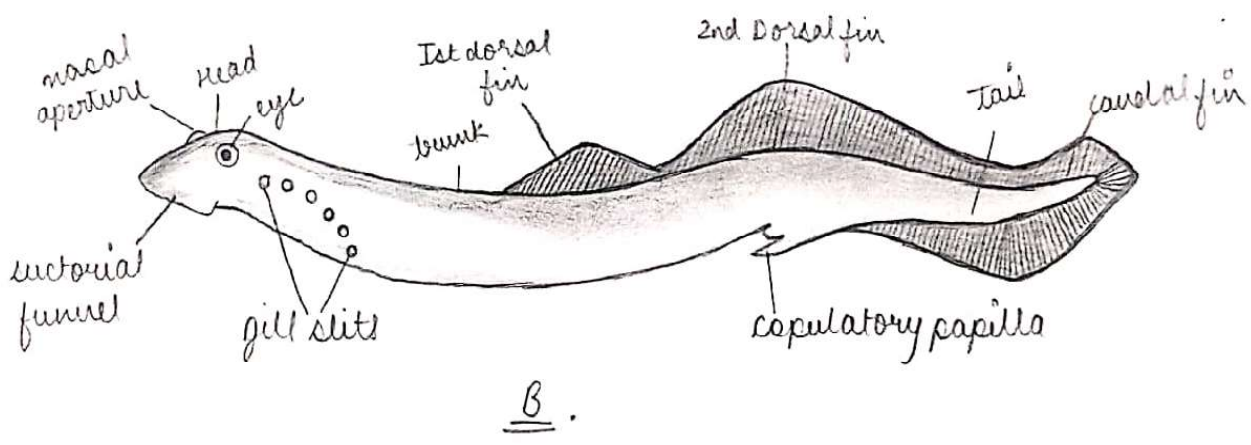
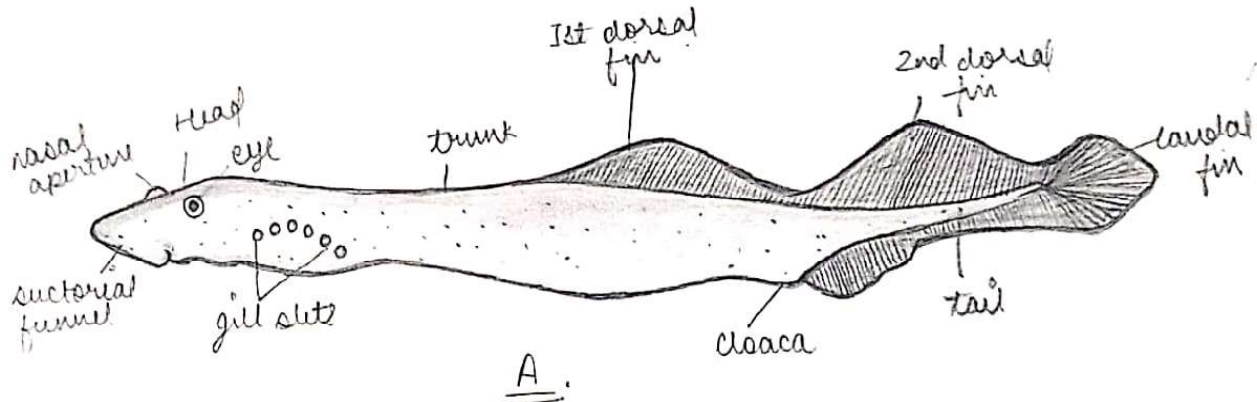


Fig Petromyzon A. Female
 B. Male

Phylum - Chordata
 Class - Craniata
 Subphylum - Vertebrata
 Division - Gnathostomata
 Class - Osteichthyes
 Order - Chondrostei
 Family - Polyodontidae
 Genus - Acipenser

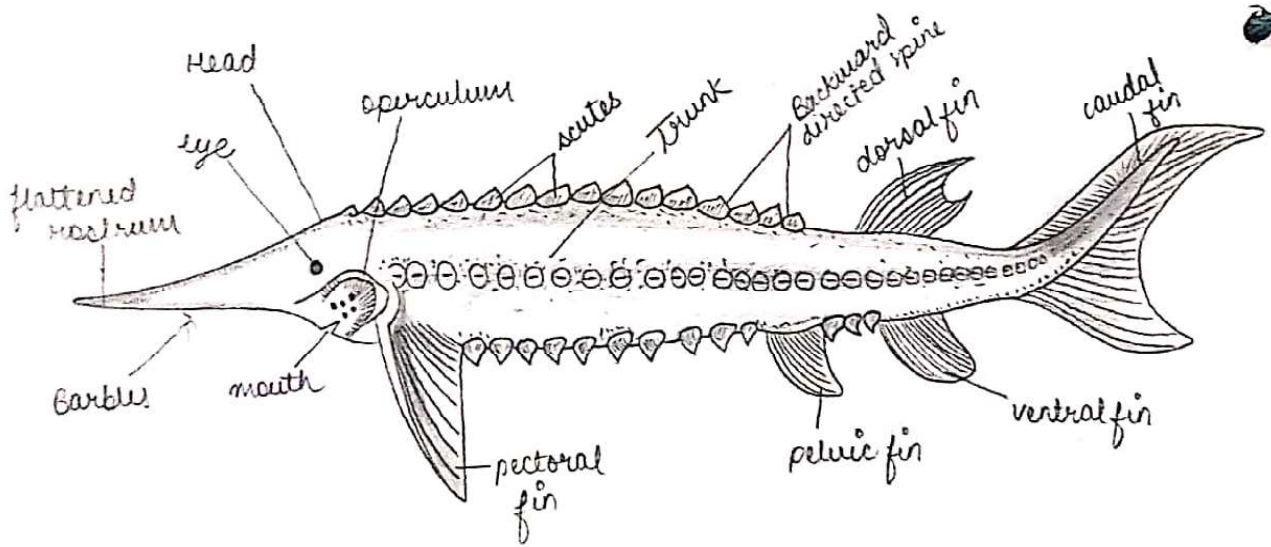


Fig. Acipenser

Acipenser

> Classification :

Phylum - Chordata → Dorsal tubular nerve chord, notochord and gill slit

Group - Craniata → Definite head with cranium and brain

Subphylum - Vertebrata → Vertebral column present

Division - Gnathostomata → Jaw and paired appendages present

Class - Osteichthyes → Bony fishes

Order - Chondrostei → Body covered with bony scales or naked

Family - Polyodontidae

Genus - Acipenser

> **Habit and Habitate :** Acipenser is marine, bottom-dwelling fish. They stir the bottom with their snout in search of small invertebrates, worm, etc

> **Distribution :** Acipenser is abundantly distributed in Black sea, sea of Azor, Caspian sea, in rivers of Europe, China and North America

> Comments :

Commonly known as Sturgeon, measuring 2 to 4 m in length.

1) Body is elongated, cylindrical and bulky and is divided into head, trunk and tail

2) Head is produced ahead as a long flattened rostrum or snout. It contains a pair of eyes and functional spiracles.

3) Mouth is ventral and transverse and without teeth in jaws. Narrow crevices between scales contain dermal denticles like those of Elasmobranchi.

4) Spiracles open and skeleton cartilaginous.

5) 2 to 3 M eggs are laid by a single fish during the breeding season

The air bladder is smooth, oval and contains ciliated epithelium.

Teacher's Signature

Phylum - Chordata
Group - Vertebrata
Subphylum - Vertebrata
Division - Chordata
Superclass - Pisces
Class - Osteichthyes
Order - Lepidostei
Family - Lepidosteidae
Genus - Lepidosteus

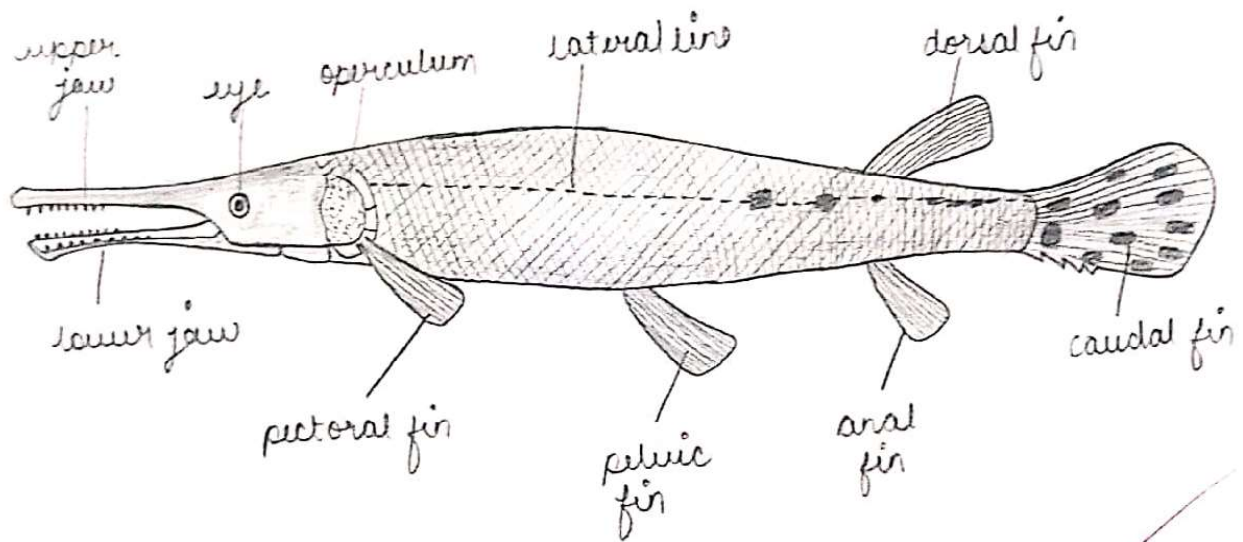


Fig. - Lepidosteus (Garpike)

Lepidosteus

Classification:

- Phylum - Chordata → Dorsal tubular nerve chord, notochord & gill-slits
- Group - Craniata → Definite head, cranium and brain
- Subphylum - Vertebrata → Vertebral column present
- Division - Gnathostomata → Jaws & paired appendages present
- Superclass - Pisces → Paired fins, gills and skin with scales
- Class - Osteichthyes → Bony fishes
- Order - Lepidostiformes → Vertebrae solid, ganoid scales in oblique row
- Family - Lepidosteidae
- Genus - Lepidosteus

- **Habit and Habitat:** Lepidosteus is found in fresh-water rivers. It is a voracious feeder on small fishes. Sometimes it also comes out of the surface to emit bubbles of gas.
- **Distribution:** widely distributed in U.S.A. Upper Cretaceous to Recent

Comments:

- (i) Commonly known as garpike, measured about 2 to 3 meters.
- (ii) Body is elongated with short caudal region and is divided into head, trunk & tail.
- (iii) Head is produced into snout. Both the upper and lower jaws are elongated to form a sort of gar.
- (iv) Eyes are developed. Gills are covered by operculum. Nostrils are found at the anterior end of snout.
- (v) Vertebrae opisthocelous. Tail symmetrical, spiracles closed.
- (vi) Air bladder is used as lung. It is vascularized and thus permits aerial respiration.

Teacher's Signature

Jurho

Phylum - Chordata
Group - Vertebrates
Subphylum - Vertebrates
Division - Chordata
Superclass - Pisces
Class - Osteichthyes
Superorder - Teleostei
Order - Cypriniformes
Family - Cyprinidae
Genus - Labeo
Species - rohita

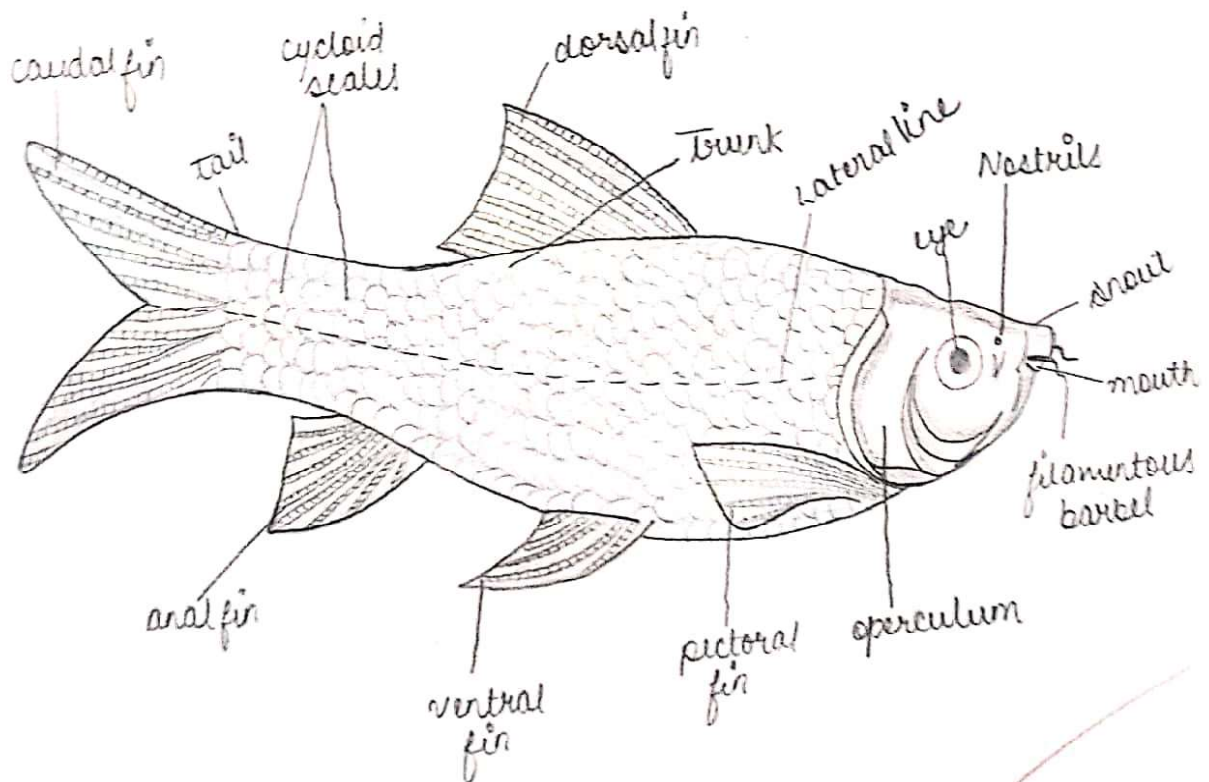


Fig. Labeo rohita (Rohu)

Labeo rohita

→ Classification :

- Phylum - Chordata → Dorsal tubular nerve chord, notochord & gill slit in.
- Group - Craniata → Define head, cranium and brain
- Subphylum - Vertebrata → Vertebral column present.
- Division - Gnathostomata → Jaws & paired appendages
- Superclass - Pisces → Paired fins, gills & skin with scales.
- Class - Osteichthyes → Bony fishes
- Superorder - Teleostei → Bony fish proper
- Order - Ostariophysi → anterior vertebrae fused.
- Family - Cyprinidae
- Genus - Labeo
- Species - rohita

→ Habit and Habitat : Labeo is abundantly found in ponds and rivers.

Carp are vegetarian and bottom feeders, occasionally on animal diet.

→ Distribution : It is widely distributed in tropical & temperal regions. Specially found in India (Punjab & Assam) & Myanmar. Eocene to recent.

→ Comments :

- (i) Commonly known as carp and Rohu in Hindi
- (ii) Body is compressed fusiform, about 1m in length & weighing about 4kgs
- (iii) Body is regioned into head, trunk & tail.
- (iv) Head is depressed and is produced into a short, obtuse and blunt snout. A pair of filamentous barbels arises from upper lips
- (v) Dorsal, anal, caudal, paired pectoral and anal fins with soft fine rays present. Caudal fin forked into equal lobes
- (vi) Weberian apparatus present between bladder & inner ear.

Teacher's Signature

Phylum - Chordata
Group - Chariata
Subphylum - Vertebrata
Division - Gnathostomata
Superclass - Pisces
Class - Osteichthyes
Order - Symptognathi
Genus - *Frocoetus*

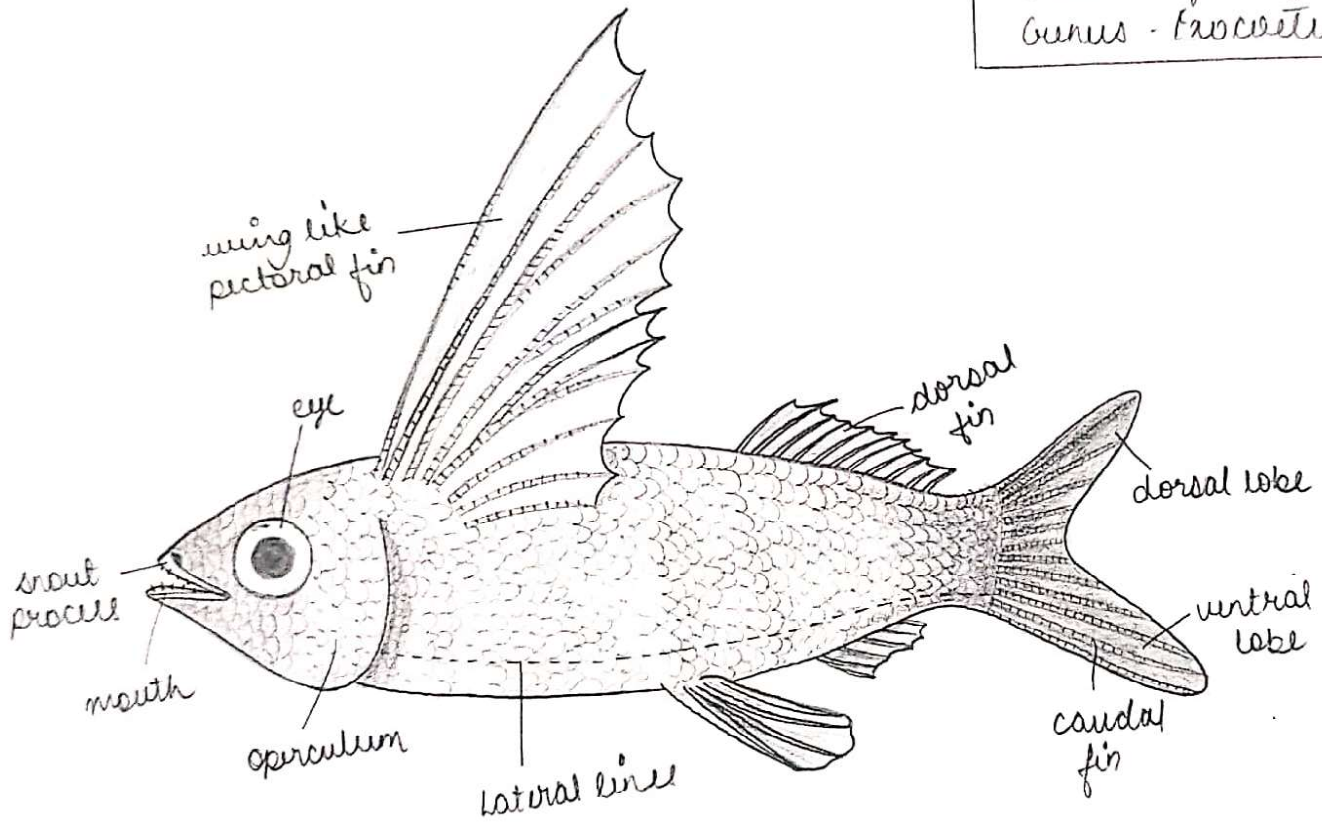


Fig. *Frocoetus* (flying fish)

Exocoetus

→ Classification:

Phylum - Chordata - Dorsal tubular nerve chord, notochord & gill slits

Group - Craniata - Distinct head, brain & cranium

Subphylum - Vertebrata - Vertebral column present

Division - Gnathostomata - Jaws and paired appendages

Superclass - Pisces - Paired fins, gills and skin with scales

Class - Osteichthyes - Bony fishes

Order - Syngnathi - Flying fish, dorsal fin above anal.

Genus - Exocoetus

→ Habit and Habitat: Found in sea, often skittering near the boats. It is pelagic and feeding on prawns and young fishes and their eggs.

→ Distribution: Distributed in tropical and warmer Atlantic, Pacific and Indian oceans.

→ Comments:

- (i) Commonly known as flying fish
- (ii) Elongated body with silvery white sides measures 30 to 45 cm in length and divided into head, trunk & tail.
- (iii) Body covered with overlapping cycloid scales
- (iv) Head contains large eyes. The upper part of snout is produced into a process and contains nostrils.
- (v) Mouth opening is small but teeth in both jaws
- (vi) Lower pharyngeals unite as a single bone. Lateral line of operculum (VII)
- (vii) Dorsal and anal fins are short and supported by 8 to 16 soft fin-rays each and are opposite to each.

Teacher's Signature _____

Juv

Phylum Chordata
 Group Chordata
 Subphylum Vertebrata
 Division Osteichthyes
 Superclass Pisces
 Class Osteichthyes
 Family Syngnathidae
 Genus Hippocampus

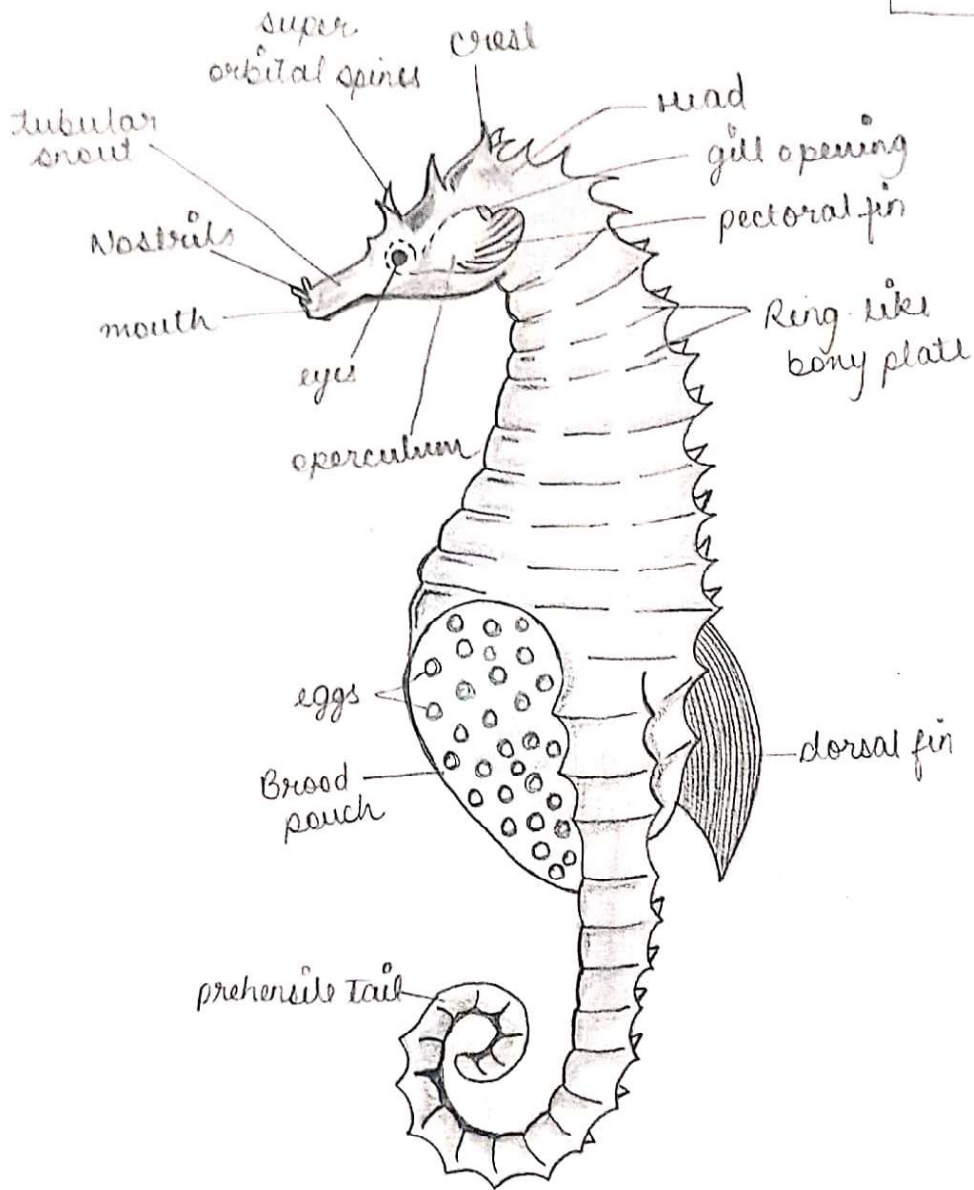


Fig. Hippocampus (Male)

Hippocampus

•> Classification:

Phylum - Chordata → Dorsal tubular nerve chord, notochord & gill-slits

Group - Craniata → Distinct head, cranium and brain

Subphylum - Vertebrata → Vertebral columns present

Division - Anathostomata → Jaws and paired appendages

Superclass - Pisces → Paired fins, gills and skin with scales

Class - Osteichthyes → Bony fishes

Order - Solenichthyes → Pipe-fishes and sea horses

Family - Syngnathidae → Snout tubular and suckorial

Genus - ~~Syngn~~ Hippocampus

•> Habit and Habitat: They swim upright swaying their tails and gyrating their trunks in graceful manners, holding a weed with their tail

•> Distribution: Hippocampus has cosmopolitan distribution

•> Comments:

(i) Commonly called as sea-horses because its anterior end is shaped like the neck and head of a horse.

(ii) Body is divided into head, trunk & tail. Size varies from 5-17cm.

(iii) Head is produced anteriorly into tubular snout and backwardly into a crest. Mouth is found at the end of the snout.

(iv) Body is covered by a rigid exoskeleton armour of ring like bony plates.

(v) Dorsal fin is single, ventral and caudal fins are absent.

(vi) Females have small anal fin. Male contain brood pouches which carry eggs until they hatch.

(vii) Tail is prehensile.

Teacher's Signature



Phylum - Chordata
 Group - Chariota
 Subphylum - Vertebrata
 Division - Gnathostoma
 Superclass - Tetrapoda
 Class - Amphibia
 Order - Anura
 Suborder - Procelia
 Family - Hylidae
 Genus - Hyla

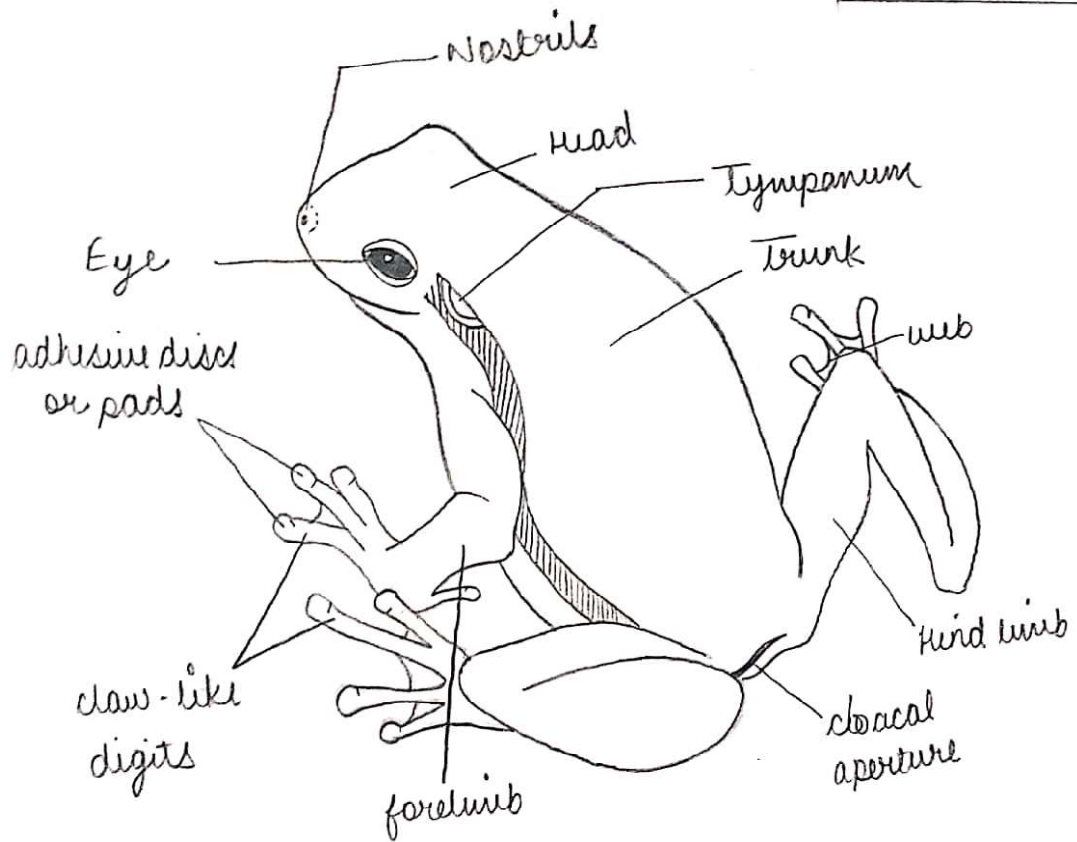


Fig. Hyla

Hyla

Classification:

Phylum - Chordata → Dorsaltubular nervechord, notochord and gill-slit

Group - Chaniata → Definite head, cranium & brain

Subphylum - Vertebrata → Vertebral column present

Division - Gnathostomata → Jaws and paired appendages

Superclass - Tetrapoda → Paired limbs, lungs, cornified skin

Class - Amphibia → Cold blooded, scaleless glandular skin

Order - Anura / Salientia → scaleless amphibia, gill slit absent

Suborder - Procel

Family - Hylidae


Genus - Hyla

Habit and Habitat: Hyla is arboreal in habit, living on trees and rocks

Distribution: Hyla is commonly distributed in India, China, United States, Africa and Canada, Micronesia

Comments:

- (i) Commonly known as tree frog
- (ii) Body measuring 3 to 8cm size, divided into head and trunk.
- (iii) Head contains eyes and nostrils
- (iv) Forelimbs and hind limbs are adapted for arboreal life
- (v) Eyes well developed with horizontal pupil. Tympanum distinct. Voices often loud
- (vi) Skin of belly contains hygroscopic glands which help in adhering the frog with leaf, twig or stem.
- (vii) Fertilization external. Eggs are laid in water. Development includes tadpole larva

Teacher's Signature 

Phylum - Chordata
Group - Choriata
Subphylum - Vertebrata
Division - Gnathostomata
Superclass - Tetrapoda
Class - Reptilia
Subclass - Anapsida
Order - Chelonia
Family - Cheloniidae
Genus - Chelone

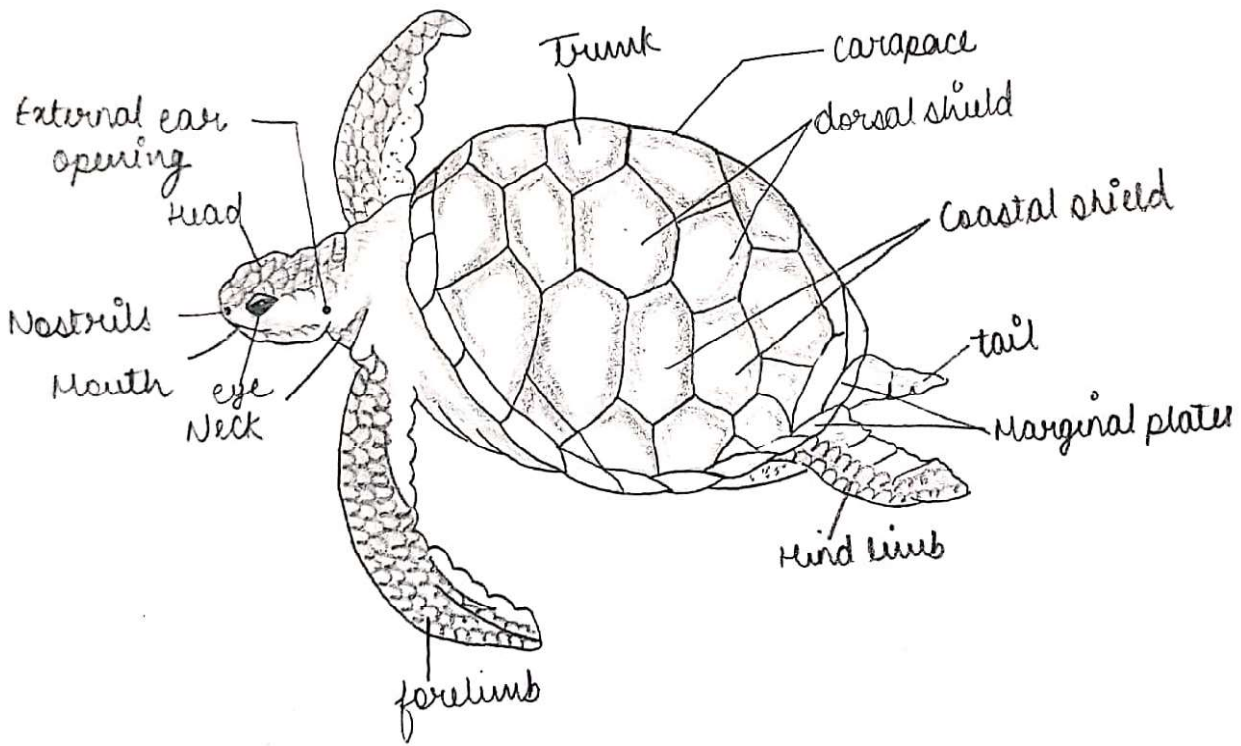


Fig. Chelone



Chelone

» Classification :

- Phylum - Chordata → Dorsal tubular nerve cord, notochord & gill slits
- Group - Craniata → Definite head, cranium with brain
- Subphylum - Vertebrata → Vertebral column present
- Division - Gnathostomata → Jaws and paired appendages present
- Superclass - Tetrapoda → Paired limbs, lungs & bony skeleton
- Class - Reptilia → Scaly vertebrate, Embryo with amnion & allantois
- Subclass - Anapsida → Primitive reptiles, skull completely roofed over
- Order - Chelonia → Turtles, tortoises and terrapins
- Family - Cheloniidae → Limbs flipper like
- Genus - Chelone

» **Habit and Habitat :** Chelone mydas is a marine reptile. They come ashore only to lay eggs

» **Distribution :** Distributed in tropical and subtropical regions and chiefly found in India, Pacific & Atlantic Ocean coasts of USA.

» Comments :

- (i) Commonly called as green turtle. Measures about 110 cms. Body is divided into head, neck, trunk and tail
- (ii) Body case is rigid. Carapace flat, heart-shaped and covered with smooth bony shield.
- (iii) Plastron is joined to carapace by ligaments.
- (iv) Dorsal shields are juxtaposed fitting closely into each other.
- (v) Head is covered by single pair of prefrontal shields.
- (vi) Eyes well developed, provided with eyelids & nictitating membrane.
- (vii) Limbs are adapted for swimming & flippers like.

Teacher's Signature _____

Phylum - Chordata
 Group - Chariata
 Subphylum - Vertebrata
 Division - Gnathostomata
 Superclass - Tetrapoda
 Class - Reptilia
 Sub-class - Diapsida
 Order - Rhynchocephalia
 Genus - Sphenodon
 Species - punctatum

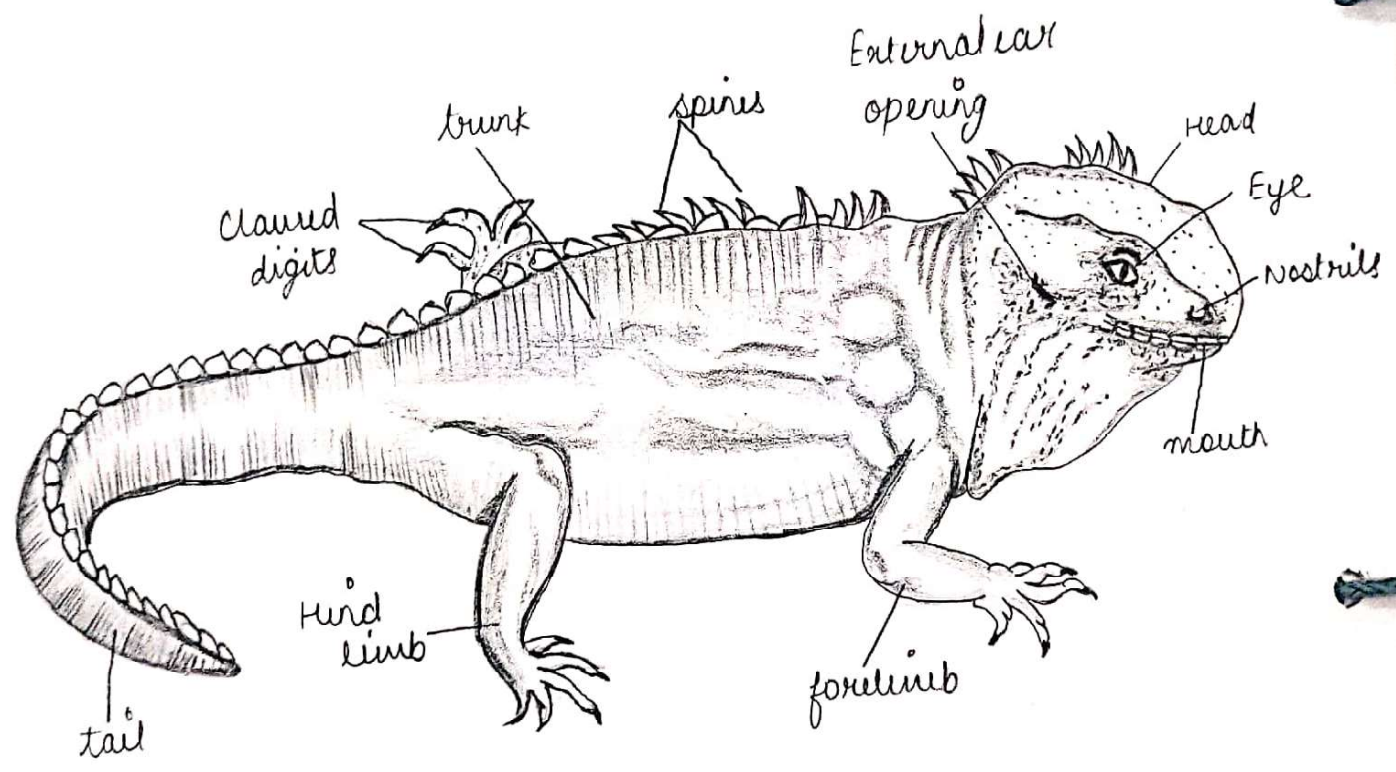


Fig. Sphenodon

Sphenodon

» Classification :

Phylum - Chordata → Dorsal tubular nerve chord, notochord & gill slits

Group - Craniata → Definite head, cranium with brain present

Subphylum - Vertebrata → Vertebral column present

Division - Gnathostomata → Jaws and paired appendages

Superclass - Tetrapoda → Paired limbs, lungs, confined skin

Class - Reptilia → Scaly vertebrates, Pulmonary respiration

Sub-class - Diapsida → Skull with two temporal opening

Order - Rhynchocephalia → Living fossil, lizard-like, Ribs single

Genus - Sphenodon

Species - punctatum

» Habit and Habitat : lives in burrow, leads semi-aquatic life, it is nocturnal and eats insects, molluscs or small invertebrates.

» Distribution : Found in New Zealand, specially in the islets of Bay of Plenty. Remains to Eocene and Recent.

» Comments :

- (i) Commonly called as tuatara.
- (ii) Animal is lizard like having dull olive green color, measuring 75 cm. Body divided head, trunk & tail.
- (iii) It contains scaly skin & long-tail.
- (iv) Forelimb and hind limbs adapted for walking having clawed dist.
- (v) Skull contains two complete fossae, quadrates is fixed, postfrontals are separated & upper jaw has beaks.
- (vi) Eye is photosensitive
- (vii) Anal opening transverse

Teacher's Signature

Phylum - Chordata
Group - Craniata
Subphylum - Vertebrata
Division - Gnathostomata
Class - Reptilia
Order - Squamata
Family - Agamidae
Genus - Draco

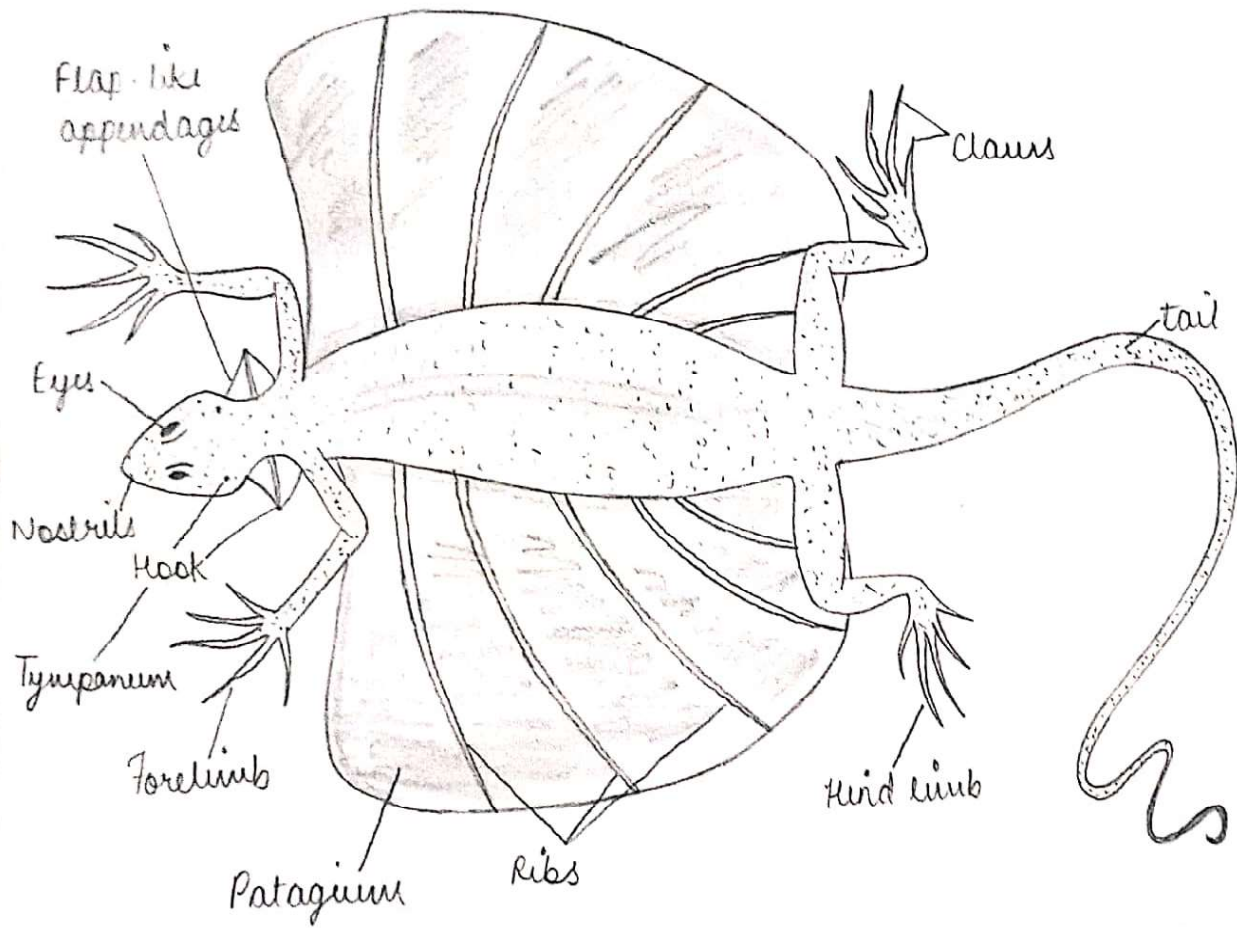
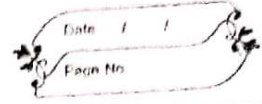


Fig. Draco

Draco



•> Classification :

Phylum - Chordata → Dorsal tubular nerve cord, notochord and gill slits

Group - Craniata → Definite head, cranium with brain present

Subphylum - Vertebrata → Vertebral column present

Division - Gnathostomata → Jaws & paired appendages present

Superclass - Tetrapoda → Paired limbs, lungs & keratinized skin

Class - Reptilia → Scaly vertebrate, pulmonary respiration

Subclass - Diapsida → Skull with two temporal opening

Order - Squamata → Lizard & snakes with horny epidermal scales

Suborder - Sauria / Lacertilia → Lizard, body slender

Family - Agamidae → Limbs normal, teeth differentiated

Genus - Draco

•> Habit and Habitat : Arboreal, living on tree. It feeds on small insects

•> Distribution : Commonly distributed in Myanmar, India, Malaysia, Europe, Africa, Asia & Australia.

•> Comments :

(i) Commonly known as flying dragon or flying lizard.

(ii) Body dorsoventrally compressed measuring 15-22 cm in length and divided into head, neck, trunk & tail.

(iii) Head is more or less triangular, contains eyes, tympanum behind eyes and nostrils. Teeth heterodont

(iv) Tongue is thick and strong.

(v) Neck contains 3 hooks for flapping like appendages.

(vi) Forelimbs & hind limbs are normal

(vii) On both sides wings formed by extension of skin is present.

Teacher's Signature

Kingdom - Chordata
 Group - Choriata
 Subphylum - Vertebrata
 Division - Chordata
 Class - Reptilia
 Order - Squamata
 Family - Colubridae
 Genus - Eryx

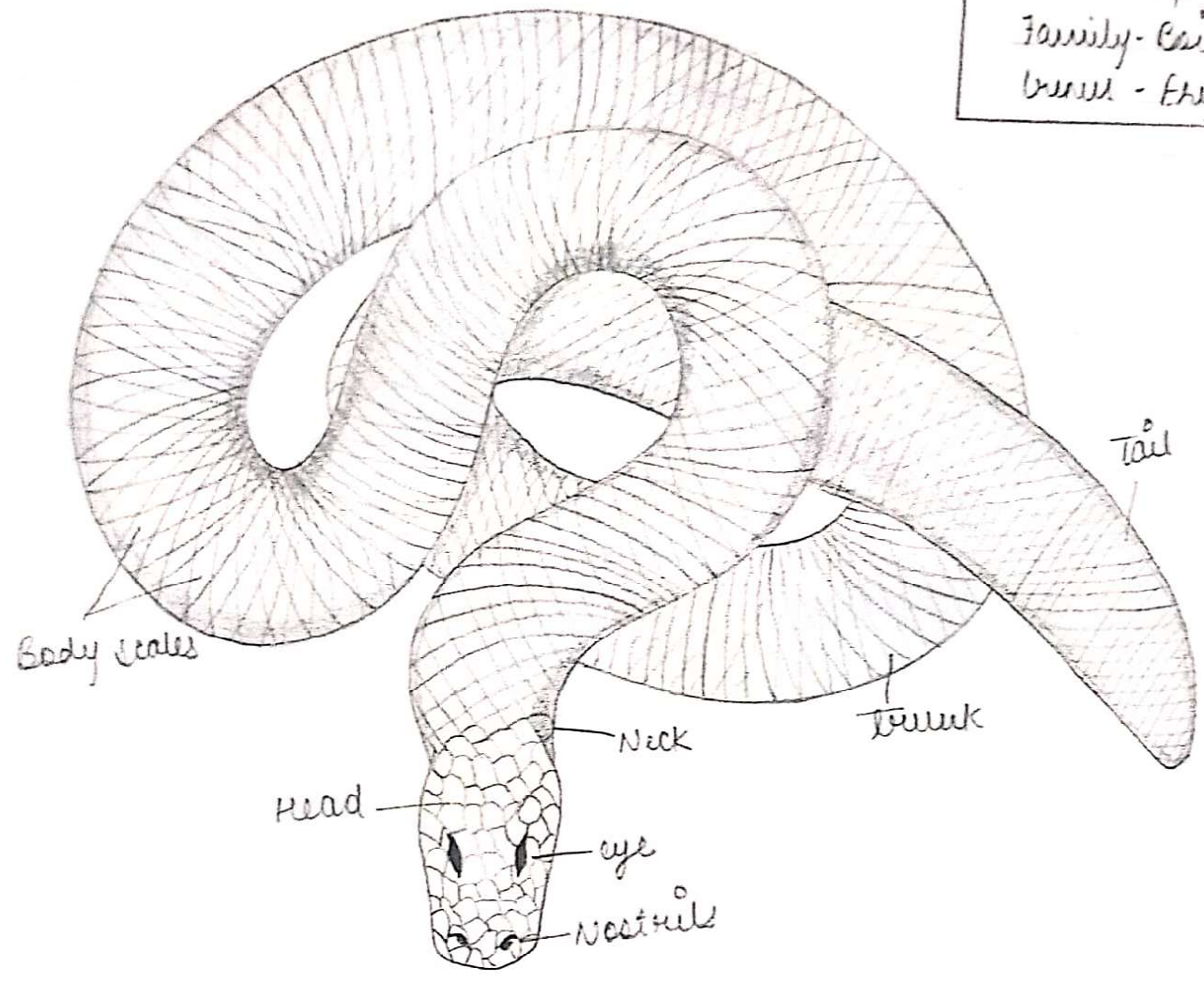


Fig. Eryx

Eryx

» Classification :

Phylum - Chordata → Dorsal tubular nerve cord, notochord and gill slit present

Group - Craniata → Definite head, cranium with brain present

Subphylum - Vertebrata → Vertebral column present

Division - Gnathostomata → Paired appendages and jaws present

Superclass - Tetrapoda → Paired limbs, lungs and cornified skin

Class - Reptilia → Scaly vertebrates, single condyle, pulmonary respiration

Subclass - Diapsida → Skull with two temporal openings

Order - Squamata → Lizard & snakes with horny epidermal scales

Suborder - Ophidia → Snakes

Family - Boidae → Vestiges of pelvic gills & hind limbs as 2 spurs

Genus - Eryx

» **Habit and Habitat :** Eryx is found in sandy regions. It remains hidden in sand and feeds on lizards, frogs and mice.

» **Distribution :** Found all over in India, Sri Lanka, Africa & Asia.

» Comments :

(i) Commonly called as sand boa, the common double mouthed snake

(ii) It is elongated measuring 1m in length. Body divided into head, trunk and tail. Head contains eyes and nostrils.

(iii) Pinkish grey dorsal surface has irregular brown patches while ventral surface is yellowish.

(iv) Head & neck indistinguishable. Head scales primitive & 3 enlarged

(v) Eyes are small with verticle pupil, reduced due to burrowing life.

(vi) Nostrils are slit like. Tympanum absent

(vii) Tail region is thick & blunt at head & hence called "Dumhi"

Teacher's Signature

[Signature]

Phylum - Chordata
 Group - Craniota
 Subphylum - Vertebrata
 Division - Ornithomorphata
 Class - Aves
 Sub-class - Archaeopteryx
 Genus - Archaeopteryx

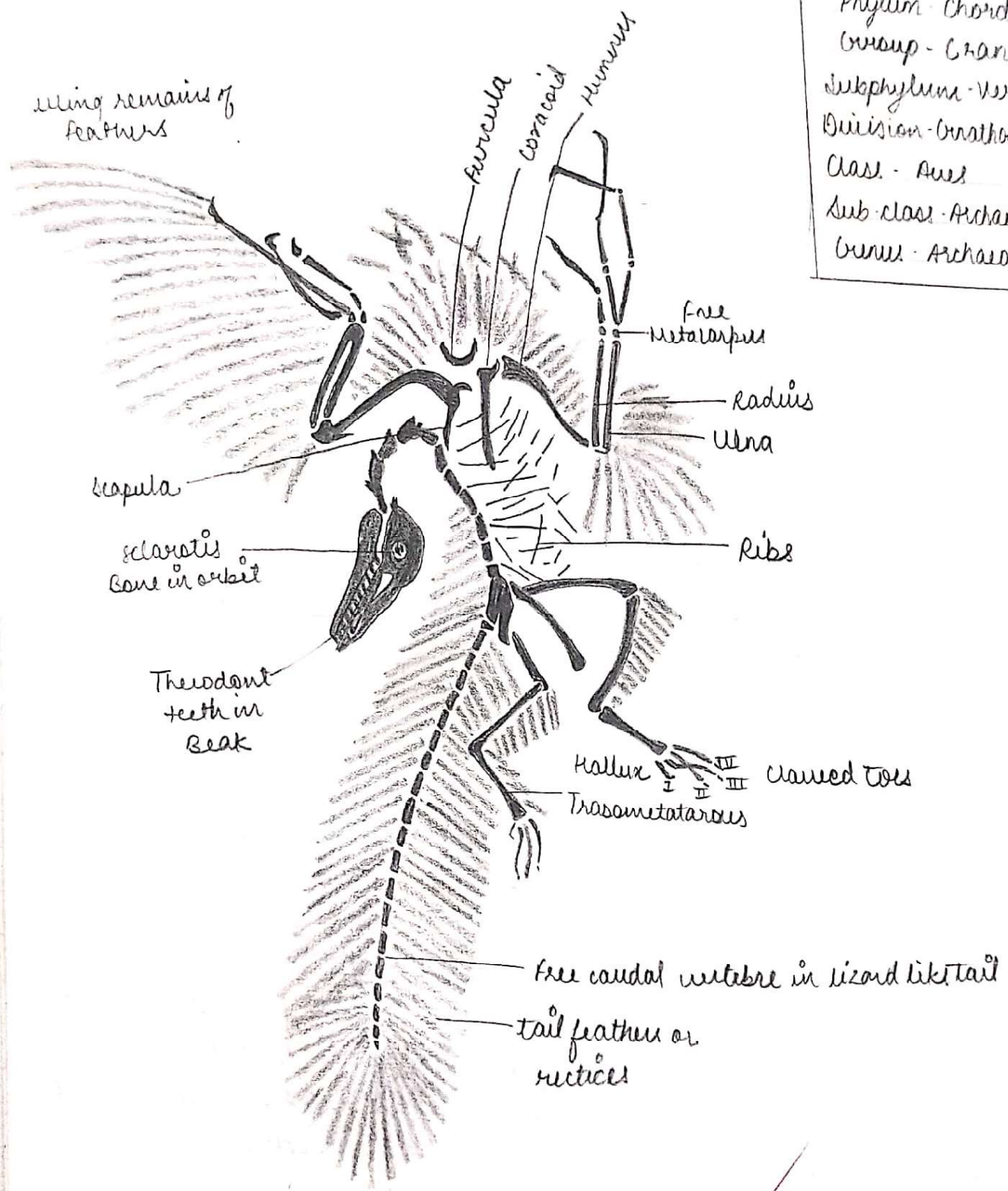


Fig. Archaeopteryx : Fossil skeleton

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Archaeopteryx

• Classification:

Phylum - Chordata → Dorsal tubular nerve cord, notochord and gill slit present.

Group - Craniata → Distinct head, cranium with brain

Subphylum - Vertebrata → Vertebral column present

Division - Gnathostomata → Jaws and paired appendages

Class - Aves → Biped and feathered vertebrates

Sub-class - Archaeopteryx → Jaws and wings present

Genus - Archaeopteryx

• Comments:

- (i) Fossilized *Archaeopteryx lithographica* was discovered in 1861 from Bavaria, Germany. It belonged to Jurassic period about 140 million years ago.
- (ii) Body was divided into head, neck, back, breast, abdomen & tail. Tail elongated.
- (iii) Head contained eye, nostril and toothed beak. Head, neck & beak like birds.
- (iv) Four limbs modified into feathers or wings. Wing feathers consisted of remiges while tail feathers are made up of retrices.
- (v) Whole body was covered with scales.
- (vi) Hind limb consisted of tarsometatarsus, hallux & clawed toes.
- (vii) Above fossil possessed both reptilian and avian character.

Teacher's Signature _____

Phylum - Chordata
 Group - Vertebrata
 Subphylum - Vertebrata
 Division - Gnathostomata
 Superclass - Tetrapoda
 Class - Mammalia
 Subclass - Proteltheria
 Order - Monotremata
 Genus - Ornithorhynchus

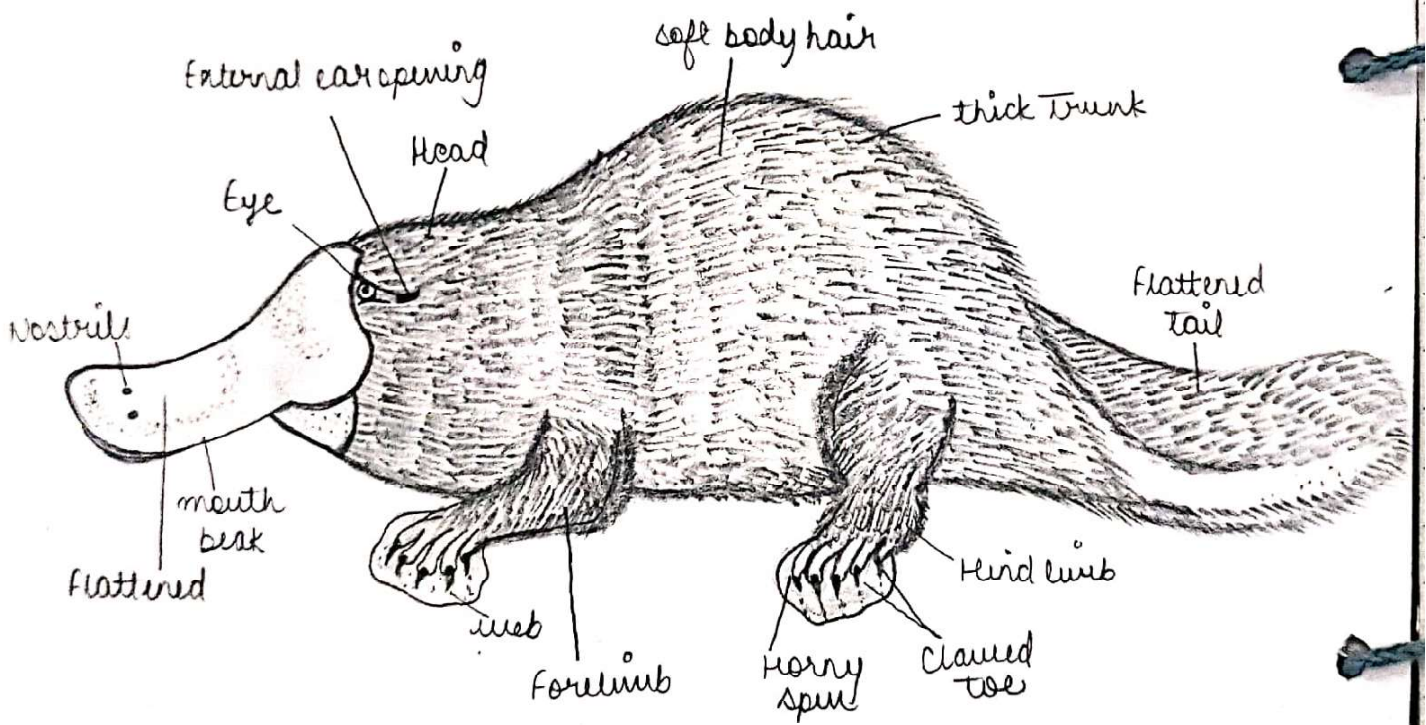


Fig. Ornithorhynchus : Duck bill

Ornithorhynchus

•> Classification:

Phylum - Chordata → Dorsal tubular nerve cord, notochord and gill slits

Group - Craniata → Distinct head with brain & cranium

Subphylum - Vertebrata → Vertebral column present

Division - Gnathostomata → Jaws & paired appendages

Superclass - Tetrapoda → Paired limbs, lungs & cornified skin

Class - Mammalia → Body covered with hairs, mammary gland in ♀

Sub-class - Prototheria → Egg-laying mammals

Order - Monotremata → Cloaca present

Genus - Ornithorhynchus (Duck-bill)

•> Habit and Habitat: It is a native of rivers, pools and creeks. It burrows to 12 to 15 m along the river banks

•> Distribution: Found in South Eastern Australia & Tasmania.

•> Comments:

- (i) Commonly called as duck-billed-platypus. It measures about 50cm in length having fine short fur.
- (ii) Body is divided into head, thick trunk and tail
- (iii) Adult has no teeth. Jaws covered with horny plate. Pinnae (-) are
- (iv) forelimb and hindlimb have 5 digits, web of clawed toes.
- (v) Coracoid and precoracoid present. T-shaped interclavicle
- (vi) Eyes small having nictitating membrane. Mammary gland without nipples.
- (vii) Cloaca present. Uterus opens in dorsal wall of urogenital passage. Testes abdominal, penis conducts only sperms. Oviducts distinct, uterus or vagina absent. Lays 1-3 eggs

Teacher's Signature _____

Phylum - Chordata
 Group - Chirosta
 Subphylum - Vertebrata
 Division - Gnathostomata
 Superclass - Tetrapoda
 Class - Mammalia
 Subclass - Prototheria
 Order - Marsupialia
 Genus - Macropus

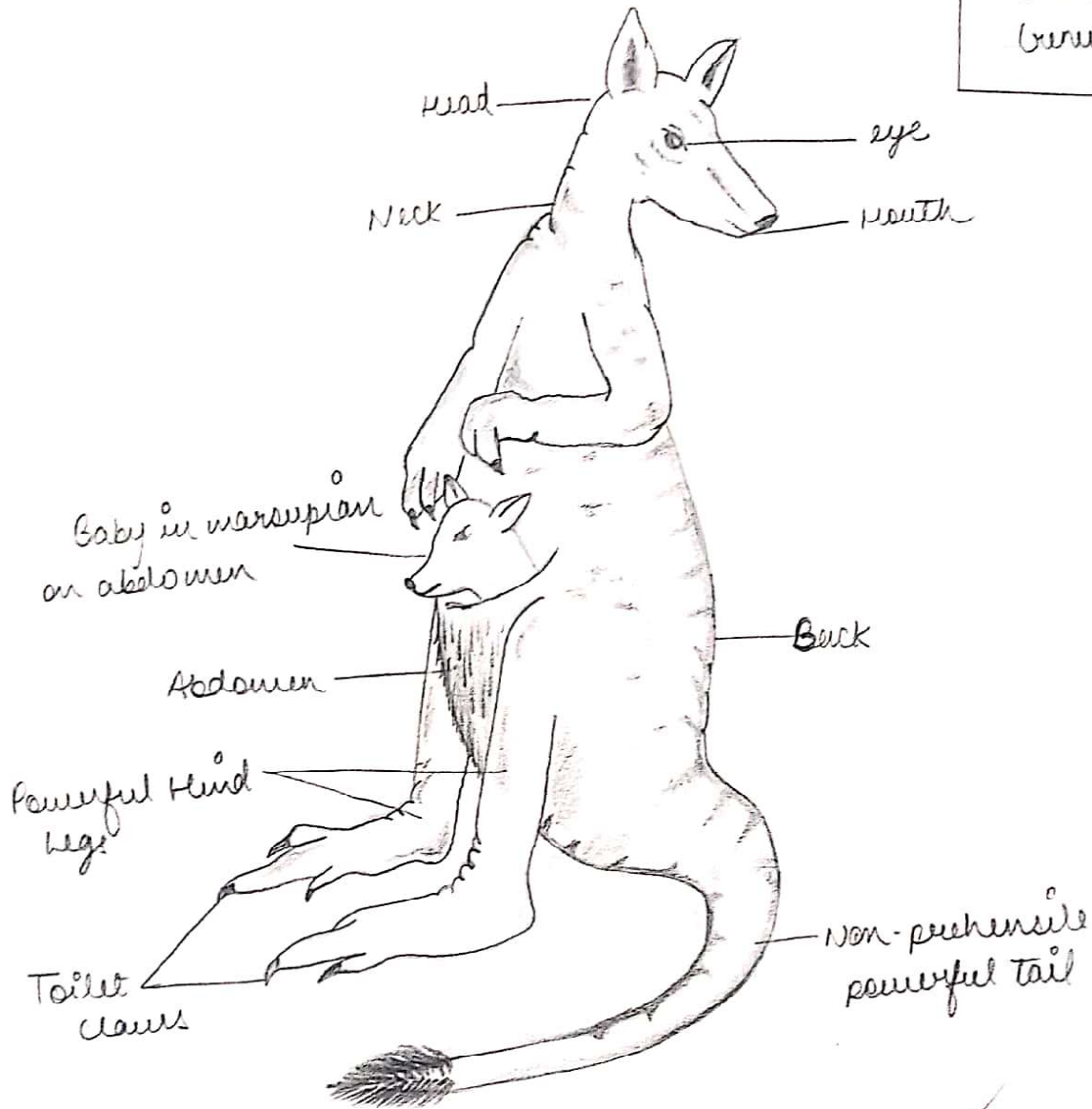


Fig. Macropus : Kangaroo

DM

Macropus

Classification:

- Phylum - Chordata → Dorsal tubular nerve cord, notochord & gill slit present
- Group - Craniata → Distinct head, cranium with brain
- Subphylum - Vertebrata → Vertebral column present
- Division - Gnathostomata → Jaws & paired appendages
- Superclass - Tetrapoda → Paired limbs, lungs & cornified skin
- Class - Mammalia → Body covered with hairs, mammary gland in ♀
- Subclass - Prototheria → Egg laying mammals
- Order - Marsupialia → Pouched & viviparous, female marsupium
- Genus - Macropus

→ **Habit and Habitat:** Terrestrial, gregarious, herbivorous, browsing and leaping animal.

→ **Distribution:** Kangaroos are found in Australia, Tasmania and New Zealand.

Comments:

- (i) Commonly called as kangaroo
- (ii) Macropus is largest kangaroo. Males standing a maximum height of 2m and weighing about 80-100 kg, while females measures upto 1.5 m & weighing 30-45 kg.
- (iii) Body divided into head, neck, back, abdomen & tail.
- (iv) Hind legs and feet very long and powerful used for leaping. Forelimbs are smaller.
- (v) Animal nearly sits on its tail during rest. The baby kangaroo is seen protruding from the marsupium on abdomen.

Teacher's Signature _____

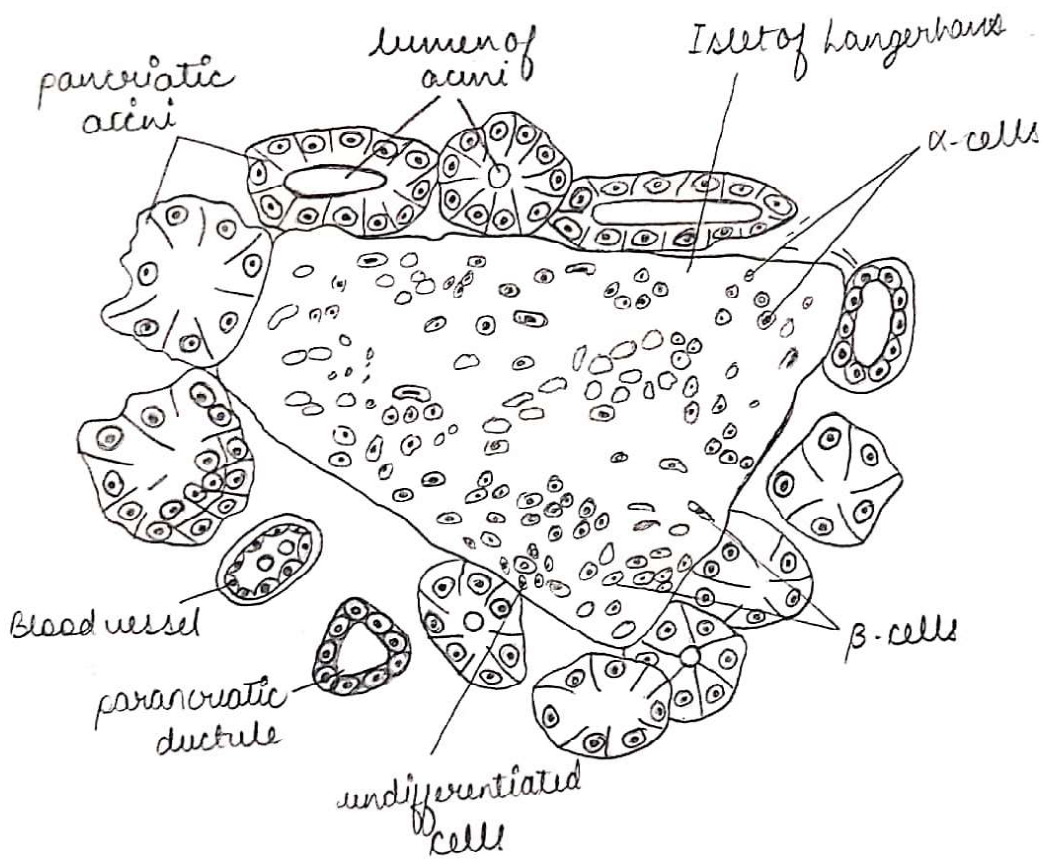


Fig. T.S of Pancreas : Rabbit

Rabbit : T.S. Passing through Pancreas

» Comments :

- (i) Pancreas is a very important digestive gland. T.S passing through it shows that it is composed of various alveoli or pancreatic acini. It is a compound-tubulo-alveolar racemose gland consisting of both exocrine & endocrine parts.
- (ii) The mammalian pancreas can be distinguished from that of frog in having distinct lobulations, alveoli or pancreatic acini & islets of Langerhans.
- (iii) Each pancreatic lobe contains 10 to 20 secretory cells or acini which are nucleated. The central part has narrow to wide lumen. The pancreatic duct, large artery and veins are also seen in the section. Several cut blood vessels present in connective tissue.
- (iv) Acini and islets of Langerhans are very clearly seen. The wall of each acinus is made up of columnar or pyramid cells. Each cell contains a central nucleus and coarse granules. Each acinus has wide lumen.
- (v) The region of islets of Langerhans reveals 3 or 4 kinds of cells - α , β and undifferentiated cells.

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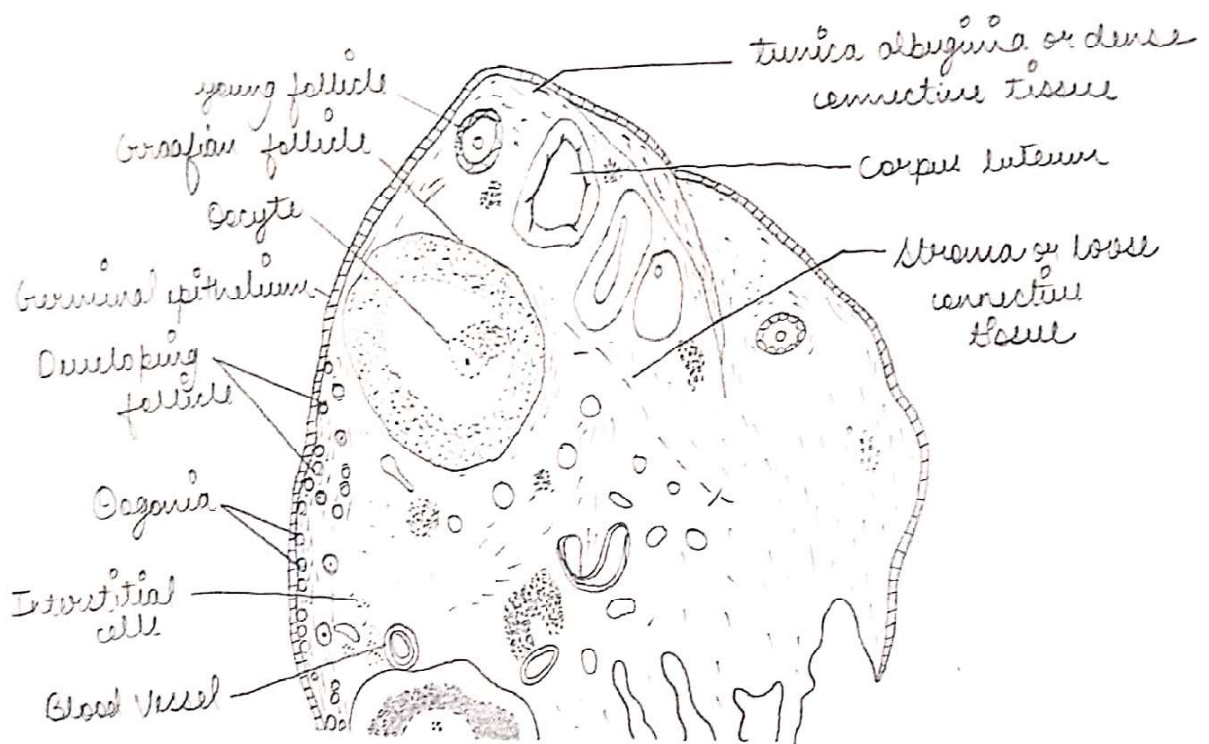
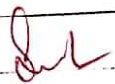


Fig. T.S. passing through ovary: Rabbit

Rabbit : T.S. Passing through Ovary

» Comments :

- (i) Outer most layer is of peritonium which has cubical cells
- (ii) Just beneath peritonium is germinal epithelium bounded by connective tissue called as tunica albuginea
- (iii) Germinal epithelium give rise to oogonia, developing follicles and Graafian follicle.
- (iv) Section shows young follicles and mature one and corpus luteum
- (v) Interior of the section show connective tissue, interstitial cell and blood vessels
- (vi) Detailed structure of Graafian follicle is seen under high magnification. Follicle is surrounded by connective tissue or stroma
- (vii) Fully mature oocyte is surrounded by a thick transparent layer called Zona pellucida surrounded by another layer corona radiata.
- (viii) Corona radiata is surrounded by mass of cells called as discus proligerous or cumulus.
- (ix) Corona radiata is surrounded by liquor folliculi and then by membrane granulosa. Thick membrane granulosa is covered by thick layer called as theca folliculi.

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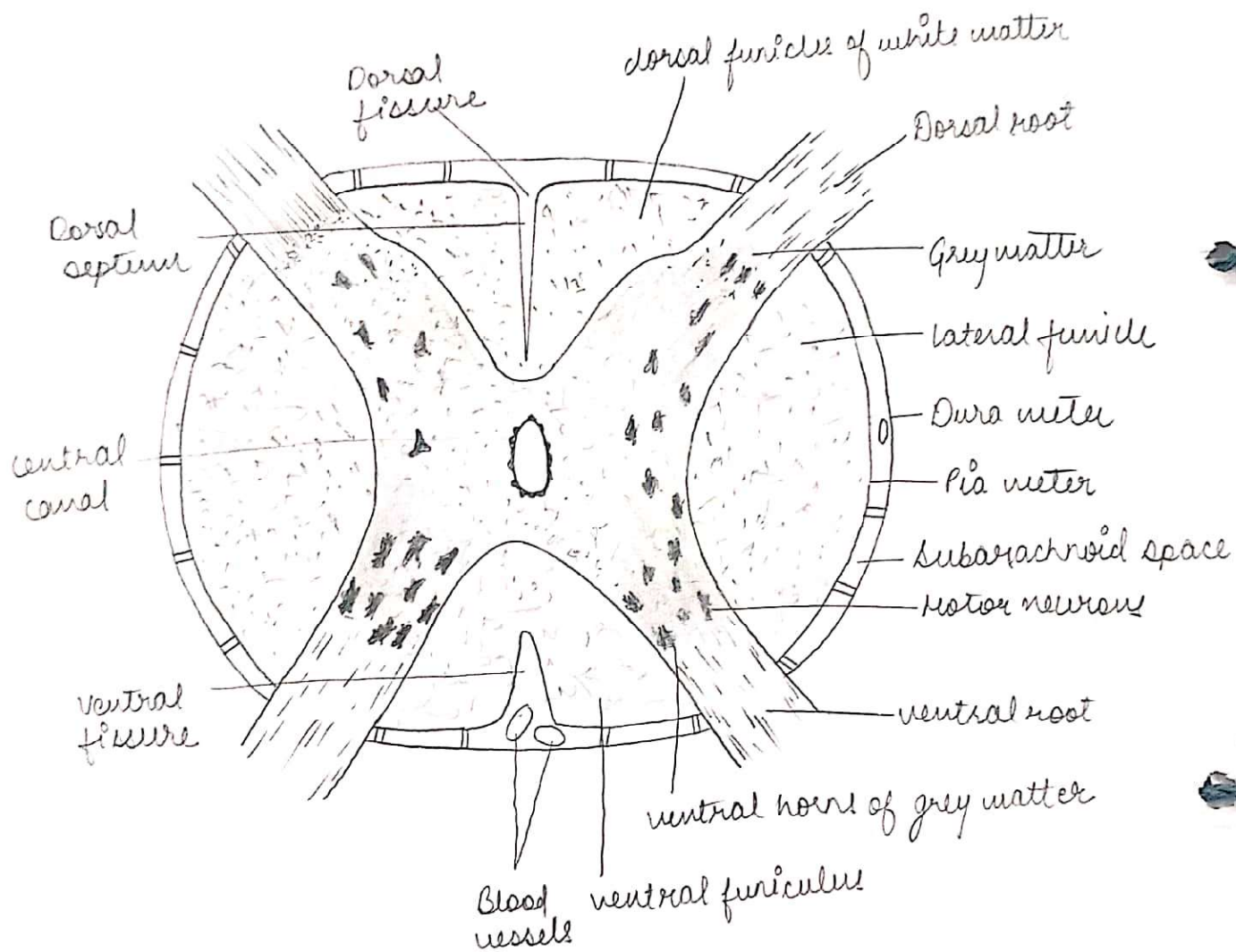
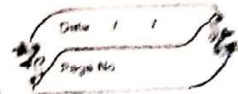


Fig: Rabbit : T.S. passing through spinal chord

Rabbit : T.S. Passing through Spinal Chord



» Comments :

- (i) Just after emergence from the foramen magnum, medulla continues as spinal cord.
- (ii) T.S. of spinal cord shows that it is covered by three meninges outer perimete, middle arachnoid space and inner dural mater.
- (iii) Entire nervous tissue is divided into outer white matter and inner grey matter.
- (iv) White matter and grey matter are made up of nerve cells and nerve fibers respectively.
- (v) Grey matter is H-shaped or butterfly shaped and is perforated by a central canal.
- (vi) Grey matter projects dorsolaterally and ventrolaterally as paired dorsal and ventral horns respectively for attachments of nerve roots.
- (vii) Dorsal and ventral horns penetrate deep into white matter or dorsal and ventral septums respectively.
- (viii) Other structures seen are motor neurons and blood vessels.
- (ix) Spinal cord gives spinal nerves which control reflex activities and also conduct impulses to and from brain.

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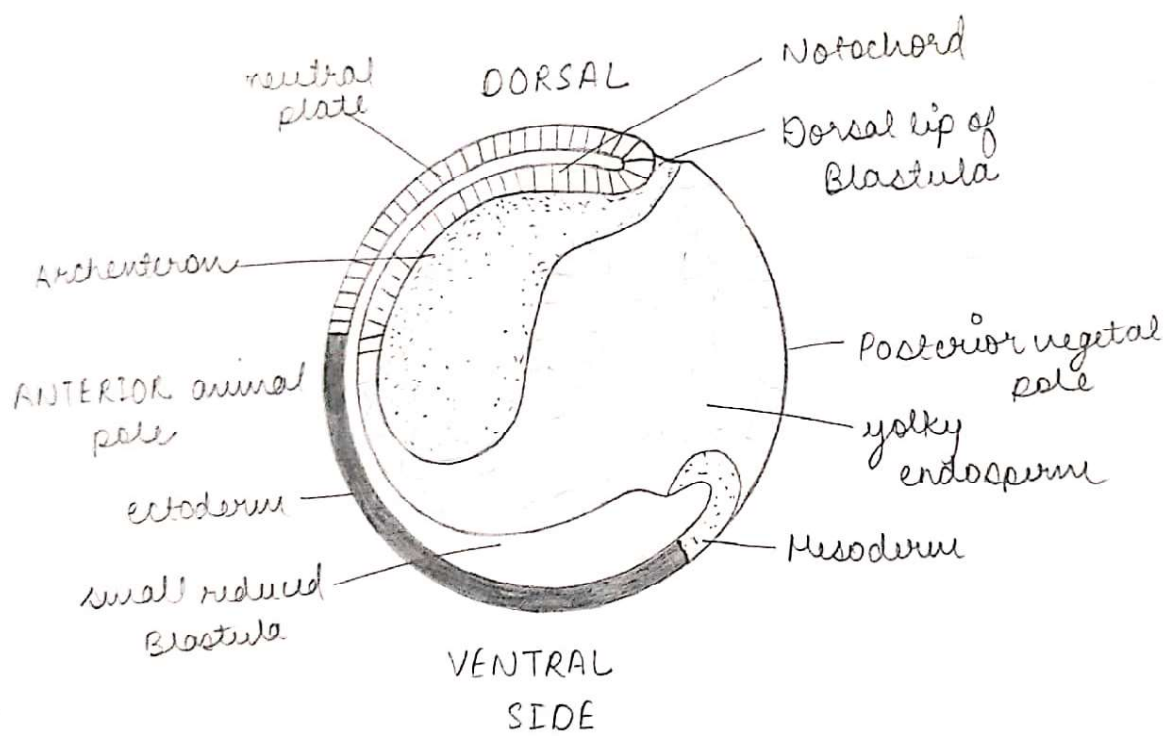


fig: Frog: V.S. through Gastrula

Frog: V.S. Through Gastrula

Comments:

- (i) Gastrulation is a rearrangement of cells already present in the blastula. This completely reorganizes embryos. During this process three germinal layers are formed.
- (ii) Future prospective organ forming cells are organised at their proper places at gastrula stage.
- (iii) Gastrulation occurs by epiboly, blastopore involution and invagination. During this process mesodermal and notochord cells migrate inside forming roof of archenteron.
- (iv) Gastrula has three germinal layers namely, ectoderm, endoderm and mesoderm which forms various organs and derived sections show dorsal side, ventral side, animal pole and vegetal pole.
- (v) Other sections seen in this are dorsal lip of blastopore, yolk plug, ventral lip of blastopore, notochordal cells & neural plate. The blastocoel is reduced due to the development of archenteron.
- (vi) Ectoderm gives rise to epidermis, cutaneous glands, nervous system, eye parts and lining of mouth cavity and cloaca.
- (vii) Endoderm forms lining of alimentary canal, liver, pancreas and urinary bladder and testes.
- (viii) Mesoderm give rise to musculature, connective tissue, vascular system, genital organs, excretory organs, skeleton and notochord.

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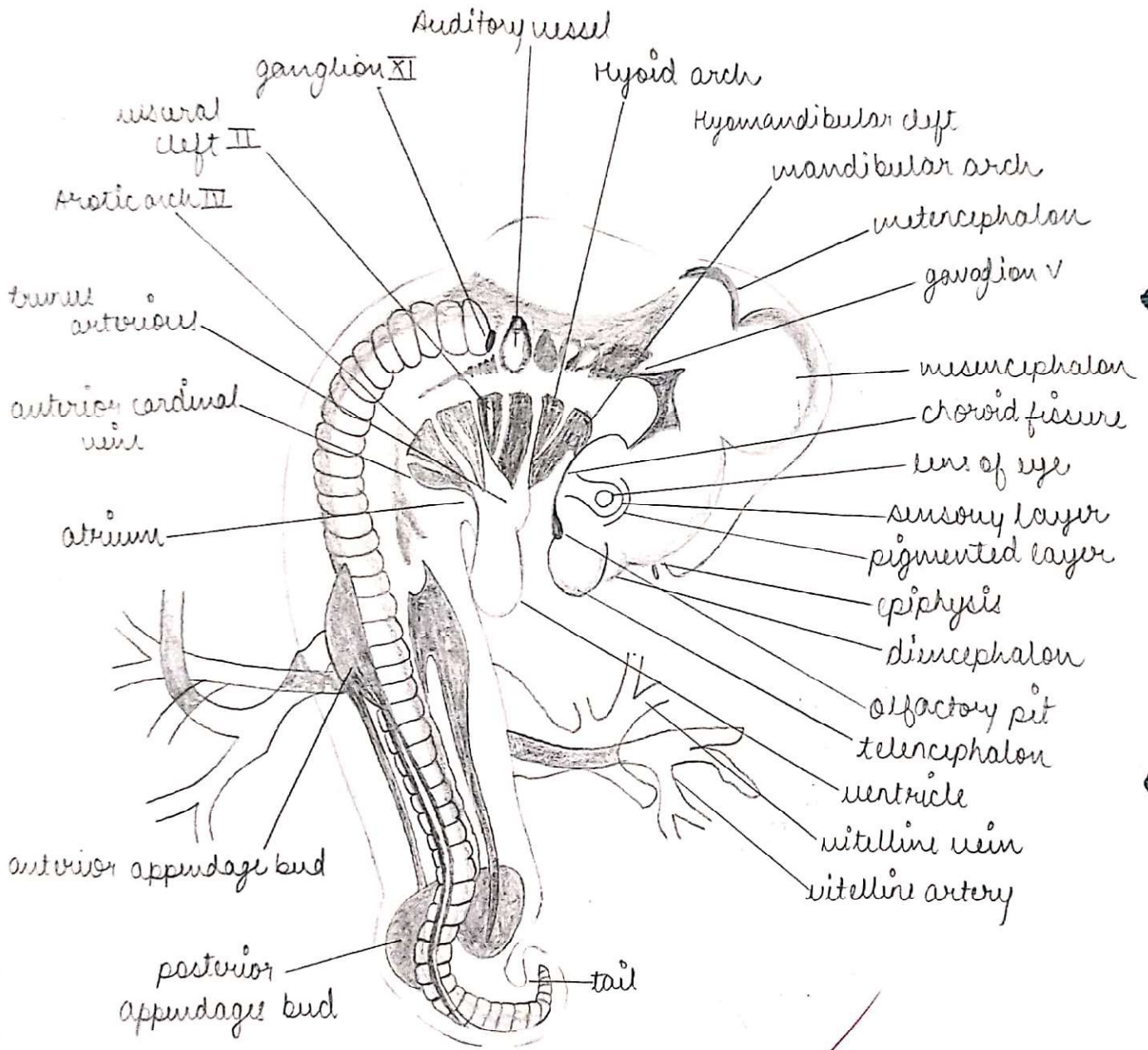


Fig: Chick embryo: Whole Mount
72 hours of incubation

Chick Embryo: Whole Mount.
72 hours of incubation.

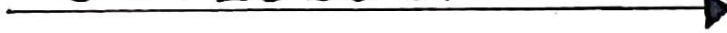
• Comments:

- (i) After 72 hours of incubation, body is affected throughout by torsion and entire body is turn to 90°
- (ii) Torsion is complete, well posterior to the level of heart, but caudal portion of embryo is not turned on its side
- (iii) Due to the cranial and cervical flexures, the long axis of the embryo shows nearly right angled bends in the mid brain and in the neck region.
- (iv) Mid-body becomes concave
- (v) Visceral arches develop.
- (vi) Mandibular arch form caudal boundary of oral depression and becomes more distinct
- (vii) Nasal pits appears as shallow depressions
- (viii) Appendages rudiments also make their appearance.
- (ix) Cephalization is going on. Telencephalon also develops anterior appendage bud near mid body and posterior appendage near the tail
- (x) In the eye, lens, sensory and pigmented layers are differentiated
- (xi) Number of somites increases to 36 pairs. Vitelline arteries and vitelline vein also make their appearance.

Teacher's Signature

[Signature]

OSTEOLOGY



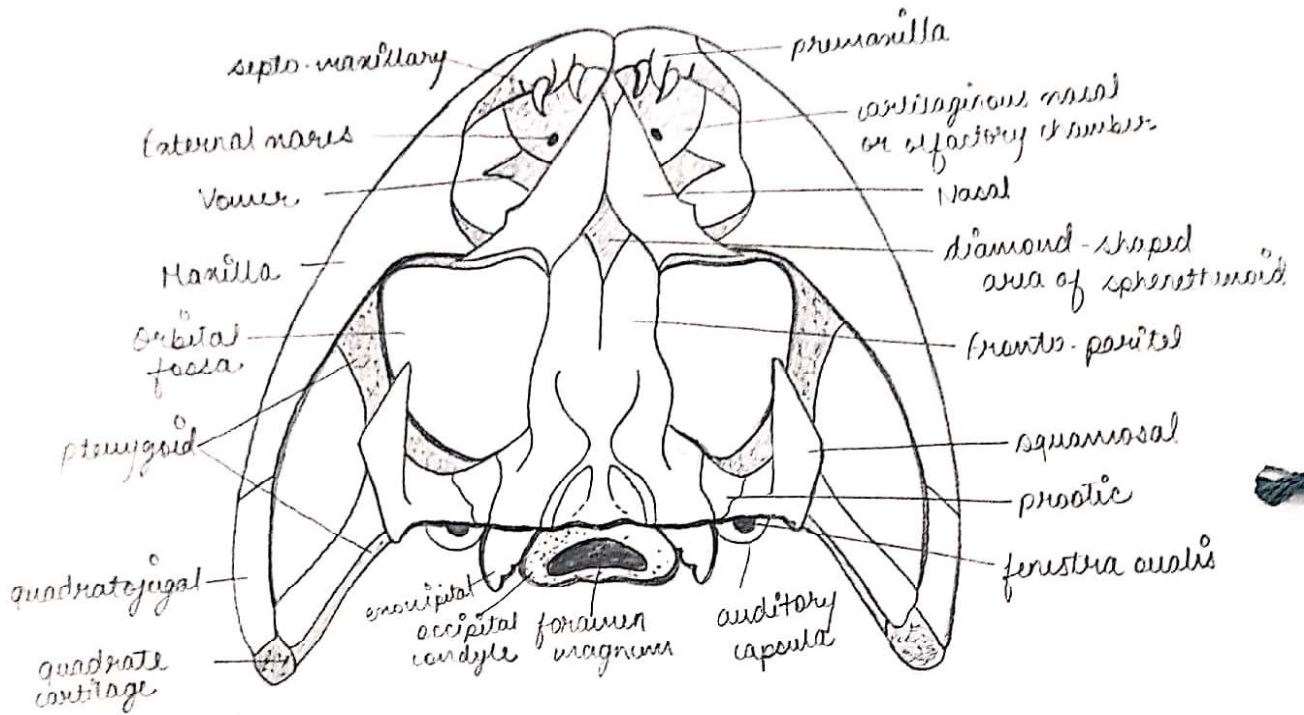


Fig. Skull of frog

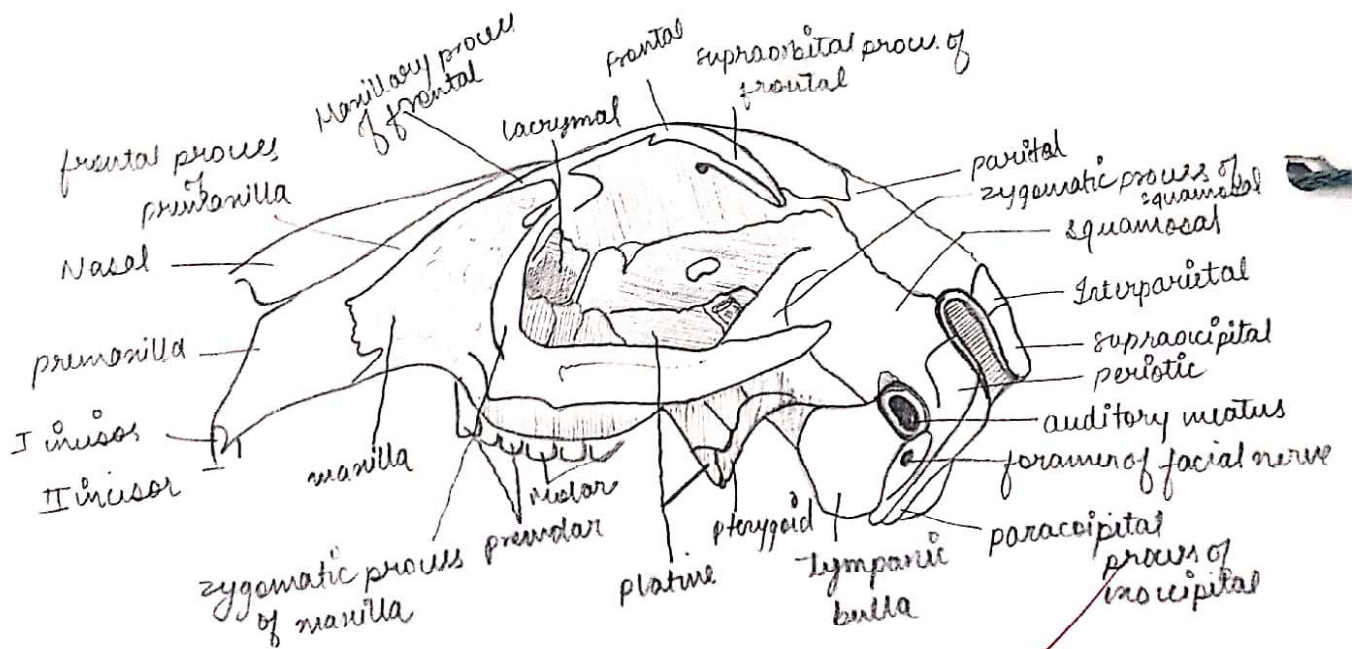


Fig: Skull of Rabbit

SKULL BONES

Date: / /
Page No:

A. Skull of Frog:

- 1) Dorsal View - Various structures seen are pre-maxillary, external nares, vomer, maxilla, orbital fossa, pterygoid, quadratojugal, quadrate cartilage, exoccipital, occipital condyle, foramen magnum, auditory capsule, fenestra ovalis, postic, squamosal, fronto-parietal, diamond-shaped area, sphenothmoid, nasal cartilaginous nasal & premaxilla.
- 2) Ventral View - Various structures seen are premaxilla, cartilaginous nasal capsule, vomer, sphenothmoid, fronto-parietal, preopercoid, squamosal, columella, quadratojugal, auditory capsule, fenestra ovalis, occipital condyle, foramen for IX & X nerves, exoccipital, quadrate cartilage, postic, pterygoid, foramen for V & VI nerves, foramen for VII nerve, foramen for II nerve, orbital fossa, maxilla, etc.

B. Skull of Rabbit:

- 1) Dorsal View - Skull bones seen in dorsal view are anterior nares, pre-maxilla, frontal, jugal, parietal, squamosal, tympanic bulla, interparietal, supraoccipital, external auditory meatus, zygomatic process of squamosal, supra-orbital process of frontal, zygomatic arch, etc.
- 2) Ventral View - Skull bones seen in ventral view are incisor teeth, palatine process of pre-maxilla, anterior palatine foramen, palatine process of maxilla, pre-molar teeth, zygomatic process of frontal, exoccipital, supraoccipital, foramen magnum, postic, etc.
- 3) Lateral View - Skull bones seen in lateral view are premaxilla, I, II incisor, zygomatic process of maxilla, pre-molar, molar, jugal, palatine, pterygoid, basisphenoid, basioccipital, tympanic bulla, paraoccipital process of exoccipital, occipital condyle, stylomastoid foramen for facial nerve, etc.

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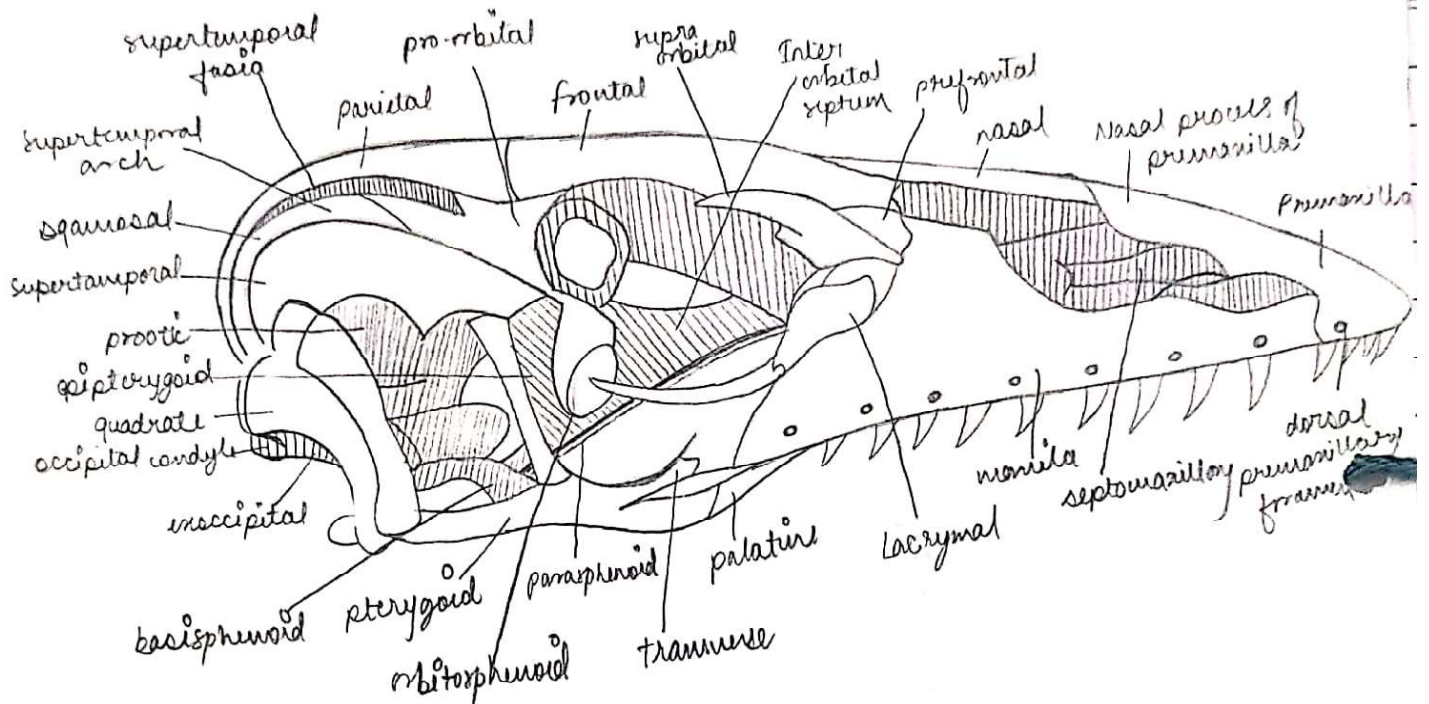


Fig. Skull of *Varanus*

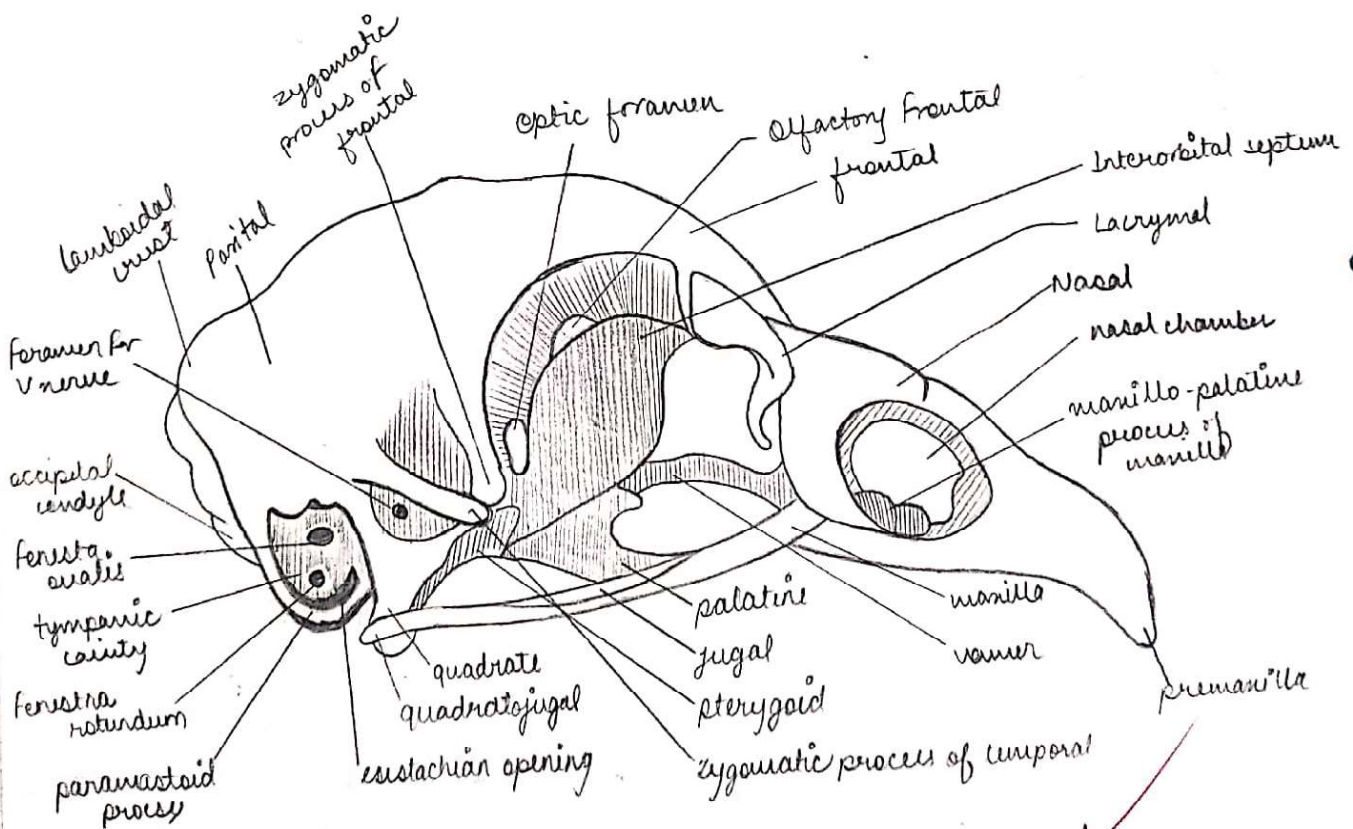


Fig. Skull of *Fox*

C. Skull of Varanus :

- 1) **Dorsal View** - Various skull bones seen are as follow - Dorsal premaxillary foramen, septomaxillary nasal, prefrontal, lacrimal, supraorbital, prootic, supraoccipital, foramen magnum, columella, squamosal, quadrate, supratemporal fossa, postorbital, pterygoid jugal, transverse palatine, ventral border of interorbital septum
- 2) **Ventral View** - Various skull bones seen are as follows - premaxilla, vomer, ventral border of interorbital septum, palatine, transverse jugal, suborbital fossa, pterygoid, postorbital, quadrate, squamosal, columella, parasphenoid process, etc.
- 3) **Lateral View** - Premaxilla, nasal process of premaxilla, nasal, prefrontal, interorbital septum, frontal, supraorbital, parietal, postorbital, supratemporal fossa, supratemporal arch, etc.

D. Skull of Fowl :

- 1) **Dorsal view** - Under premaxilla, internal nares, nasal, maxilla, lacrimal, jugal, orbital, quadratojugal, quadrate, parietal, supraoccipital, zygomatic process of frontal, frontal maxillary process of premaxilla, palatine process of premaxilla, etc.
- 2) **Ventral View** - Premaxilla, palatine process of premaxilla, maxillary process of premaxilla, frontal zygomatic process of frontal, zygomatic process, basitemporal basioccipital, occipital condyle, exoccipital, paramastoid process, tympanic cavity, etc.
- 3) **Lateral View** - Maxillopalatine process of maxilla, nasal chamber, nasal lacrimal, inter-orbital septum, frontal, olfactory frontal, optic foramen, zygomatic process of frontal parietal lambdoid crest, supraoccipital foramen of vertebrae, occipital condyle, fenestra ovalis, tympanic cavity, fenestra rotunda etc.

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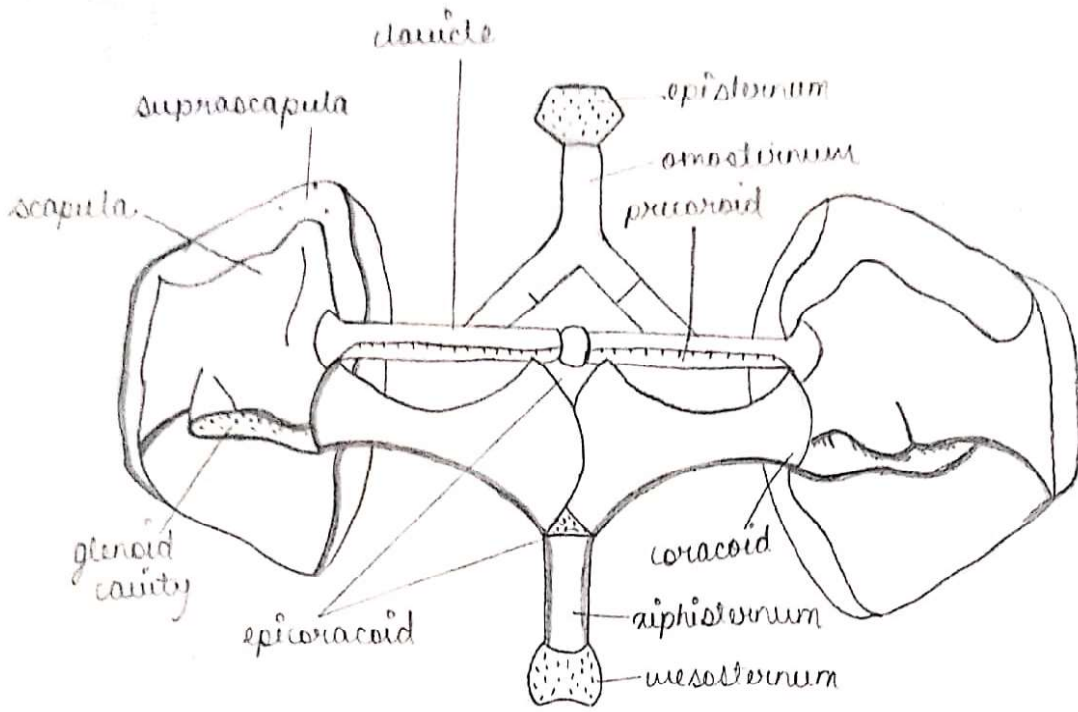


Fig. Pectoral girdle & sternum of frog

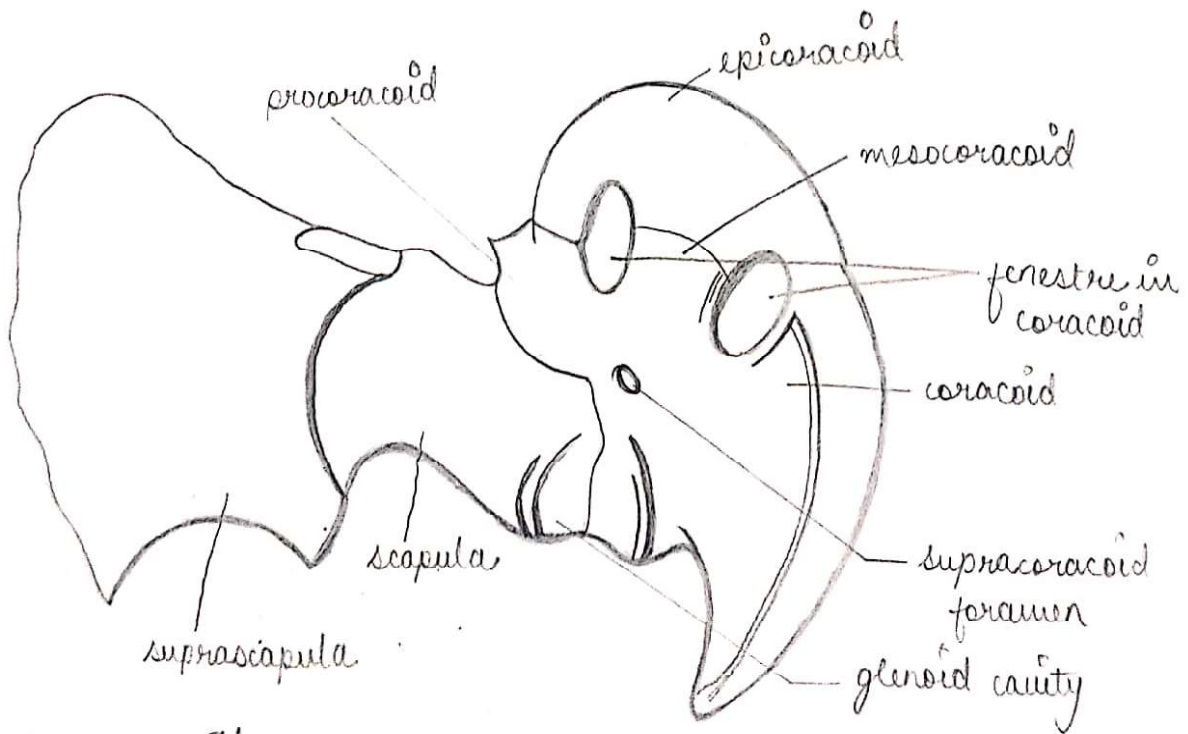


Fig. Pectoral Girdle of Varanus

PECTORAL GIRDLES

A. Pectoral Girdle of Frog:

- (i) Pectoral girdle is found embedded in the body wall in thoracic region. It is composed of two identical halves which are permanently attached with sternum.
- (ii) Each half is composed of scapular and coracoid region.
- (iii) Scapular region consists of suprascapula and scapula. Suprascapula is a broad, flat and rectangular bone having free calcified cartilaginous margin.
- (iv) Pectoral girdle protects viscera and gives support to limbs.
- (v) Coracoid region is made up of two bones, namely clavicle and coracoid and two cartilages viz. epicoracoid & procoracoid.

B. Pectoral Girdle of Varanus:

- (i) Pectoral girdle of varanus is also made up of two identical halves, firmly attached with a T-shaped interclavicle or episternum.
- (ii) Each half is composed of suprascapula, scapula, coracoid, interclavicle and clavicle.
- (iii) Suprascapula. It is flattened, calcified and cartilaginous plate, articulating with suprascapula and coracoid.
- (iv) Scapula. It is completely ossified, flattened and unperforated plate, articulating with suprascapula and coracoid.
- (v) Coracoid is a plate partly ossified and partly cartilaginous. It contains two large fenestrae which divide ossified region into three parts, namely anterior procoracoid, middle mesocoracoid and posterior broad coracoid proper.
- (vi) Interclavical or episternum T-shaped investing bones between two halves.

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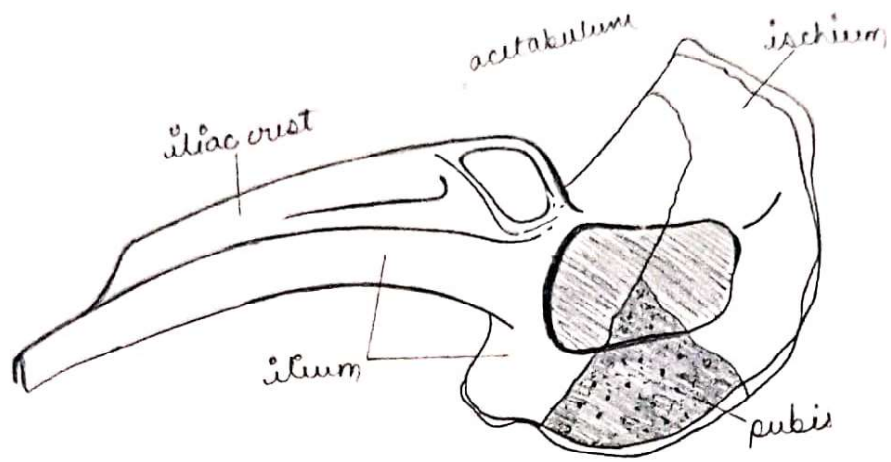


Fig - Pelvic Girdle of frog

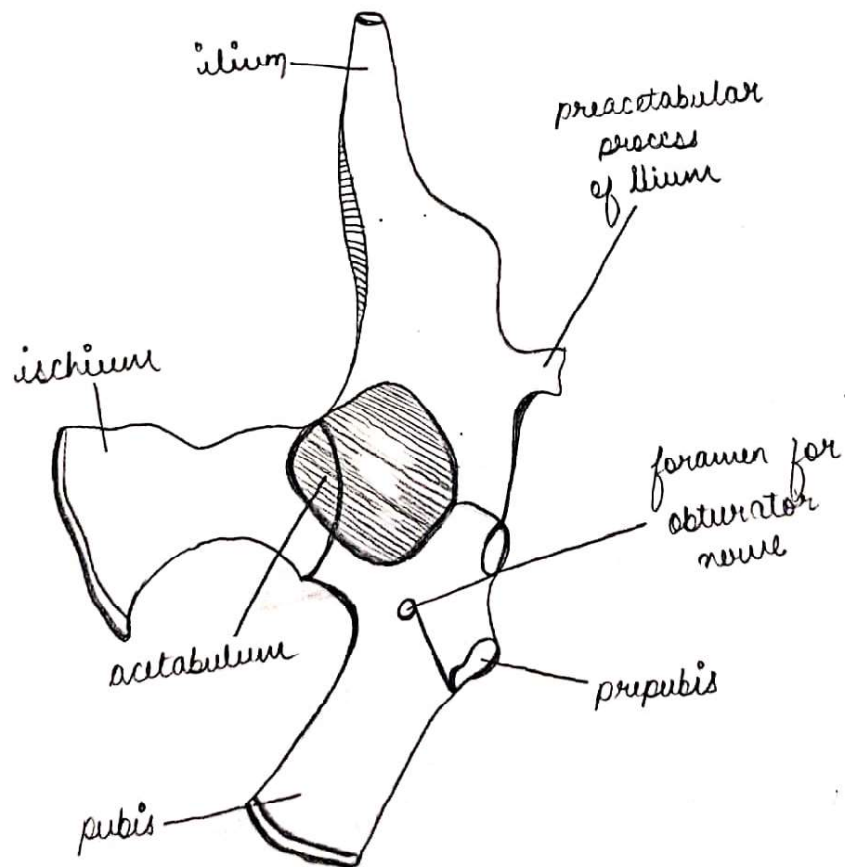
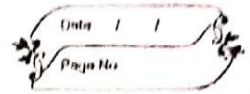


Fig. Pelvic Girdle of Varanus

PELVIC GIRDLE



A. Pelvic Girdle of Frog :

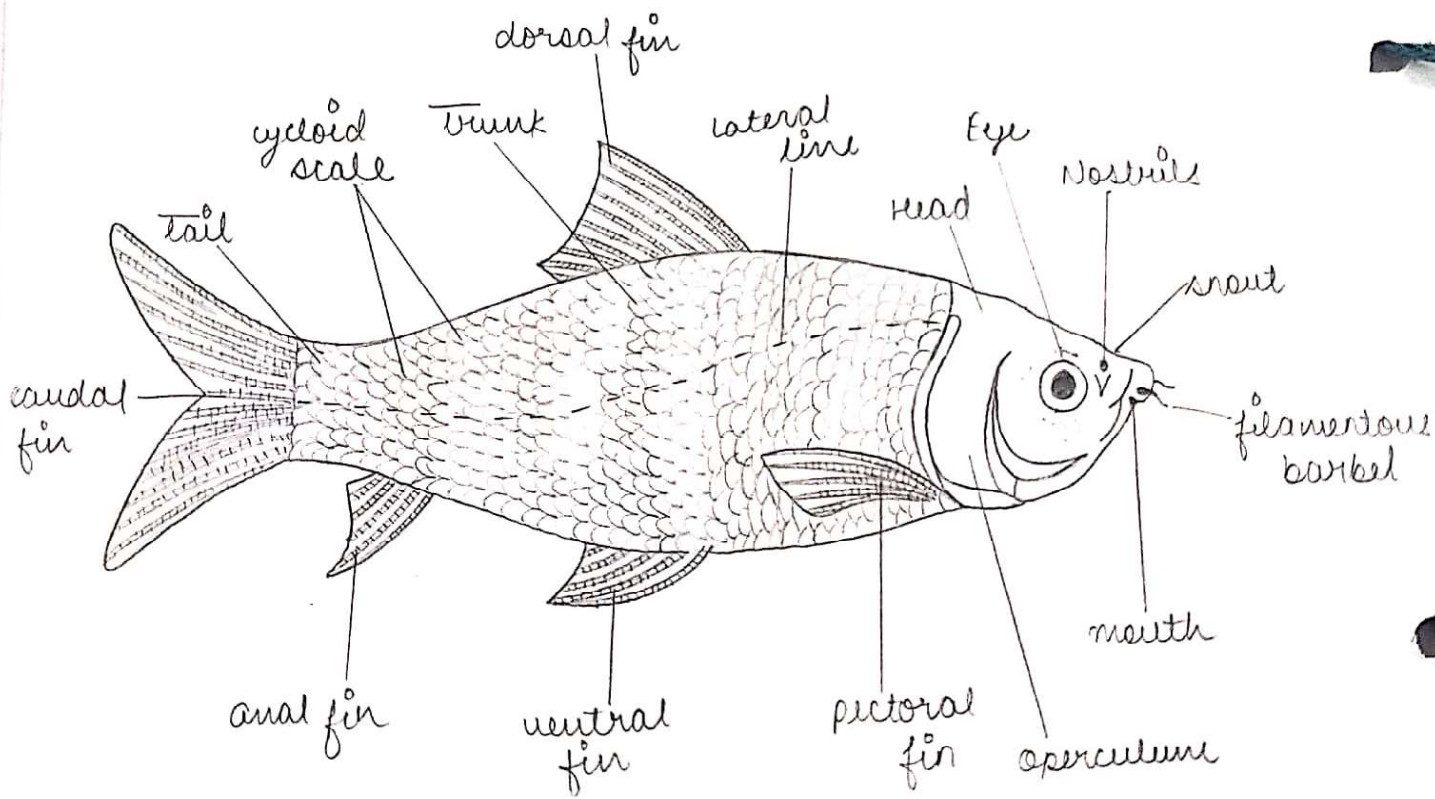
- (i) Two pelvic girdles form a V-shaped structure. Each half of girdle or innominalum is composed of ilium, ischium and pubis which unite posteriorly into a verticle disc having disc bearing a cup-shaped cavity called acetabulum.
- (ii) Ilium - (a) It is a long meeting with transverse process of ninth vertebra (b) Dorsally it contains a distinct iliac vessel. (c) Two meet together at iliac symphysis.
- (iii) Pubis - It is a reduced calcified cartilage forming major part of acetabulum. The pubic cartilage of both sides are completely fused.
- (iv) Ischium - Two ischia give rise to one-third of disc and completely fuse together at an ischiatic symphysis.

B. Pelvic Girdle of Varanus :

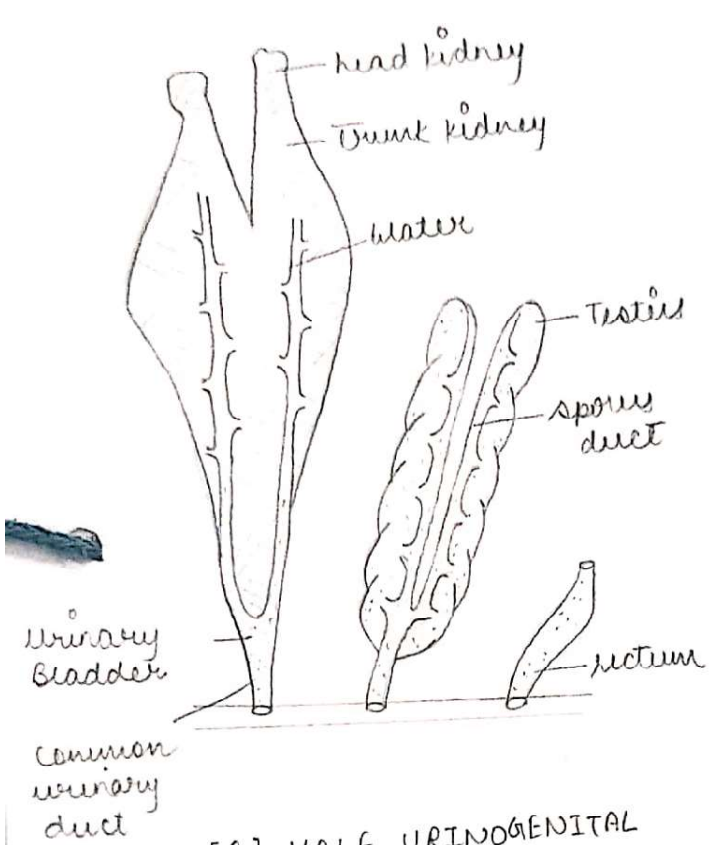
- (i) It is composed of usual three bones, namely ilium, pubis and ischium.
(b) Three bones are very hard and solid. (c) Extremely, at the junction of three bones is a large acetabulum for head of femur.
(d) Joints are distinct.
- (ii) Ilium - (a) It is a rod-shaped bone constituting major part of acetabulum (b) It articulates with sacral vertebrae. (c) It has a pre-acetabular process.
- (iii) Pubis - (a) It is a curved bone (b) Two pubis meet at a pubic symphysis, which contains a cartilage called epipubis.
- (iv) Ischium - (a) Two ischia are flat and curved bones meeting at an ischiatic symphysis. (b) From ischiatic symphysis, a rod-shaped hypoischium extends backwards to support ventral wall of cloaca.

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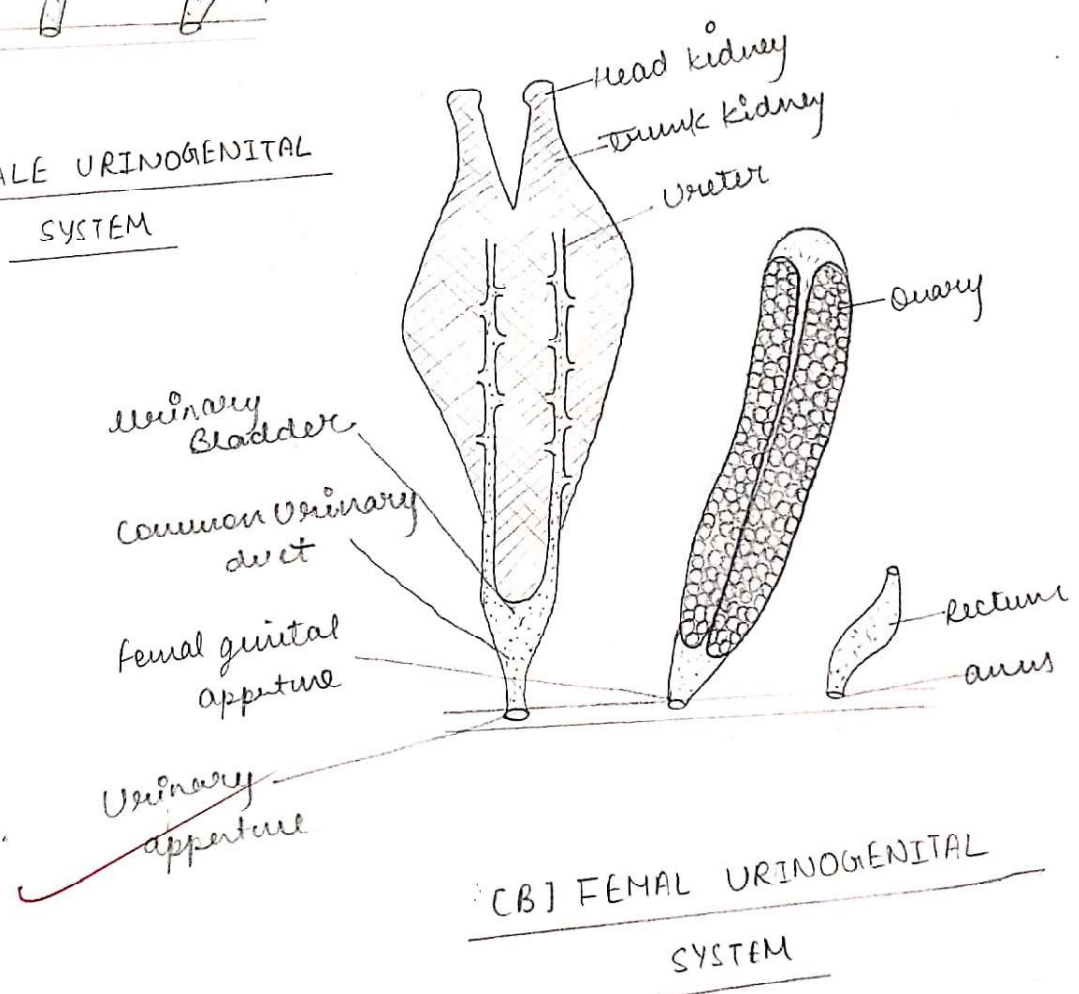
DISSECTION



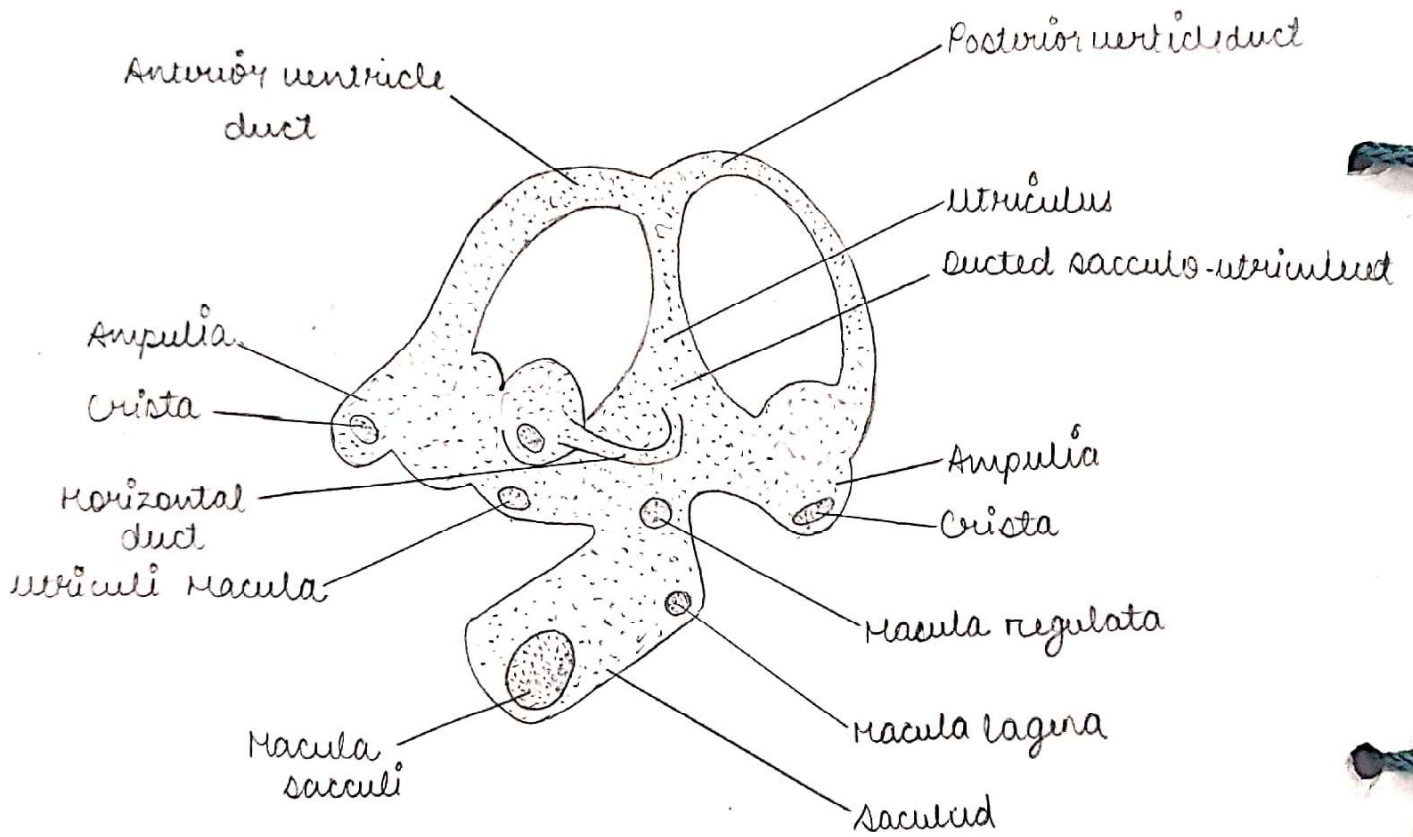
Diag. External feature - Rohu



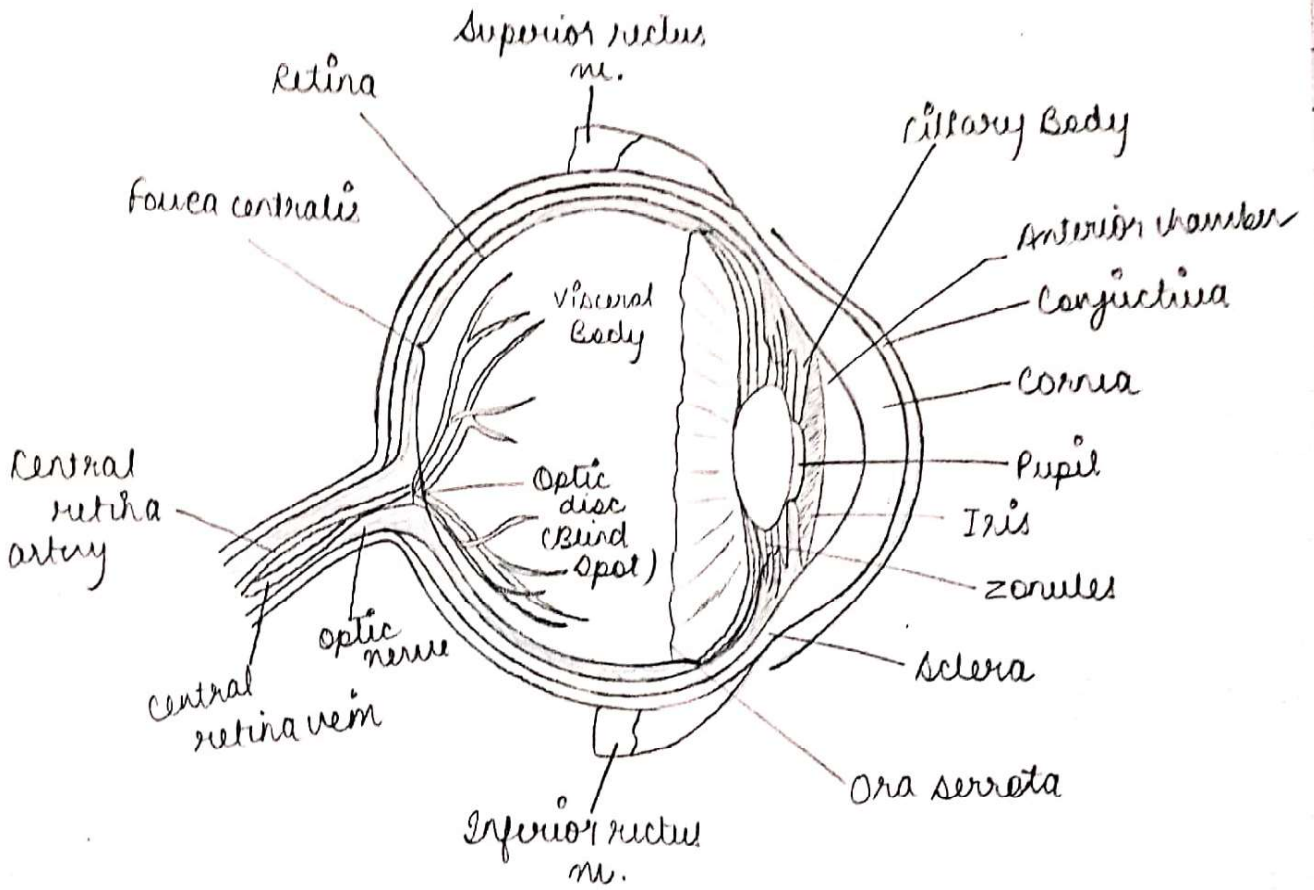
[A] MALE URINOGENITAL SYSTEM



[B] FEMALE URINOGENITAL SYSTEM



Diag. Internal ear



Diag. Human eye Ball

Maa Bharti P.G. College, Kota



Department of Zoology
Master of Science (M. Sc.)
Subject: Zoology
File: Taxonomy

Submitted By:
Preeti Sharma

Sub → A - PROTOZOA
KINGDOM: (unicellular organism)

↓
PHYLUM: PROTOZOA
eg - Euglena, Amoeba, Paramecium

↓
DIPLOSONS

A. RADIATA
(Radially symmetrical animals
- Tissue grade body organization)

↓
PHYLUM → 2. Cnidaria
(Nematoblast cells & tentacles present) eg - Hydra, Physalia

↓
3. Ctenophora
(possess Comb plates)
eg - Beroe

↓
SCHIZOCOELOM PHyla

(coelom formed by splitting of mesoderm)

↓
PHYLUM → 6. ANNELIDA
(segmented worms)
eg - Earthworm

↓
7. ARTHROPODA
(jointed & paired appendages)
eg - Prayan

↓
8. MOLLUSCA
(soft body covered with shell)
eg - Snail

PHYLUM - PORIFERA

CLASSES →

| | | |
|---|--|---|
| 1. CALCAREA (Body skeleton made of calcareous spicules) | 2. HEXACTINELLIDA (Skeleton of six-rayed tetraaxon siliceous spicules) | 3. DEMOSPONGIAE (skeleton of siliceous spicules or spongin fibres, or both or absent) |
|---|--|---|

ORDER

| | |
|---|--|
| 1. HOMOCOELA (Asconoid Sponges) eg - <u>Leucosolenia</u> | 2. HETEROCOELA (Syconoid & Leuconoid sponges) eg - <u>Sycon</u> |
|---|--|

ORDER

1. **HEXASTEROPHORA**
(spicules are Hexasters i.e; star-shaped)
eg - Euplectella

ORDER

2. **AMPHIDISCOPHORA**
(spicules are amphidiscs i.e. with convex disc)
eg - Hyalonema

SUB-CLASSES

| | | |
|---|--|--|
| 1. TETRACTINELLIDA (spicules Tetraaxon or absent) | 2. MONOAXONIDA (spicules Monoaxon) | 3. KERTIOSA (No spicules, Horny sponges) eg:- <u>Euspongia</u> |
|---|--|--|

ORDERS

| | | |
|--|---|--|
| 1. MYXOSPONGIDA (Structure simple, equal-sized spicules absent) eg - <u>Oscarella</u> | 2. CARNOSA (equal-sized spicules present) eg - <u>Chondrilla</u> | 3. CHORISTIDIA (Both large & small spicules present) eg - <u>Geodia</u> |
|--|---|--|

ORDERS

| | | | |
|---|--|---|---|
| 1. HADRIMERINA (Large spicules knobbed at ends, spongin absent) eg - <u>Cliona</u> | 2. HALICHONDRIINA (Large spicules usually 2-rayed, scanty spongin) eg - <u>Halichondria</u> | 3. POECTLOSCLERINA (Large spicules united by spongin into a regular network) eg - <u>Micoclona</u> | 4. HAPLOSCLERINA (Large spicules 2-rayed, spongin present) eg - <u>Spongilla</u> |
|---|--|---|---|

SPECIMEN-1

- Multicellular organism with cellular level of Body Organisation.
- Body with many pores (ostia), canals and chambers that serve for the flow of water.
- Choanocytes or flagellated collar cells present.
- Skeleton of calcareous, or siliceous spicules, or of protein spongin fibres.

- PHYLUM PORIFERA

- Body shape cylindrical or vase-like.
- skeleton of separate one or three or four rayed calcareous spicules.

- CLASS CALCAREA

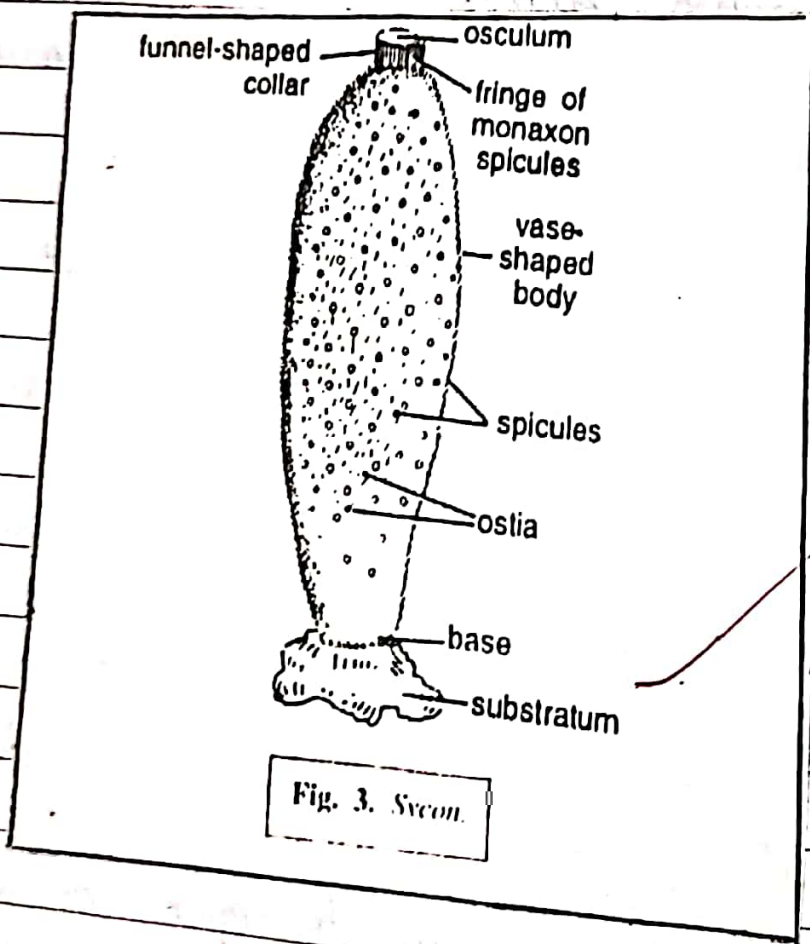
- Body wall thick and folded.
- Choanocytes line the flagellated chambers (radial canals) only.
- Syconoid Sponge

ORDER HETEROCOELA

- Colour varies from grey to light brown.
- A vase shaped and radially symmetrical body.
- At the distal free end there is a large osculum, encircled by a fringe of large giant monoaxon spicules forming funnel shaped collar or oscular fringe.
- Body wall thick through which monoaxon, triaxon and tetraxon spicules project.
- Canal system Syconoid.

- GENUS Sycon

COMMON NAME: Crown sponge.





CLASSIFICATION:-

SPOT NO: 1

| | |
|---------|-------------|
| PHYLUM | PORIFERA |
| CLASS | CALCAREA |
| ORDER | HETEROCOELA |
| FAMILY | SYCETIDAE |
| GENUS | SYCON |
| SPECIES | CILIATUM |

| | |
|-----------------|----------------------------|
| ZOOLOGICAL NAME | <i>Sycon ciliatum</i> |
| COMMON NAME | Von sponge or Crown sponge |

| | |
|-----------------|---------------------------|
| SPECIAL FEATURE | Presence of dermal ostia. |
| | |
| | |

CONCLUSION:- Hence, the spot is of *Sycon ciliatum*

CHECKED BY:- Sushma

NAME OF THE STUDENT:- Priya Sharma

DATE:- 20.2.2023

SPECIMEN - 2

- Cellular grade of organization.
- Body bears several pores.
- Presence of canal system.
- Skeleton of calcareous or siliceous spicules or horny spongin fibres.
- Asymmetrical or radially symmetrical.

- PHYLUM PORIFERA

- Six rayed siliceous spicules.
- Exclusively marine
- Glass sponges with siliceous spicules of triaxon or six-pointed type.

- CLASS HEXACTINELLIDA

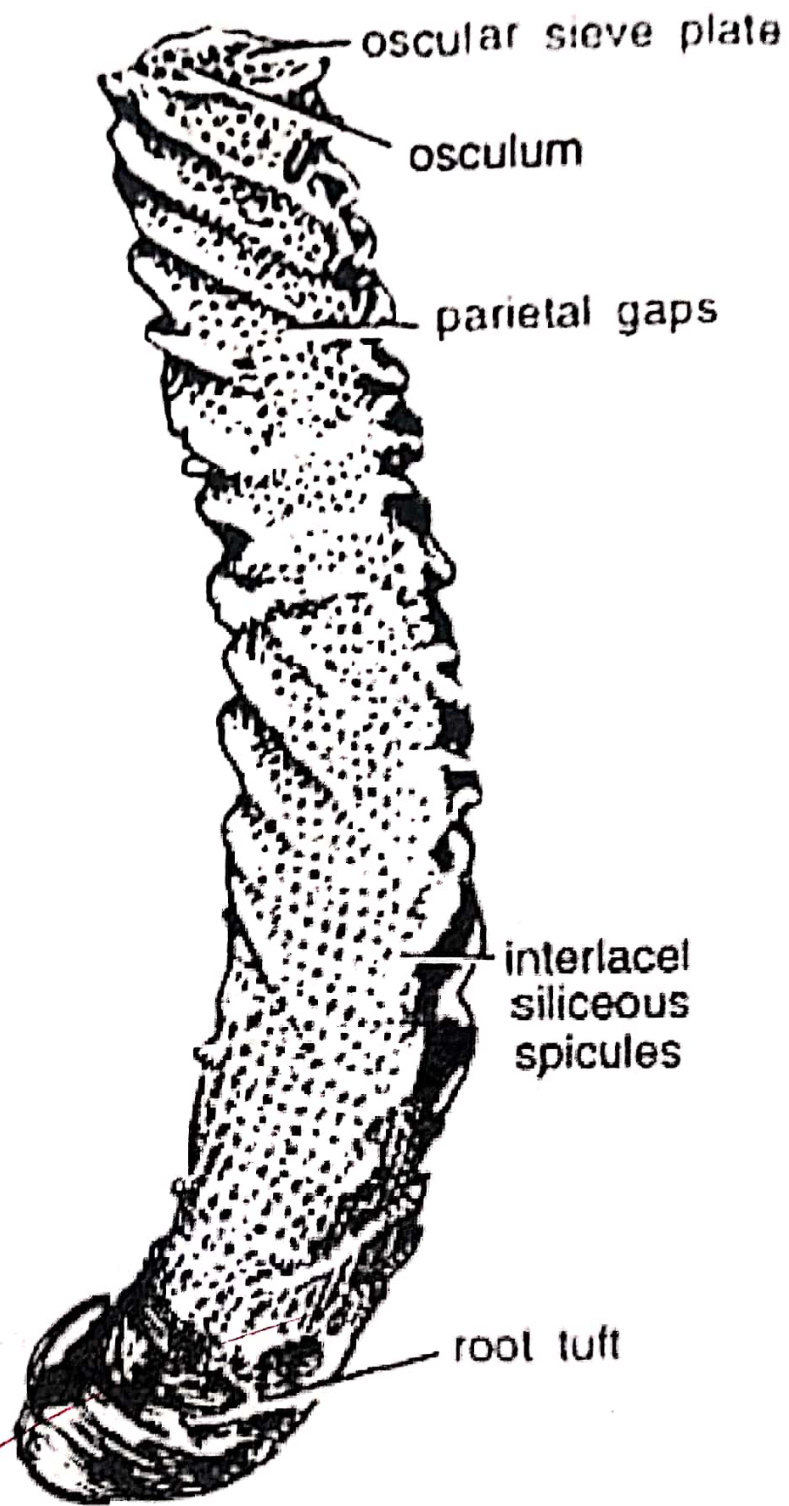
- Spicules hexasters
- Usually attached to substratum.
- Amphid is absent.

- ORDER HEXASTEROPHORA

- Body is long, rigidly curved and cylindrical.
- Spicules are joined together forming a network.
- Osculum contain sieve called as oscular sieve plate. Canal system sycon type.
- Body composed of 4 or 6 rayed siliceous spicules fuse at their tips forming three dimensional network with peritellar

GENUS EUPLECTELLA

Common Name: Venus flower basket



'EUPLECTELLA'



CLASSIFICATION:-

SPOT NO: 2

| | |
|---------|----------------|
| PHYLUM | Porifera |
| CLASS | Hexactinellida |
| ORDER | Hexasterophora |
| FAMILY | Euplectellidae |
| GENUS | Euplectella |
| SPECIES | aspergillum |

| | |
|-----------------|-------------------------|
| ZOOLOGICAL NAME | Euplectella aspergillum |
| COMMON NAME | Venus flower basket |

| | |
|-----------------|---|
| SPECIAL FEATURE | • four and six rayed siliceous spicules. |
| | • Basket shaped body, ostia, oscular sieve plate. |

CONCLUSION:- Hence, the spot is of Euplectella aspergillum

CHECKED BY:- Leishna

NAME OF THE STUDENT:- Preeti Sharma

DATE:- 20.2.23

PHYLUM : COELENTERATA

- I. HYDROZOA
 - Either polyploid or medusoid or both
- II. SCYPHOZOA
 - Medusae umbrella shaped without velum.

- ORDER ↓
- I. HYDROIDEA
 - Medusa present or absent.
 - II. TRACHYLINA
 - Polyps absent or poorly developed
 - III. HYDROCORALLINA
 - Polyps are gastrovascular and dactylogonoids.

- ORDER ↓
- I. STAUROMEDUSAE
 - sessile attached by an aboral stalk
 - Absence of tentaculocysts. eg -
 - II. COBOMEDUSAE
 - Tentaculocysts present. eg - Charybdea
 - III. CORONATE
 - Tentacles long born on pedalia. eg - Periscolpa
 - IV. DISCOIDEAE
 - Eight

SUB-CLASS -

- I. OCTOCORALLIA (Polyps with 8 pinnate tentacles)
- II. TABULATA
 - Extinct colonial anthozoans. eg - Halysites

- ORDER ↓
- I. STOLONIFERA
 - Skeleton of calcareous tubes. eg - Tubipora
 - II. TELESTACEA
 - Skeleton of calcareous spicules. eg - Telesto
 - III. ALCYONACEA
 - Skeleton of separate calcareous spicules. eg - Alcyonium

- III. ANTHOZOA
 - Exclusively polyploid
 - Gastrovascular cavity divided by 8 or multiple of 8.

- ORDER ↓
- III. SIPHONOPHORA
 - Shows polymorphism.
 - IV. CHONDROPHORA
 - Gonozooids produce free medusae.

- ORDER ↓
- I. ZOOANTHIDIA
 - Polyps small and usually united by basal stolons. eg - Zoanthus
 - II. ACTINIARIA
 - Tentacles and mesenteries are numerous. eg - Metridium
 - III. CERANTHARIA
 - Siphonoglyphs single and dorsal. eg - Ceratoporella
 - IV. ANTIPTHARIA
 - Siphonoglyphs two. eg - Antipathes
 - V. MADREPORARIA
 - Siphonoglyphs. eg - Madrepora

- ORDER ↓
- III. HEXACORALLIA
 - Tentacles usually unbranched.

- ORDER ↓
- IV. COENOTHECALIA
 - Polyps connected by selenoid tubes. eg - Heliopora
 - V. GORGONACEA
 - Sessile or fused calcareous spicules. eg - Gorgonia
 - VI. PENNATULACEA
 - Bearing dimorphic polyps. eg - Pennatulid

- Tissue grade diploblastic and acoelomate
- Solitary or colonial, freshwater or marine
- Only a single cavity, gastrovascular cavity or coelenteron present
- Nematocysts present
- Division of labour occurs.

- PHYLUM COELENTERATA

- Exclusively polypoid
- No medusae
- Gastrovascular cavity divided by 8 or more mesenteries
- Sessile, solitary or colonial

- CLASS ANTHOZOA

- Polyps with 8 tentacles.
- Bioluminescent.

- SUB CLASS OCTOCORALLIA

- Tree or feather like colony containing short polyps and central skeleton of gorgonin.
- Horny corals
- Polyp short not reaching up to the base.

- ORDER GORGONACEA

- With axial spicule

- SUB-ORDER SCLERAXONIA

- slender stem
- Thin Coenenchyme
- Partially retractile anthocodia

- FAMILY GORGONIDA

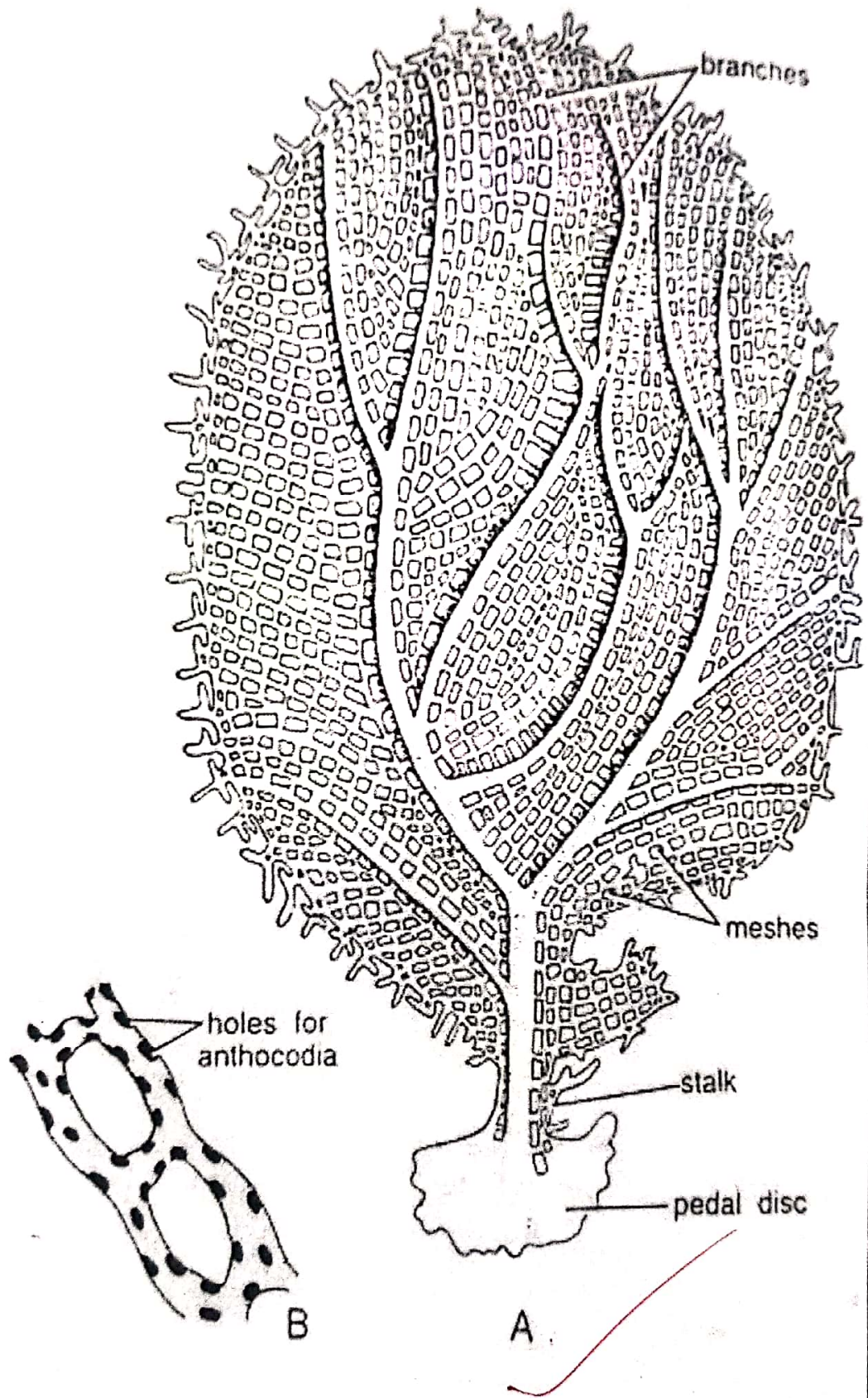
It forms erect, yellowish or reddish arborescent branches in one plane connected by cross connections in a feathery manner.

Base of the colony is expanded to form a hold fast organ called as pedal disk.

Polybs or anthocodia emerge from branches and contain 8 pinnate tentacles, mouth, gastrovascular cavity, 8 gastric filaments and mesenteries.

- GENUS GORGONIA

COMMON NAME : Sea fan



Gorgonia.

A - Entire colony, B - A portion (magnified).



M.Sc. ZOOLOGY SEMESTER 2 (SESSION 2022-23)

CLASSIFICATION:-

SPOT NO: 2

| | |
|---------|--------------|
| PHYLUM | COELENTERATA |
| CLASS | ANTHOZOA |
| ORDER | GORGONACEA |
| FAMILY | GORGONIDA |
| GENUS | GORGONIA |
| SPECIES | Ventalina |

| | |
|-----------------|--------------------|
| ZOOLOGICAL NAME | Gorgonia Ventalina |
| COMMON NAME | Sea fan |

| | |
|-----------------|--|
| SPECIAL FEATURE | • Base of the colony is called pedal disk. |
| | • Arboresecent branches |

CONCLUSION:- Hence, the spot is of Gorgonia Ventalina

CHECKED BY:- Sushma

NAME OF THE STUDENT:- Preeti Sharma

DATE:- 20.2.2023

PHYLUM: CTENOPHORA

CLASS

1. TENTACULATA

(Tentacles present)

2. NUDA

(Tentacles absent)

ORDER 1. BEROIDEA

(Body laterally compressed)

eg- Beroe

ORDER

1. CYDIPIDIA

(Two long branched retractile tentacles)
eg- Meritensia

2. LOBATA

(Tentacles present only in larva)
eg- Mnemiopsis

3. CESTIDA

(Body ribbon like)
eg- Velamen

4. PLATYCTENEA

(Body greatly flattened)
eg- Ctenopiana

SPECIMEN - 1

- Tissue grade, biradial, marine and pelagic.
- Nematocyst absent. Instead adhesive cells called colloblasts present.
- Locomotory combrows present.
- Skeleton, circulatory, respiratory system absent.

- PHYLUM Ctenophora

- Tentacles absent.

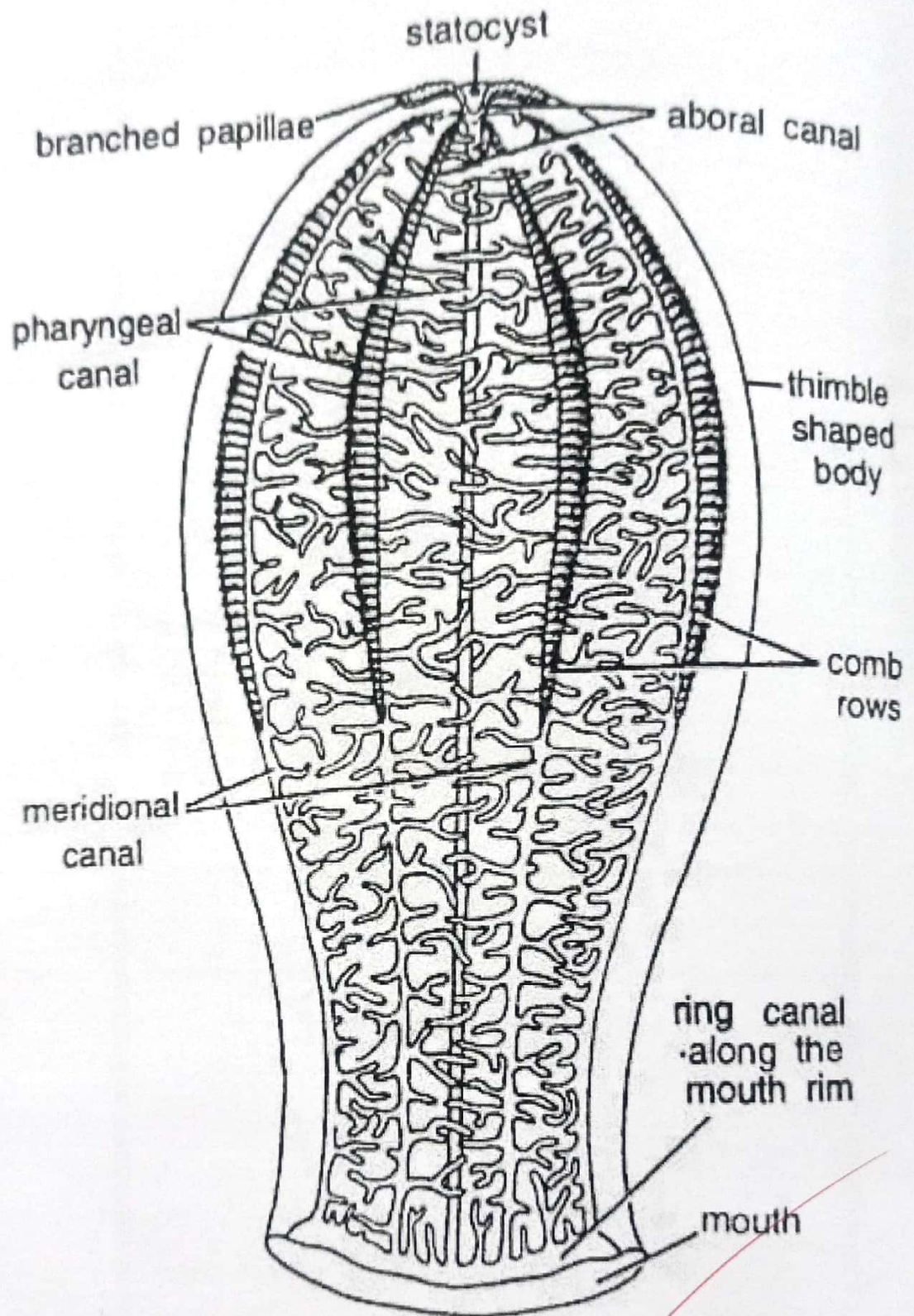
- CLASS Nuda

- Body laterally compressed.
- Mouth large, stomach voluminous
- Conical form with wide mouth and pharynx.

- ORDER Beroidea

- Body is conical or thimble shaped, compressed in the lateral plane with no trace of tentacles or tentacle sheath.
- Rounded aboral end contains statocyst and branched papillae.
- ~~Truncated~~ oral end contains mouth. Comb rows extend upto the middle of the body.

- GENUS Beroe



'BEROE'



CLASSIFICATION:-

SPOT NO: 1

| | |
|---------|------------|
| PHYLUM | CTENOPHORA |
| CLASS | NUDA |
| ORDER | BEROIDA |
| FAMILY | BEROIDAE |
| GENUS | BEROE |
| SPECIES | elegans |

| | |
|-----------------|----------------------|
| ZOOLOGICAL NAME | <u>Beroe elegans</u> |
| COMMON NAME | Mitre jelly fish |

| | |
|-----------------|------------------------|
| SPECIAL FEATURE | comb rows extend up to |
| | the middle of the |
| | body. |

CONCLUSION:- Hence, the spot is of Beroe elegans.

CHECKED BY:- Sushma

NAME OF THE STUDENT:- Preeti Sharma

DATE:- 20.2.2023

PHYLUM: PLATYHELMINTHES

| CLASS | | |
|---|--|---|
| I. TURBELLARIA Suckers absent body unsegmented and covered with ciliated | II. TREMATODA Suckers and sometimes hooks present | III. CESTODA Segment and micro- villi. |

| ORDER | | | |
|--|--|---|---|
| I. ACOELA Flame cells, definite gonads. eg. Convoluta | II. RHABDOCOELA Protonephridial ex- system eg. Lagenula | III. ALLOCOELA Penis papilla mostly present eg. Gemathophora | IV. TRICELADA Testes numer- ous, ovary two eg. Dugesia |

V. ALYCLADEDA
Pharynx plicate,
intestine highly
branched.
eg. Leptopoda

| ORDER | | |
|---|---|---|
| I. MONOGENEA Posterior adhesive organ with suckers armed with hooks or spines. eg. Polystoma | II. DIGenea Single posterior excretory pore. eg. Fasciola | III. ASPIDOCOTA Oral sucker absent. eg. Cotyllopsis |

ORDER

| SUB-CLASS | ORDER |
|---|--|
| I. CESTODARIA Without scolex and strobila | 1. AMPHILINIIDEA No suckers, uterus coiled. eg. Amphilinga |
| II. EUCESTODA | 2. GYRCOTYLIDEA Eversible proboscis at the ant. end eg. Gyrocotyle |

Divided into
scolex, neck and
strobila with
many proglottids.

| | |
|---|---|
| 1. PROTEOCEPALIDEA Ovary bilobed, uterus branched. eg. Ophio taenia | 7. CYCLOPHYLIDEA Vitellaria follicular. eg. Taenia |
| 2. TETRAPHYLIDEA Testis ant. to ovaries eg. Phyllobothrium | 8. APOIDEA No external segmentation. |
| 3. DISCULICEPITIDEA Uterus lobed, scolex with large cushion eg. Disculiceps | 9. NIPPOTAENIIDEA No sucker but well developed terminal sucker eg. Nippotaenia |
| 4. LECANICEPHALIDEA Vitellaria as two lat. bands. eg. Lecanicephalum | 10. CARYOPHYLLIDEA Scolex without true suckers & bothria eg. Archig. |
| 5. PSEUDOPHYLLIDEA Vitellaria follicular. eg. Hallobothrium | 11. SPATHEBOTHRI- DEA Scolex without suckers. |
| 6. TRYPANOPHYNCHA Vitellaria in continuous layer in cortical paren- -chyma. eg. Tetrahyinchus | eg. Spathebothrium |

- Flatworms
- Open mode of circulation
- Acoelomate (lacks a distinct definitive anus)
- Triploblastic (ectoderm, endoderm & mesoderm)
- Mesoderm give rise to various organs such as excretory, reproductive, etc
- Skeletal, circulatory and respiratory system absent
- Free living or parasitic causing various diseases.

- PHYLUM PLATYHELMINTHES

- Mostly free living
- Body is covered with epidermis
- Mouth ventral
- Epidermis is partly ciliated containing shobolites.

- CLASS TURBELLARIA

- Intestine contain 3 branches, one anterior and two posterior.
- Axial protonephridia and nephridiopores
- Fresh water, marine or terrestrial

- ORDER TRICLADIDA

- Adhesive organ absent
- Head triangular and truncated.

- FAMILY PLANARIIDAE

- Body differentiated into dorsal and ventral surface. Ventral surface contain adhesive and ciliated zones
- Anterior region is called as head.
- Head is triangular containing 2 ear like auricles on side and 2 semicircular ocelli.
- Body tapers posteriorly as a pointed end.
- Mouth incised by proboscis pore.

- GENUS DUGESIA

Common Name: Planaria

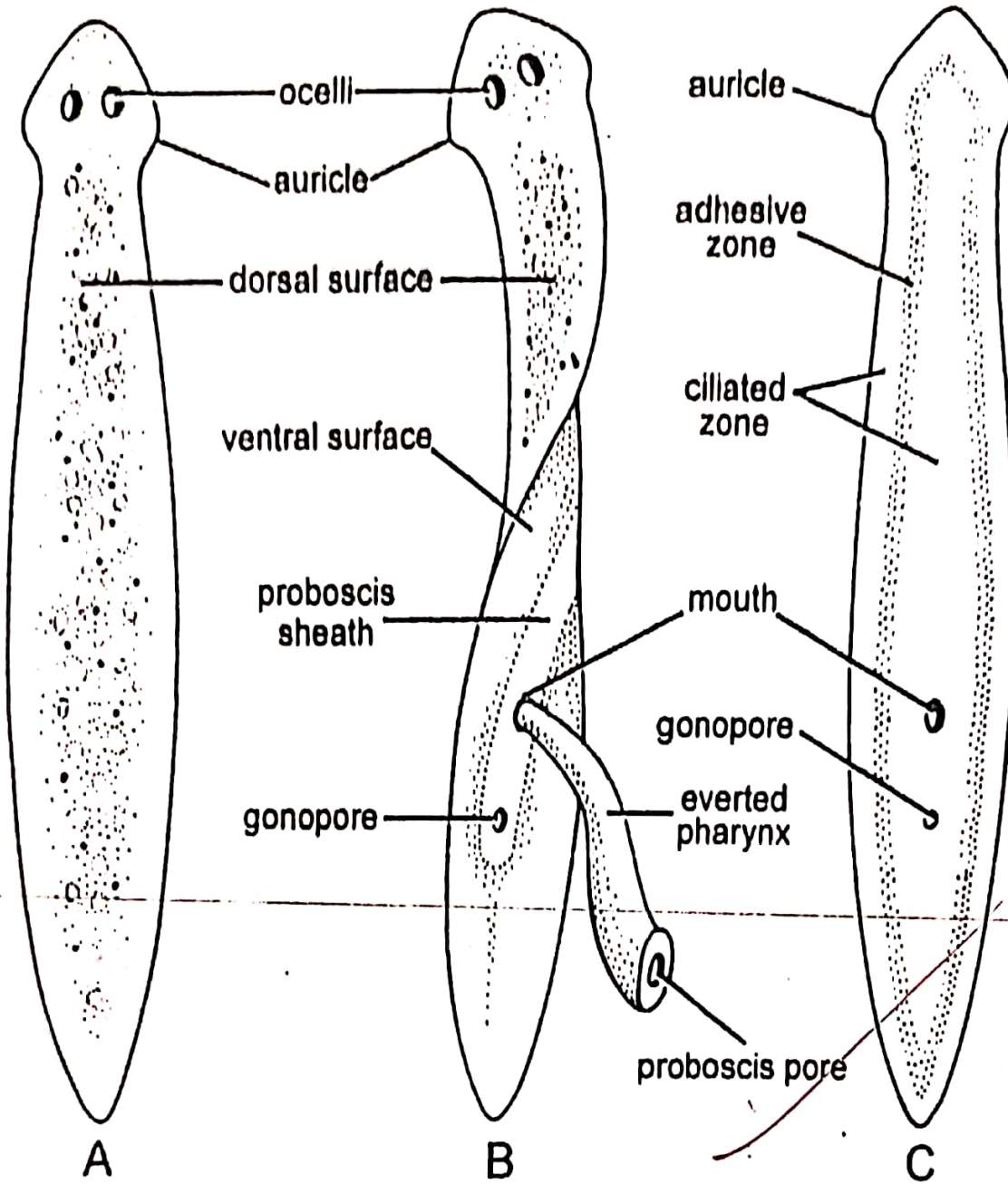


Fig. 72. *Dugesia*. A. Dorsal view. B. Dorsoventral view. C. Ventral view.



M.Sc. ZOOLOGY SEMESTER 2 (SESSION 2022-23)

CLASSIFICATION:-

SPOT NO: 1

| | |
|---------|-----------------|
| PHYLUM | PLATYHELMINTHES |
| CLASS | TURBELLARIA |
| ORDER | TRICLADIDA |
| FAMILY | PLANARIIDAE |
| GENUS | DUGESIA |
| SPECIES | aborensis |

| | |
|-----------------|-------------------|
| ZOOLOGICAL NAME | Dugesia aborensis |
| COMMON NAME | Planaria |

| | |
|-----------------|--|
| SPECIAL FEATURE | <ul style="list-style-type: none">• Mouth encircled by peristomes pore.• Contain auricles eyes. |
|-----------------|--|

CONCLUSION:- Hence, the spot is of Dugesia aborensis.

CHECKED BY:- Jesha

NAME OF THE STUDENT:- Prati Sharma

DATE:- 20.2.23

SPECIMEN - 2

Date / / Page No

- Flatworms
- Passer grade of organization.
- Bilateral without definite anus.
- Triploblastic (ectoderm, endoderm & mesoderm)
- Mesoderm give rise to various organs such as excretory, reproductive, etc.
- Skeletal, circulatory and respiratory systems absent.
- Free living or parasitic causing various diseases.

PHYLUM PLATYHELMINTHES

- Commonly called as flukes.
- Body dorsoventrally flattened and covered with tegument.
- Ectoparasitic or endoparasites.
- No free living forms.
- Suckers for adhesion.

- CLASS TREMATODA

- Endoparasitic flukes.
- Life cycle is completed in two or more hosts, hence oligolectic.
- Oral and ventral suckers.
- Single excretory pore.

- ORDER DIGenea

DOMS Page No
Date / /

- Commonly called as liver flukes.
- Internal organs branched.

- FAMILY FASCIOLIDAE

- It is a polyxenous and pathogenic.
- Anterior end is produced into a conical projection called cephalic cone.
- There is a small ventrally-placed mouth at the anterior extremity, surrounded by oral sucker.
- It is found in the bile ducts of liver and biliary passages of sheep, etc.

- GENUS FASCIOLA

- SPECIES ~~hepatica~~

Common NAME: Sheep liver fluke

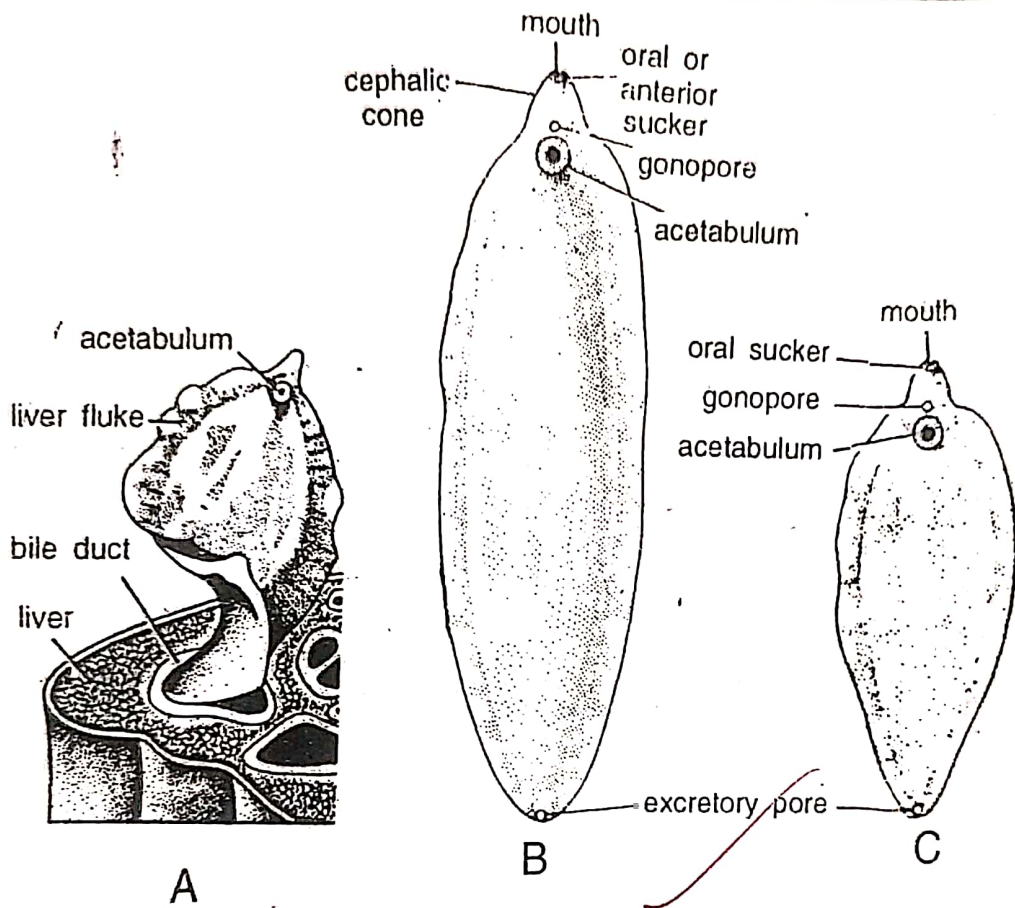


Fig. 74. A. *Fasciola gigantica* in situ, B. *Fasciola gigantica*, C. *Fasciola hepatica*.



CLASSIFICATION:-

SPOT NO: 2

| | |
|---------|-----------------|
| PHYLUM | PLATYHELMINTHES |
| CLASS | TREMATODA |
| ORDER | DIGENEA |
| FAMILY | FASCIOLIDAE |
| GENUS | FASCIOLA |
| SPECIES | <u>HEPATICA</u> |

| | |
|-----------------|--------------------------|
| ZOOLOGICAL NAME | <u>Fasciola hepatica</u> |
| COMMON NAME | sheep liver fluke |

| | |
|-----------------|---|
| SPECIAL FEATURE | • Specimen contain cephalic cone, acetabulum. |
| | • Presence of mouth & oral sucker. |

CONCLUSION:- Hence, the specimen is of Fasciola hepatica.

CHECKED BY:- Jushin

NAME OF THE STUDENT:- Preeti Sharma

DATE:- 20.2.2023

PHYLUM - ASCHELMINTHES

ORDERS

I. ENOPLOIDEA

- cuticle bears bristles.
- Amphids present.
- eg - Enoplus

II. PORYLAMOIDEA

- Amphids present
- eg - Loxofanus

III. STRONGYLOIDEA

- Presence of copulatory bursa.
- eg - Ancylostoma

IV. TRICHUROIDEA

- Pharynx contains stichosomes.
- eg - Trichuris ovis

V. RHABDITOIDEA

- Pharynx Rhabditis form
- eg - Rhabditis

VI. OXYUROIDEA

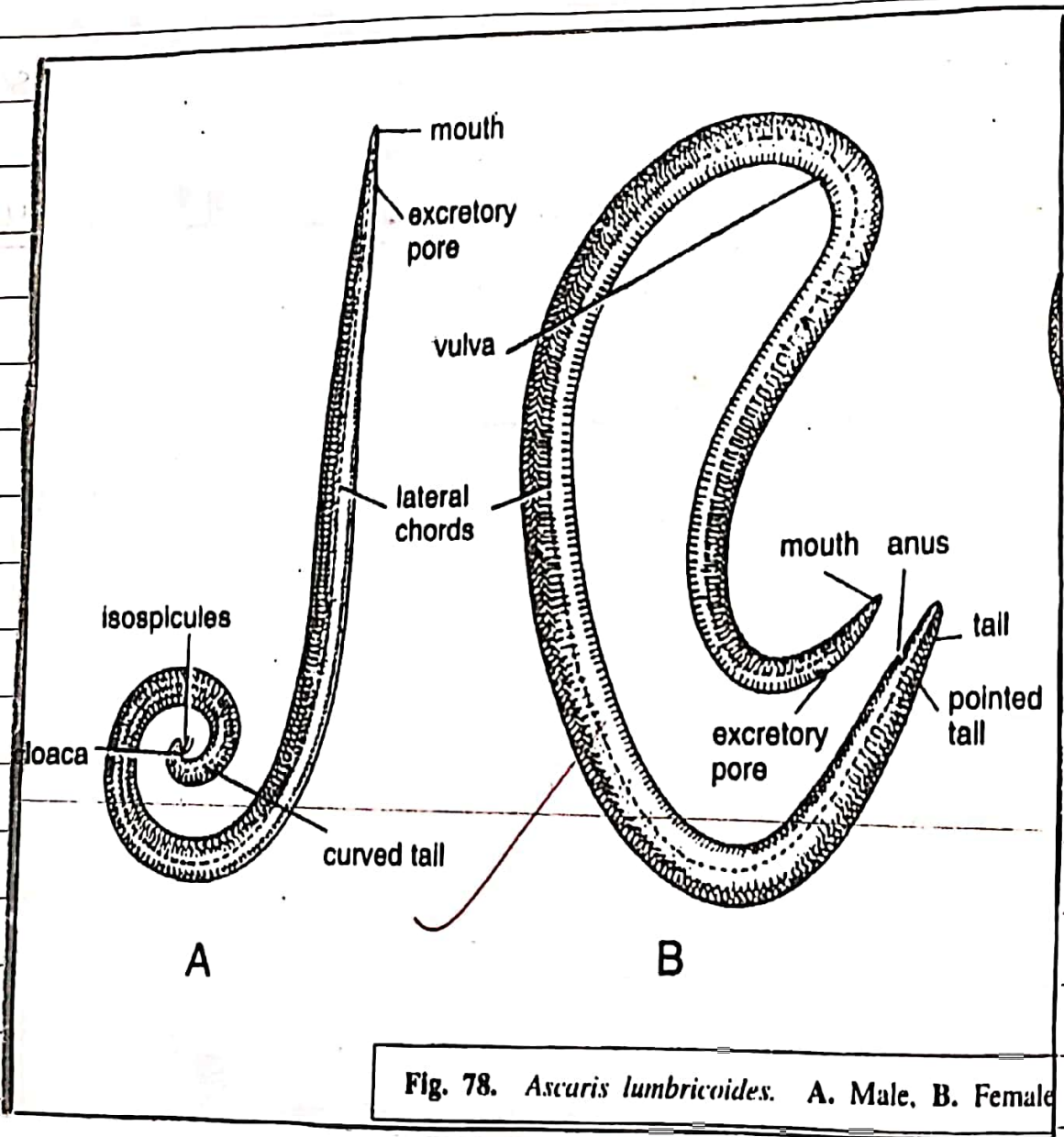
- Pharynx contains bulb.
- eg - Enterotius Vermicularis

VII. ASCAROIDEA

- Pharynx cylindrical mouth with 3 lips
- eg - Ascaris lumbricoides

VIII. FILAROIDEA

- Pharynx muscular fanular.
- eg - Wucheria bancrofti





CLASSIFICATION:-

SPOT NO: 1

| | |
|---------|---------------------|
| PHYLUM | ASCHELMINTHES |
| CLASS | NEMATODA |
| ORDER | ASCARIDEA |
| FAMILY | ASCARIDIDAE |
| GENUS | <u>ASCARIAS</u> |
| SPECIES | <u>LUMBRICOIDES</u> |

| | |
|-----------------|------------------------------|
| ZOOLOGICAL NAME | <u>Ascarius lumbricoides</u> |
| COMMON NAME | Round Worm |

| | |
|-----------------|---------------------------------|
| SPECIAL FEATURE | • Unsegmented cylindrical body. |
| | • Curved tail in male. |
| | • Pointed tail in female. |

CONCLUSION:- Hence, the spot is of Ascarius lumbricoides.

CHECKED BY:- Sushan

NAME OF THE STUDENT:- Preeti Sharma

DATE:- 20.2.2023

PHYLUM - ANNELIDA

CLASS

- | | |
|--|--|
| <p>I. POLYCHAETA</p> <ul style="list-style-type: none"> • Many setae in each segment • Clitellum absent | <p>II. OLIGOCHAETA</p> <ul style="list-style-type: none"> • Few setae in each segment • Clitellum present |
|--|--|

ORDERS

- | | | |
|--|--|--|
| <p>I. ERRANTIA</p> <ul style="list-style-type: none"> • Locomotory organs parapodia eg - Nereis | <p>II. TUBICOLA</p> <ul style="list-style-type: none"> • Tubiculous animals eg - Chaetopterus | <p>III. SEDENTARIA</p> <ul style="list-style-type: none"> • Sedentary animals eg - Aerenicola |
|--|--|--|

ORDER

- | | |
|---|---|
| <p>I. ARCHISPIROCHAETA</p> <ul style="list-style-type: none"> • Primitive forms • Small and fresh water eg - Aelosoma | <p>II. NEDOLIGOCHAETA</p> <ul style="list-style-type: none"> • Modern parasitism • Terrestrial and burrowing eg - Pheretima |
|---|---|

- III. HIROPIDINEA**
- Anterior and posterior suckers present
 - Parapodia absent
 - External segmentation

- | | | |
|--|---|--|
| <p>I. ACANTHOBDELLIDA</p> <ul style="list-style-type: none"> • Primitive leeches • Coelom with compartments • Anterior sucker absent eg - Acanthobdella | <p>II. AGNATHOBDELLIDA</p> <ul style="list-style-type: none"> • Anterior sucker absent • Ectoparasitic aquatic leeches eg - Pontobdella | <p>III. ANATHELOBDELLIDA</p> <ul style="list-style-type: none"> • Both anterior and posterior suckers present eg - Hirudo |
|--|---|--|

- Segmental and Coelomate animals
- Segmentation metameric
- Closed Circulation
- Excretory organs metanephridia
- Exoskeleton absent
- Fresh water, marine, terrestrial, burrowing or tubicolous

- PHYLUM ANNELEDA

- It includes leeches
- Anterior and posterior suckers present
- Parapodia absent
- Only external segmentation

- CLASS HIRUDINEA

- Proboscis, non-protrusible
- Jaws present

- ORDER RHYNCHBDELLIDA

Body is soft, vermiform, elongated, dorso-ventrally flattened

Skin is kept moist and slimy due to abundant mucous secretion

Anterior or posterior suckers are well developed

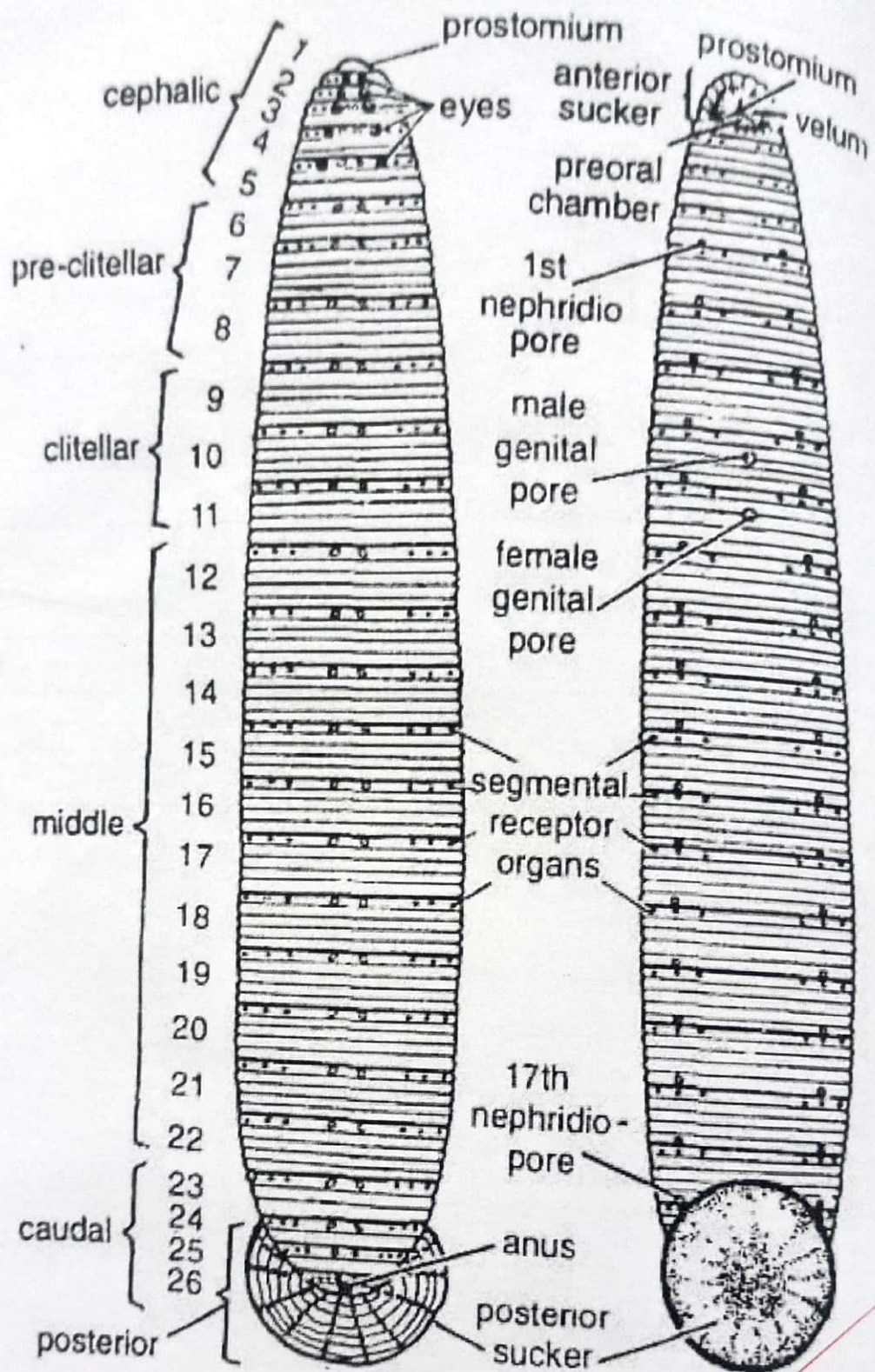
Body is divisible into cephalic, pericardial, middle, caudal and posterior suckers regions

divided into 5 annuli

- GENUS HIRUDINARIA

- SPECIES GRANULOSA

COMMON NAME: Indian cattle leech



Hirudinaria granulosa. A. Dorsal view, B. Ventral view.



M.Sc. ZOOLOGY SEMESTER 2 (SESSION 2022-23)

CLASSIFICATION:-

SPOT NO: 1

| | |
|---------|--------------------|
| PHYLUM | ANNELIDA |
| CLASS | HIRUDINEA |
| ORDER | RHYNCHOBDELLIDA |
| FAMILY | |
| GENUS | <u>HIRUDINARIA</u> |
| SPECIES | <u>GRANULOSA</u> |

| | |
|-----------------|------------------------------|
| ZOOLOGICAL NAME | <u>Hirudinaria granulosa</u> |
| COMMON NAME | Indian Cattle leech |

| | |
|-----------------|--|
| SPECIAL FEATURE | <ul style="list-style-type: none">• Anterior and posterior suckers• 33 segments• Hermaphrodite |
|-----------------|--|

CONCLUSION:- Hence, the spot is of Hirudinaria granulosa

CHECKED BY:- Sushma

NAME OF THE STUDENT:- Preeti Sharma

DATE:- 20.2.2023

PHYLUM: ARTHROPODA

SUB-PHYLUM

I. TRILOBITE MORPHA
 • Fossil trilobites. One pair of antennae, body 3 lobed, due to 2 longitudinal furrows.
 eg - Trilobites

2. CHELICERATA
 • Antennae 8
 • Three jaws absent.

3. MANDIBULATA
 • Compound eyes common.

CLASS

I. CRUSTACEA
 • Head often joined with thorax to form Cephalothorax.

II. MERESTOMIATA
 • Abdomen ending in a sharp telson, or spine.

II. ARACHNIDA
 • Abdomen generally without appendages.

SUB CLASS

I. XIPHOSURA
 • Abdomen unsegmented with a long terminal telson.
 eg - Limulus

2. EURYPTERIDA
 • Carapace plain, not extended.
 eg - Pterygotus

I. CEPHALOCARIDA
 • Antennae short.
 eg - Hutchinsoniella

ORDER

1. SCORPIONIDA
 • Metasoma ending in a telson & poison sting.
 eg - Plectanagrus

2. PSEUDOSCORPIONIDA
 • Chelicerae 2-jointed.
 eg - Chelifer

3. FRANEAE
 • With a poison duct in terminal claw.
 eg - Achaeanagrus

4. SIFONIDA
 • No poison glands.
 eg - Galeodes

5. PALPIGRADI
 • Last segment with a long flagellum on claw.
 eg - Mastigoproctus

6. PSEPIPELTI
 • Proximal carapace entire.
 eg - Thelyphonus

7. AMBLYPYGI
 • Carapace undivided.
 eg - Charinus

8. RICINULE
 • Opisthosoma 6-segmented.
 eg - Ricinoides

ORDER

I. DIPLOPODA
 • Mandibles and maxillae, 1 pair each.
 eg - Iulus

II. CHILOPODA
 • Centipedes
 eg - Scolopendras

III. SAUROPODA
 • No eyes.
 eg - Paraxipus

IV. MYRIAPODA
 • Mandibulate arthropods

V. SYMPHYLA
 • Body slender made of head and trunk segments.
 eg - Scutigera

ORDER

1. MYSIDOCOPA
 • Carapace with antennae notches.
 eg - Cypridin

2. PODOCOPA
 • Carapace unnotched.
 eg - Cypris

3. PLATYCOPA
 • Antennae uniramous.
 eg - Cythereella

BRANCHIOPODA

1. ANTENNULATA
 • Antennules 8
 absent

2. ASTRACOPA
 • Antennules 8
 Antennae large.

ORDER

A. ANOSTRACA
 • Carapace absent.
 eg - Anemia

B. NOTOSTRACA
 • Carapace shield like.
 eg - Apus

C. DIPLASTRACA
 • Styles unjointed, claw like.
 eg - Daphnia

4. CLADOCOPA
 • Antennae bisamous.
 eg - Polycopa

9. OPILIONES
 • Scent glands under carapace.
 eg - Phalangium

10. ACARINA
 • Ticks and mites.
 eg - Argas

SPECIMEN-23

Date _____
Page _____

- jointed appendages
- exoskeleton of chitinous cuticle.
- Coelom replaced by haemocoel.
- Open circulation.
- Compound eyes
- Sexes separate
- Largest group.

- PHYLUM ARTHROPODA

- Primitive arthropods.
- Contain annelidan and arthropodan character.
- Unjointed legs.

- CLASS ONYCHOPHORA

- Living fossil.
- Body of the animal is cylindrical and elongated.
- Outer covering of the body is thin velvety, chitinous showing transverse wrinkles, numerous small papillae or tubercles.
- Anterior end is marked by preantennae and ventral mouth and posterior end by anus.
- There is a head of three segments which is not clearly separate from the body.

classmate
Date _____
Page _____

- There is a tracheal system with spiracles scattered irregularly over the body surface.
- Cervical glands are absent and genital pore is posterior.

- GENUS PERIPATUS

COMMON NAME: living fossil

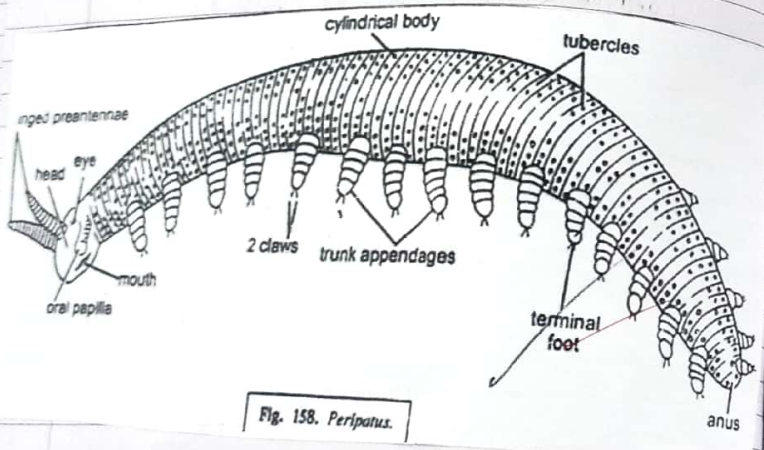


Fig. 158. Peripatus.



CLASSIFICATION:-

SPOT NO: 2

| | |
|---------|----------------|
| PHYLUM | ARTHROPODA |
| CLASS | ONYCHOPHORA |
| ORDER | EUDONCYCOPHORA |
| FAMILY | PERIPATUS |
| GENUS | PERIPATUS |
| SPECIES | juliformis |

| | |
|-----------------|----------------------|
| ZOOLOGICAL NAME | Peripatus juliformis |
| COMMON NAME | hundred footed |

| | |
|-----------------|---|
| SPECIAL FEATURE | <ul style="list-style-type: none"> • contains pre-antennae, • 2 clawed appendages |
|-----------------|---|

CONCLUSION:- Hence, the spot is of Peripatus juliformis

CHECKED BY:- *Sushma*

NAME OF THE STUDENT:- *Prachi Shah*

DATE:- *20.2.2023*

PHYLUM: MOLLUSCA

CLASS

- I. MONOPLACOPHORA
 - Five pairs of gills in pallial cavity.
 - Internal segmentation.
 - eg- Neopilina
- II. AMPHINEURA
 - Shell as 8 dorsal plates OR as spicules.
- III. SCAPHOPODA
 - Foot conical.
 - Radula + tentacles.
 - no gills.
 - eg- Dentalium

SUB-CLASS

- I. APLACOPHORA
 - Lekeranous spicules buried in a cuticle.
 - eg- Neomenia
 - II. POLYPLACOPHORA
 - Shell as 8 calcareous dorsal plates.
- SUB-CLASS
- I. PROBOBRANCHIA
 - Shell closed by an operculum bone on foot.

- I. LEPEOPLEURENA
 - Valves of shell without insertion plates.
 - eg- Lepidopleurus
- II. CHITONIDA
 - Valves of shell with insertion plates.
 - eg- Chaetopleura

ORDER

- I. ARCHAEYGASTROPODA
 - Nervous system not concentrated with pedal cord.
 - eg- Patella

ORDER

- I. CEPHALASPIDEA
 - Reddish tentacles.
- II. ANASIDEA
 - Well developed parapodial lobes.
 - eg- Aplysia
- III. PTEROPODA
 - Parapodial fin for swimming.
 - eg- Cnidaria
- IV. SACOGLOSSA
 - Shell absent.
- V. ANASPIDEA
 - No shell, gill mantle and operculum.
 - eg- Doris
- VI. NOPIBRANCHIA
 - No shell, gill mantle and operculum.
 - eg- Doris
- VII. PYRAMIDELLA
 - no shell & radula.
 - eg- Pyramidella
- VIII. PYZOBRANCHIA
 - Shell present.

- IV. GASTROPODA
 - Shell present or absent, univalve and usually coiled.
- V. PELECYPODA
 - Body enclosed in a bivalve shell and laterally compressed.
- VI. CEPHALOPODA
 - Body elongated dorsally-ventrally.

ORDER

- I. PROTOBRANCHIA
 - Gills filaments not folded.
 - eg- Nucula
- II. FILIBRANCHIA
 - Gills filaments reflexed but incompletely fused.
 - eg- Ostrea
- III. EULAMELLOBRANCHIA
 - Gills filaments fused completely to form tissue sheets.
 - eg- Unio
- IV. SEMI-^{CHIA}BRANCHIA
 - Gills absent.
 - eg- Pecten

- II. OPHISTHOBRANCHIA
 - Body mass twisted or detorted.
- III. PULMONATA
 - Detorted body mass.

ORDER

- I. BASOMMATOPHORA
 - Gonophores generally separate.
 - eg- Planorbis
- II. STILOMMATOPHORA
 - Gonophores usually united.
 - eg- Limax
- III. NAUTILOIDEA
 - Suckerless.
 - Shell external and coiled with septa.
 - eg- Nautilus
- IV. STYLOMMATOPHORA
 - Gonophores usually united.
 - eg- Limax

SUB-CLASS

- I. NAUTILOIDEA
 - Suckerless.
 - Shell external and coiled with septa.
 - eg- Nautilus
- II. STYLOMMATOPHORA
 - Gonophores usually united.
 - eg- Limax

- II. MESOGASTROPODA
 - Nervous system without pedal cords.
 - eg- Pila
- III. NEOGASTROPODA
 - Nervous system concentrated.
 - eg- Murex
- III. COELOIDEA
 - Tentacles with few suckers.

ORDER

- I. DECAPODA
 - Ten arms.
 - eg- Loligo
- II. DOLIPODA
 - Eight equal arms.
 - eg- Doto

- V. ACOCHIDIACEAE
 - Visceral mass separated from foot.
 - eg- Uvula
- VI. RHODOPACEA
 - Ants on right side of the body.
 - eg- Rhodope

- XI. ONCHIDIACEAE
 - Posteriorly located anus.
 - eg- Onchidium
- XII. PARASITICA
 - Shelled and parasitic.
 - eg- Ecto

Organized shell with visceral mass and
 system of
 by paired metanephridia
 = PHYLUM MOLLUSCA

Both shells or lack shells
 shell and mouth tubular, closed and open
 at both ends
 = Class SCAPHOPODA

Body called as Eleutherozoa has shell
 body of the animal has a vestibular head
 which protrudes or protrudes from shell and eyes
 mouth is surrounded by leaf like
 like bristles called as captacula having
 suckers like tips which can
 sensory prehensile and can
 regenerate

The Clasicles are present. The
 tubules bring possibly homologous
 to them

Conical foot also protrudes from shell from
 anterior end but burrow in sand

Circulatory system is open and
 there is no chamber and

- Genus JEMINIUM

Coelom type: Low shell



CLASSIFICATION:-

SPOT NO: 1

| | |
|---------|--------------|
| PHYLUM | MOLLUSCA |
| CLASS | SCAPHOPODA |
| ORDER | DENTALIDA |
| FAMILY | DENTALITIDAE |
| GENUS | DENTALIUM |
| SPECIES | nedmeragonum |

| | |
|-----------------|-------------------------------|
| ZOOLOGICAL NAME | <u>Dentalium nedmeragonum</u> |
| COMMON NAME | <u>tooth shell</u> |

| | |
|-----------------|--|
| SPECIAL FEATURE | <ul style="list-style-type: none"> • Body enclosed in a <u>tooth shell</u>. • Presence of <u>conical foot</u>. |
|-----------------|--|

CONCLUSION:- Hence, the spot is of Dentalium nedmeragonum

CHECKED BY:- Sushma

NAME OF THE STUDENT:- Preeti Sharma

DATE:- 20.2.2023

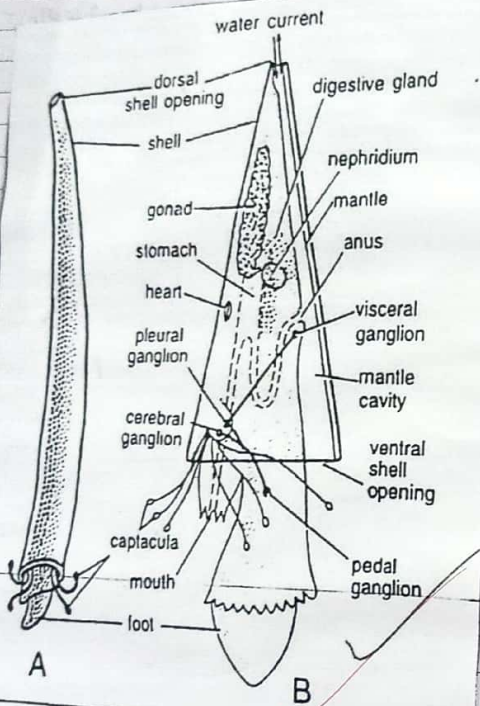


Fig. 111. Dentalium. A. Shell, B. Animal buried in sand.

SPECIMEN-19

classmate
Date _____
Page _____

- Unsegmented
- Presence of shell mantle, visceral mass and foot.
- Circulatory system open.
- Excretion by paired metanephridia.

- PHYLUM MOLLUSCA

- Head large, eyes conspicuous and complex.
- Shell external or internal or absent.

- CLASS CEPHALOPODA

- Gills 2.
- Nephridia 2
- Shell internal or reduced.

- SUB-CLASS DIBRANCHIA

- Eight arms
- Shell absent

- ORDER OCTOPODA

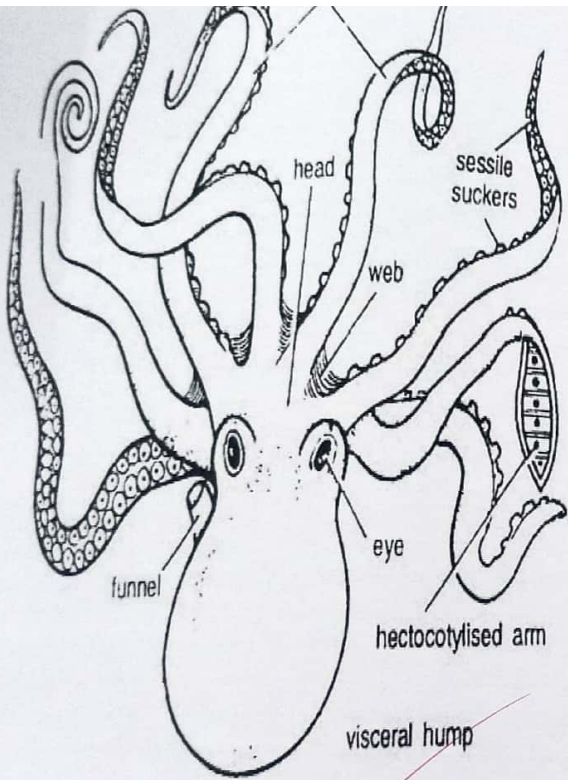
- Roundish or globose body is differentiated into a visceral hump and head.
- Head contains eyes, siphon and 8 elongated arms

classmate
Date _____
Page _____

- having 2 rows of sessile cupped, suckorial pockets or suckers on inner side.
- Shell and nidamental glands absent.
- Visceral mass and mantle cavity are enclosed by mantle.
- Nervous system is well developed.
- Octopus is dibranchiate, having 2 gills, 2 auricles and 2 kidneys.

- GENUS OCTOPUS

COMMON NAME: The devil fish



'Octopus'



CLASSIFICATION:-

SPOT NO: 3

| | |
|---------|-------------|
| PHYLUM | MOLLUSCA |
| CLASS | CEPHALOPODA |
| ORDER | OCTOPODA |
| FAMILY | |
| GENUS | OCTOPUS |
| SPECIES | macropus |

| | |
|-----------------|-------------------------|
| ZOOLOGICAL NAME | <u>Octopus macropus</u> |
| COMMON NAME | <u>The devil fish</u> |

| | |
|-----------------|---|
| SPECIAL FEATURE | <ul style="list-style-type: none"> - globose body differentiated into visceral hump and head. <p>Hence, the spot is of <u>Octopus macropus</u></p> |
|-----------------|---|

CONCLUSION:- Hence, the spot is of Octopus macropus

CHECKED BY:- Jasmin

NAME OF THE STUDENT:- Heeti Sharma

DATE:- 20.2.2023

PHYLUM: ECHINODERMATA

SUB-PHYLUM

I. ELEutherozoa

Free-living echinoderms

CLASS

- I. ASTEROIDEA
- II. OPHIUROIDEA
- III. ECHINOIDEA
- IV. HOLIDUROIDEA

Tube feet in orally placed ambulacral grooves with suckers
 Ambulacral grooves absent or covered by ossicles
 Skeleton or test compact bearing movable spines

SUB CLASS

- I. SPMASTEROIDEA: Fossil paleozoic sea stars, eg - Plasterias
- II. EUASTEROIDEA: Living sea stars, ORDER I. OPHIURAE (Arms move transversally, eg - Ophiura), II. EURYALAE (Arms move vertically, eg - Patergax)
- III. BOTHEROIDEA: Without typical lantern, eg - Bothriocidaris

ORDER

- I. PHANEROZONIA: Tube feet without suckers, eg - Pentaceros
- II. SPINULOSA: Aboral surface with low spines, eg - Asteroina
- III. FORCIPULATA: Four rows of tube feet, eg - Asterian

SUB PHYLUM

- II. PELMATOZOA: stalked sedentary echinoderms
- CLASS V. CRINOIDEA: Arms with pinnules
- ORDER ARTICULATA: Feather stars non sessile & free swimming, eg - Antedon

Date: _____
Page: _____

ORDER

- I. DENDROCHIROTA: Tentacles irregularly branched, eg - Cucumaria
- II. ASPIDUCHIROTA: Tentacles peltate, eg - Holothuria
- III. ELASIPODA: Worm like, Tentacles leaf-like, eg - Pelagothuria
- IV. MOLFADONIA: No tube feet, eg - Malpadia

classmate
Date: _____
Page: _____

ORDER

- II. MOLECTYPOIDA: Centrally located peristome, eg - Holoctypus
- II. CASSIDULOIDA: Aboral ambulacral areas petaloid, eg - Cassidulus
- III. IRREGULARIA: Anus marginal, outside the apical system of plates
- III. CLYPEASTROIDA: Aboral ambulacral areas petaloid, eg - Clypeaster

ORDER

- I. LEPIDOMYRTOIDA: Test flexible with overlapping plates, eg - Palaeodonta
- II. MELONECHINOIDEA: Ambulacral plates continue to mouth lip, eg - Melonechinus
- III. CIDADARIDA: No peristomial gills, eg - Histiodaris
- IV. SPATANGOIDA: Four aboral ambulacral areas petaloid, eg - Echinocardium

IV. DIADEMATOIDA

Peristomial gills present, eg - Echinus

SPECIMEN - 27

classmate
Date _____
Page _____

- Spiny skinned animals.
- Triploblastic deuterostomes.
- Distinct head and segmentation absent.
- Body divided into oral and aboral surfaces.
- Peculiar water vascular system for locomotion.
- Exclusively marine.
- Non-microscopic.
- Pentaradiate.
- Spiny skinned animals with vascular system.

- PHYLUM ECHINODERMATA

- Non-pedicellate and free-living.
- Oral surface directed downwards.

- SUB-PHYLUM ELEUTHEROZOA

- Commonly called as star-fishes.
- Body like shaped central disc and arms not sharply demarcated.

- CLASS ASTEROIDEA

- Pedicellariae tough or crossed.
- Tube feet in 4 rows.

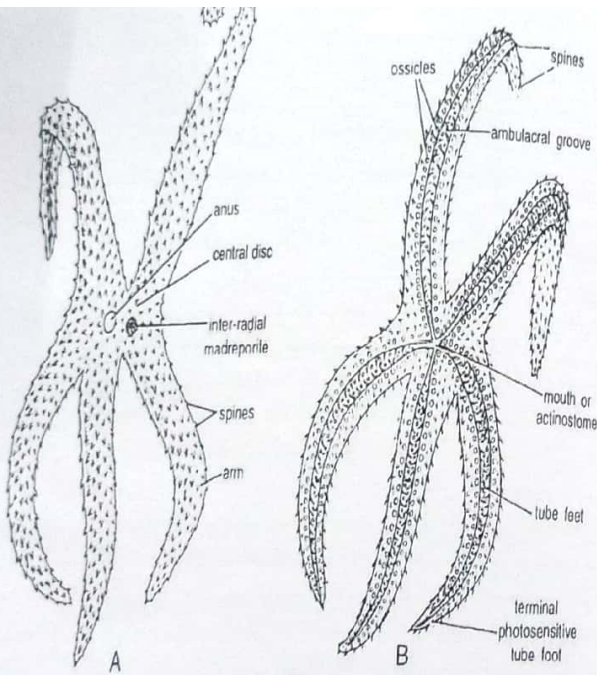
- ORDER FORCIPULATA

classmate
Date _____
Page _____

- Radially symmetrical, free-living and star shaped, pentagonal.
- Body or central disc of the animal is distinguished into downwardly directed oral and upwardly directed aboral surfaces.
- Central disc is continued into 5 arms.
- Terminal tube feet are photosensitive.
- Pedicellariae are usually present and may be of more than one kind.

- GENUS ASTERIAS

COMMON NAME: Starfish or sea star.



Asterias : Starfish A. Aboral view, B. Oral view.



CLASSIFICATION:-

SPOT NO: 1

| | |
|---------|---------------|
| PHYLUM | ECHINODERMATA |
| CLASS | ASTEROIDEA |
| ORDER | FORCIPULATA |
| FAMILY | ASTERIIDAE |
| GENUS | ASTERIAS |
| SPECIES | <u>Rubens</u> |

| | |
|-----------------|----------------------------|
| ZOOLOGICAL NAME | <u>Asterias rubens</u> |
| COMMON NAME | <u>Starfish / Sea star</u> |

| | |
|-----------------|---|
| SPECIAL FEATURE | <ul style="list-style-type: none"> - Central disc continued into 5 arms. - Contains conical spines. |
|-----------------|---|

CONCLUSION:- Hence, the spot is of Asterias rubens.

CHECKED BY:- Jasna

NAME OF THE STUDENT:- Preeti Sharma

DATE:- 20.2.2023

PHYLUM: HEMICHORDATA

General Characters :-

- Presence of so-called earlier notochord.
- Marine organism
- enterocoelous coelomate.
- Buccal pouch present.
- gill bars
- Digestive tract
- Derivation of anus from blastopore.
- Notochord confined to head region.

PHYLUM: HEMICHORDATA

CLASS

I. ENTEROPNEUSTA
(Burrwing animals)
Eg: Balanus

II. PTEROBRANCHIA
(Encased body)

ORDER

I. RHABDOPLEURIDA
Eg: Rhabdopleura

II. CEPHALODISIDA
Eg: Cephalodiscus

SPECIMEN-31

classmate
Date _____
Page _____

- Maxillae
- Enterocoelous coelomate
- Notochord confined to head region

- PHYLUM HEMICHORDATA

- Several gill slits.
- Intestine straight
- Solitary.

- CLASS ENTEROPNEUSTA

- Bilaterally symmetrical.
- Triploblastic deuterostome with worm-shaped body divisible into three regions - anterior proboscis or prosoma, middle collar or mesosoma and posterior trunk or metasoma.
- Proboscis is conical, collar is funnel like, while trunk is cylindrical.
- Proboscis is conical, collar is funnel-like, while trunk is cylindrical.
- Proboscis contains heart vesicle, central sinus and buccal diverticulum.
- Collar contains the mouth and collar coelom which opens by a pair of collar pores on dorsal surface.

classmate
Date _____
Page _____

Trunk region contains most of the internal organs, such as pharynx, gonads or hepatic region.

- GENUS BALANOGLOSSUS

COMMON NAME: Acorn worm.

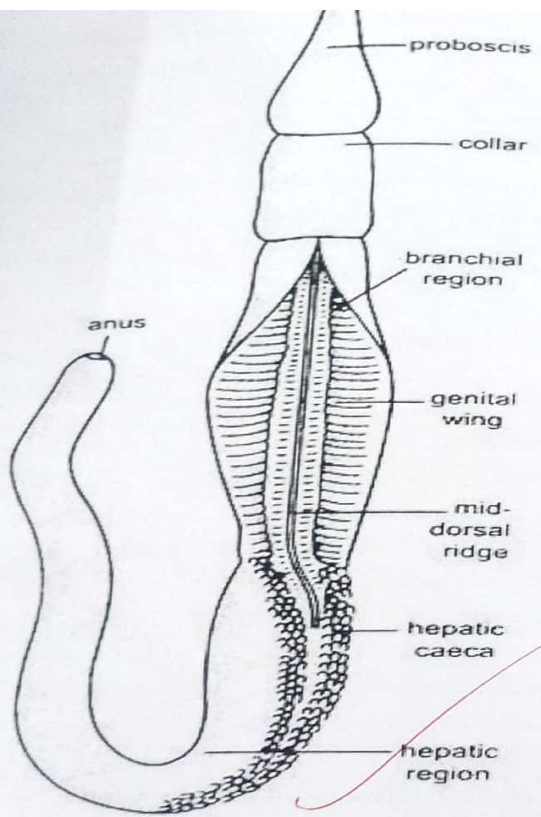


Fig. 2.2. *Balanoglossus*. External features in dorsal view.



CLASSIFICATION:-

SPOT NO: 1

| | |
|---------|---------------|
| PHYLUM | HEMICHORDATA |
| CLASS | ENTEROPNEUSTA |
| ORDER | |
| FAMILY | PTYCHOPRETAE |
| GENUS | BALANOGLOSSUS |
| SPECIES | apertus |

| | |
|-----------------|------------------------------|
| ZOOLOGICAL NAME | <i>Balanoglossus apertus</i> |
| COMMON NAME | The Tongue Worm |

| | |
|-----------------|---|
| SPECIAL FEATURE | <ul style="list-style-type: none"> - short Proboscis - Power of regeneration - so-called notochord present |
|-----------------|---|

CONCLUSION:- Hence, the spot is of *Balanoglossus apertus*

CHECKED BY:- *Leena*

NAME OF THE STUDENT:- *Prati sha*

DATE:- *20.2.2023*

Maa Bharti P.G. College, Kota



Department of Zoology
Master of Science (M. Sc.)
Subject: Zoology
Project Report

Submitted By:
Sakshi Yogi



PROJECT-WORK

TOPIC :-

GENETIC

DISORDER

- SAKSHI YOGI
- POOJA SHARMA
- MEENU NAGAR
- MEENAKSHI SUMAN
- KRATIKA YOGI

CONTENT

- 1) Introduction
- 2) Classification
- 3) History
- 4) Fact
- 5) Chromosomal Disorders
(Down's syndrome, Klinefelter syndrome)
- 6) Mendelian Disorders
(Phenylketonuria, Sickle cell anaemia, Thalassaemia)

GENETIC DISORDERS

DOWN SYNDROME

TURNER'S SYNDROME

COLOUR BLINDNESS

HAGMOPHILIA

HUNTING TONS

Carina

HUMAN GENETIC DISORDERS

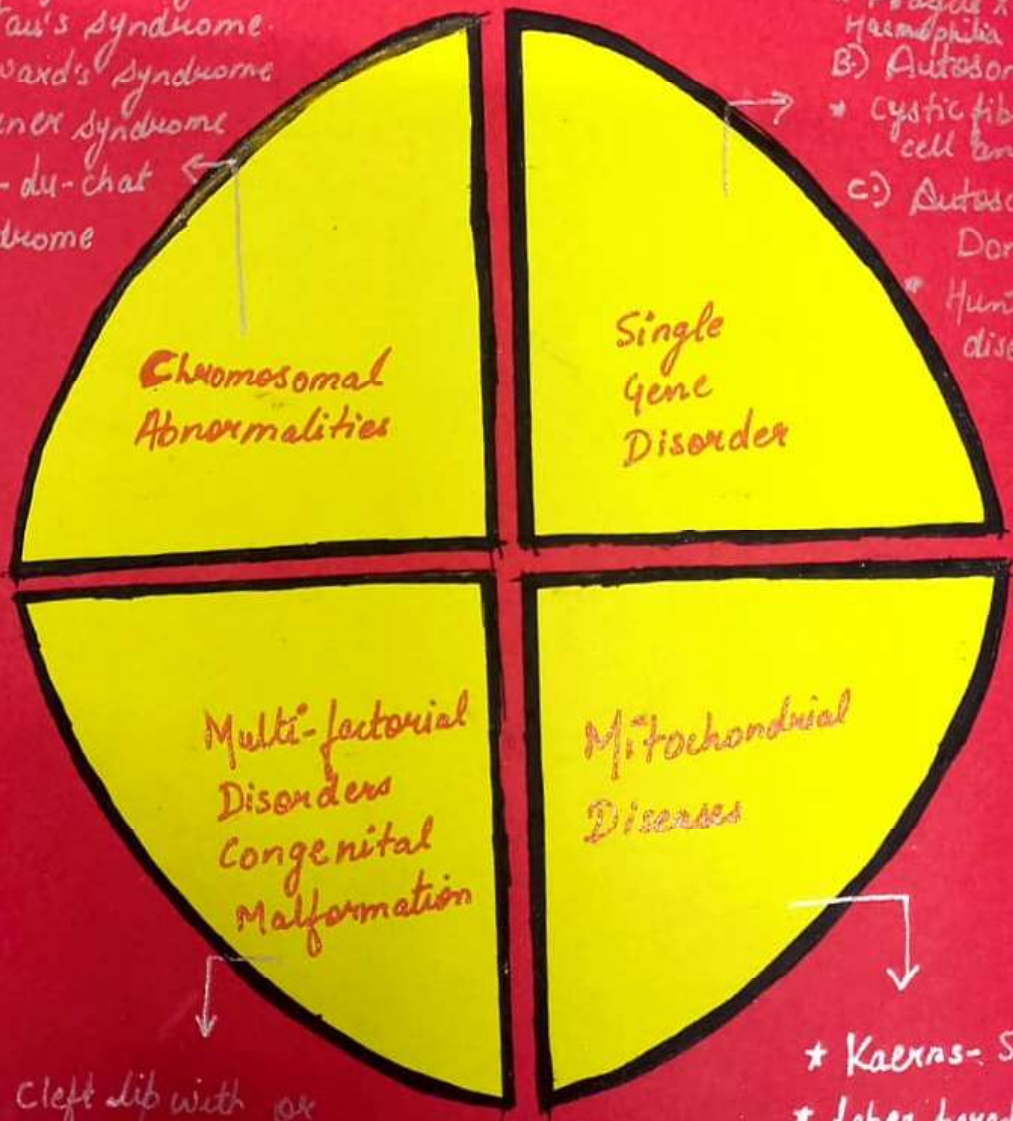
INTRODUCTION:

- * Genetics is the study of heredity and its variation. Many disorders of childhood have a genetic cause.
- * According to the centres for disease control and prevention, birth defects and genetic disorders are a significant cause of morbidity and mortality in infancy and childhood.
- * Variation within DNA sequence of a particular gene affects its functions and may cause or predispose an individual a particular disease.
- * Such an alternation or change in genetic material is referred to as Mutation.

CLASSIFICATION OF GENETIC DISORDERS

- * Down Syndrome
- * Klinefelter Syndrome
- * Patau's syndrome
- * Edward's syndrome
- * Turner syndrome
- * Cri-du-chat Syndrome

- A) X-linked
 - * Fragile X-syndrome
 - Haemophilia
- B) Autosomal Recessive
 - * cystic fibrosis, sickle-cell anaemia.
- C) Autosomal-Dominant
 - * Huntington's disease



- * Cleft lip with or Cleft palate
- * Congenital heart defects
- * Neural tube defect
- * Mental Retardation

- * Kearns-Sayre Syndrome
- * Leber hereditary optic neuropathy
- * Mitochondrial encephalopathy
- * Myoclonic epilepsy

HISTORY

* 1866 - First there was Gregor Mendel, who studied inherited characteristics

* This was followed by Francis Crick and James Watson who unraveled the DNA molecule.

* This has led us to understanding the human genome sequence.



Gregor Mendel

* 1950's - Maurice Wilkins, Rosalind Franklin, Francis H.C. Crick of Britain and James D. Watson of the U.S. discover the chemical structure of DNA, starting a new branch of science - molecular biology.



James D. Watson

Francis H. C. Crick

* In 1957 - Arthur Kornberg of the U.S. produced DNA in a test tube.

* 1966 - The Genetic code was discovered.

| | U | C | A | G |
|---|--|--|--|--|
| U | UUU Phe UUC Phe UUA Leu UUG Leu | UCU Ser UCC Ser UCA Ser UCG Ser | UAU Tyr UAC Tyr UAA End UAG End | UGU Cys UGC Cys UGA End UGG Trp |
| C | CUU Leu CUC Leu CUA Leu CUG Leu | CCU Pro CCC Pro CCA Pro CCG Pro | CAU His CAC His CAA Gln CAG Gln | CGU Arg CGC Arg CGA Arg CGG Arg |
| A | AUU Ile AUC Ile AUA Ile AUG Met | ACU Thr ACC Thr ACA Thr ACG Thr | AAU Asn AAC Asn AAA Lys AAG Lys | AGU Ser AGC Ser AGA Arg AGG Arg |
| G | GUU Val GUC Val GUA Val GUG Val | GCU Ala GCC Ala GCA Ala GCG Ala | GAU Asp GAC Asp GAA Glu GAG Glu | GGU Gly GGC Gly GGA Gly GGG Gly |

Genetic Code

* 1983 - "Genes are able to change position on chromosomes" - Barbara McClintock.

* Late 1980s - An international team of scientists began the project to map the human genome.

* 1990 - Gene therapy, first used for Patient.

Chromosomal disorders :-

* Chromosomal disorders arise in various ways as non-disjunction (an error in nuclear division which involves a pair of chromosomes that failed to separate and are carried to one pole), translocation, deletion, duplication and inversion.

Table : Some chromosomal disorders

| | Syndrome | Karyotype | Main clinical features |
|----|------------------------|------------|--|
| 1. | Down's Syndrome | Trisomy 21 | Short, broad hands, decreased muscle, mental retardation, broad head, open mouth with large tongue. |
| 2. | Edward's Syndrome | Trisomy 18 | Small eyes, mouth and nose, severe mental deficiency, congenital heart defects and double kidney. |
| 3. | Turner's Syndrome | 45, X | Female with retarded sexual development, usually sterile, short stature, webbing of skin in neck region, hearing impairment. |
| 4. | Klinefelter's Syndrome | 47, XXY | Male infants with small testes, may have some breast development, tall, mild mental deficiency, long limbs. |

Topic

Date

CHROMOSOMAL DISORDERS

Mendelian disorders such as haemophilia, sickle-cell anaemia and phenylketonuria are due to the mutant allele and their defective products.

However, disorders can also be created by imbalance in chromosomal number and chromosomal rearrangement.

These are called as chromosomal disorders.

Examples :-

- * Down's syndrome
- * Klinefelter's syndrome
- * Turner's syndrome
- * Edward's syndrome

DOWN SYNDROME PHYSICAL CHARACTERISTICS



DOWN

SYNDROME



"DOWN'S SYNDROME"

also called - trisomy 21

→ Down syndrome is a genetic disorder caused when abnormal cell division results in extra genetic material from chromosomes 21.

HISTORY :-

- * It is named after John Langdon Down, the British physician who described the syndrome for the first time in 1866.

COMPLICATIONS :-

- * Heart defects
- * Blood disorder that can include leukemia, and immune system problems.

SYMPTOMS :-

- * Developmental - delayed development, learning disability, short stature or speech delay in a child.
- * Eyes :- lazy eye or spots.

Common :- difficulty thinking and understanding, single line on palm, congenital heart disease, displacement of the tongue, hearing loss.

DIAGNOSIS :-

- * Chorionic Villus Sampling (CVS) - Examines material from the placenta.
- * Amniocentesis - Examines the amniotic fluid.

TREATMENT :-

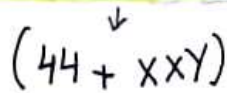
- * Early intervention programmes with a team of therapists and special educators who can treat each child's specific situation are helpful in managing Down's Syndrome.

CASE STUDY :-

"American Idol" contestant inspired by a friend with Down's Syndrome.



KLINEFELTER-SYNDROME



- Genetic disorder that affects males.
- * It occurs when a boy is born with one or more extra X-chromosome.
 - * Trisomic disorder.

HISTORY :-

- * In 1942, Dr. Harry Klinefelter, and his coworkers found nine men with small testes, aspermatogenesis, elevated urinary gonadotrophin and gynecomastia. These persons were later designated as Klinefelter's Syndrome.

COMPLICATIONS :-

- * Anxiety and Depression
- * Infertility, Breast Cancer, lung disease
- * Weak bones, Dupuytren's contracture and rheumatoid arthritis.

SYMPTOMS :-

- * Undescended Testicles, Taller than average height.
- * Slow motor development.
- * Breast tissue development, decreased facial hair.

DIAGNOSIS :-

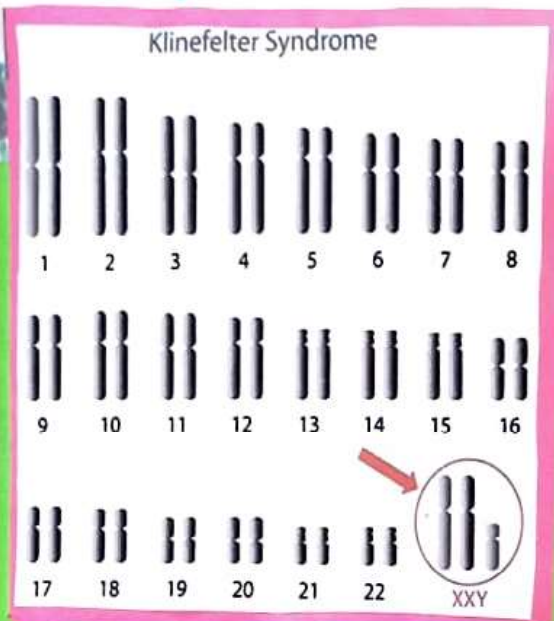
- * Hormone testing
- * Chromosome analysis

TREATMENT :-

- * Testosterone Replacement therapy
- * Breast tissue removal
- * Speech and physical therapy
- * Fertility treatment

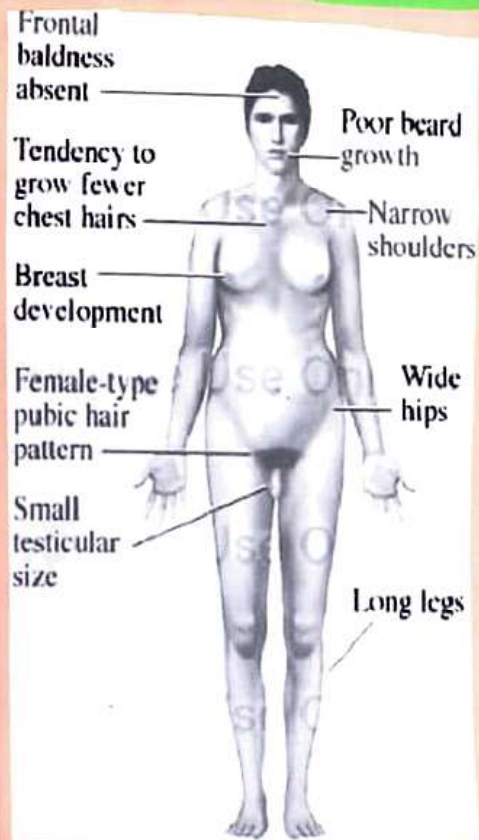
CASE STUDY :-

A case of a 45 year old gentleman with Klinefelter syndrome with schizophrenia-like psychosis and seizure disorder.



TRISOMIC

DISORDER



MENDELIAN DISORDERS

These are mainly determined by mutation in the single gene, therefore also called gene related human disorders.

They are transmitted to the offspring as per Mendelian principles. The pattern of inheritance of such disorders can be traced in a family by the pedigree analysis.

Some common and prevalent Mendelian disorders are as follows:

| DISORDER | DOMINANT / RECESSIVE |
|------------------------|----------------------|
| 1. Haemophilia | X-linked, Recessive |
| 2. Colour Blindness | X-linked, Recessive |
| 3. Sickle cell Anaemia | Autosomal, Recessive |
| 4. Phenylketonuria | Autosomal, Recessive |
| 5. Thalassemia | Autosomal, Recessive |

PHENYL-

KETONURIA

BACKGROUND

- ESSENTIAL AMINO ACID INVOLVED IN SYNTHESIS OF PROTEINS, NEUROTRANSMITTERS & HORMONES
- ACQUIRED THROUGH PROTEIN SUPPLEMENTS IN DIET



PHENYLKETONURIA (PKU)

- GENETIC DISORDER CAUSED BY DEFICIENCY IN PHENYLALANINE HYDROXYLASE (PAH)
- HELPS BREAK DOWN PHENYLALANINE INTO TYROSINE
- IF PHENYLALANINE CONVERTED TO PHENYLKETONES EXCRETED IN URINE
- BUILD UP OF PHENYLALANINE & PHENYLKETONES

DIAGNOSIS

- NEONATAL SCREENING



SIGNS & SYMPTOMS

- WIDESPREAD TESTING FOR PKU IN NEONATAL SCREENING MAKES CLINICAL MANIFESTATIONS RARE
- TYPICALLY ASYMPTOMATIC UNTIL START OF BREASTFEEDING OR STANDARD INFANT FORMULA
- IF NOT DETECTED IN NEWBORN, ONSET INSIDIOUS & MAY NOT CAUSE SYMPTOMS UNTIL EARLY INFANCY
- DEVELOPMENTAL DELAYS, INTELLECTUAL DISABILITY, BEHAVIORAL PROBLEMS, SEIZURES, SKIN DISORDERS




TREATMENT

- DIETARY RESTRICTION OF NATURAL PROTEIN TO PREVENT ACCUMULATION OF PHENYLALANINE IN BODY
- DIET DRINKS & FOODS CONTAINING ASPARTAME ALSO ELIMINATED BECAUSE OF PHENYLALANINE CONTENT
- MOST FRUITS & VEGETABLES CAN BE EATEN
- SUPPLEMENTATION WITH MEDICAL FOODS CONTAINING PHENYLALANINE-FREE PROTEIN SUBSTITUTES PROVIDING MOST OF BODY'S PROTEIN REQUIREMENTS
- MILD CASES: SYNTHETIC FORM OF PAH CALLED SAHPROTERBY GIVEN TO MAKE DIET LESS RESTRICTIVE & MANAGE BLOOD LEVELS
- PEGVALANSE (RECOMBINANT ENZYME CONVERTING PHENYLALANINE TO NON-TOXIC METABOLITES) USED IN ADULTS WITH HIGH LEVELS



Phenylketonuria

www.medinaz.com



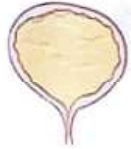
- Mental retardation
- Hypopigmentation
- Increase Tyrosine in diet
- Mousy odor
- Seizure
- Eczema
- Autosomal recessive
- ↑↑ Phenylketones in urine

MED NAZ

PHENYLKETONURIA

Nc1ccc(cc1)CC(=O)O

PHENYLALANINE



PHENYLKETONES in URINE

- INTELLECTUAL DISABILITY
- PSYCHIATRIC DISORDERS
- SEIZURES

PHENYL KETONURIA

- * It is one of the most common defects of amino acid metabolism.
- * Most common inherited metabolic diseases affecting brain development.

HISTORY :-

- Dr. Asbjorn Folling, a Norwegian biochemist and physician, first published the description of Phenylketonuria (PKU) as cause of Mental Retardation in 1934.

COMPLICATION :-

- Neurological problems such as seizures and tremors.
- Major health and development problems.

SYMPTOMS :-

- * At birth, No symptoms.
- * At adult :-
 - ↳ Skin rashes, such as eczema.
 - ↳ Lighter skin, hair and eye colour.
 - ↳ Mental health disorder, small head size.

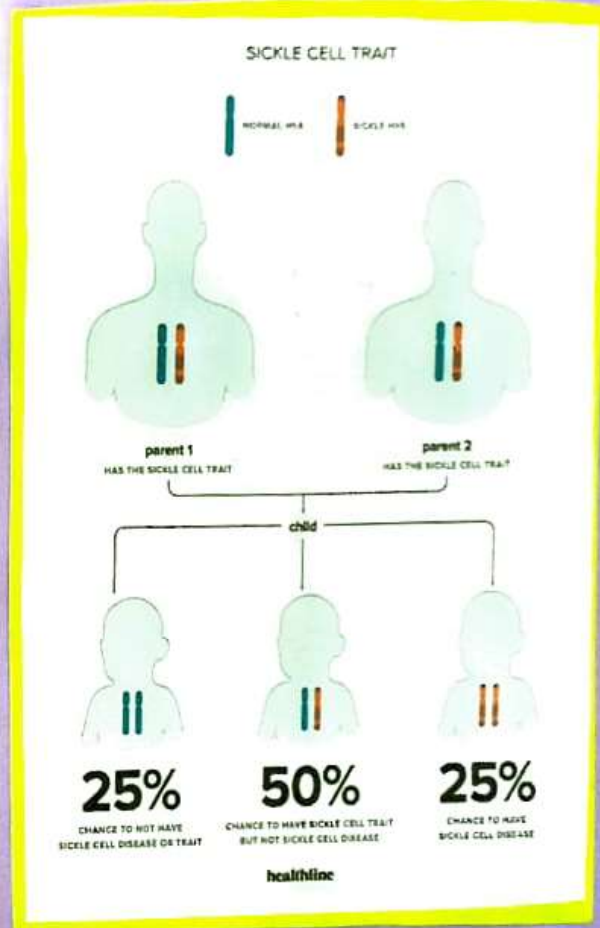
TREATMENT :-

- A low-protein diet and controlled intake of many other foods.
- Novel enzyme therapy for adults.

• SYMPTOMS :-

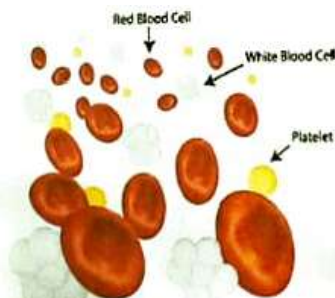
- * Anemia sickle cells break apart easily and die.
- * Swelling of hands and feet.
- * Episodes of Pain. Periodic episodes of extreme pain, called pain crises.
- * Delayed growth or Puberty
- * Vision Problems.

SICKLE-CELL ANEMIA

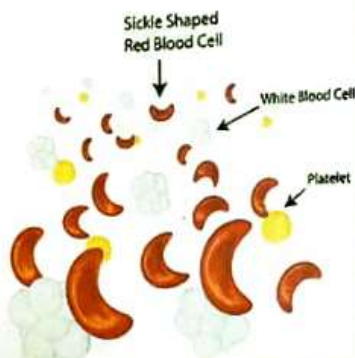


Sickle Cell Anemia

Normal



Sickle Cell Anemia



SICKLE CELL ANAEMIA

"also called Sickle cell disease"

A group of disorders that cause red blood cells to become misshapen and break down.

- * RBCs contort into a sickle shape. The cells die early leaving a shortage of healthy RBCs.

HISTORY :- Discovery-1910

- * First discovery made in western medicine, A physician of Chicago published the first medicine paper about a blood sample that showed sickle-shaped Red Blood cells.

COMPLICATIONS :-

- * Acute chest syndrome.
- * Anemia, Blood clots, Kidney Problems.
- * A vascular Necrosis (Death of tissue bone)
- * Dactylitis (Hand-foot syndrome)

DIAGNOSIS :-

- * Blood test and Genetic test:
 - Genetic test can help determine which type of sickle cell disease you have.
- * Prenatal Screening:-
 - Diagnose sickle cell disease before a baby is inborn.
- * Newborn screening :-

Thalassemia Symptoms



Fatigue



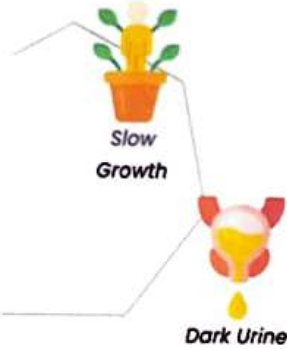
Weakness



Pale Or Yellowish Skin



Facial Bone Deformities



Slow Growth



Abdominal Swelling

Dark Urine

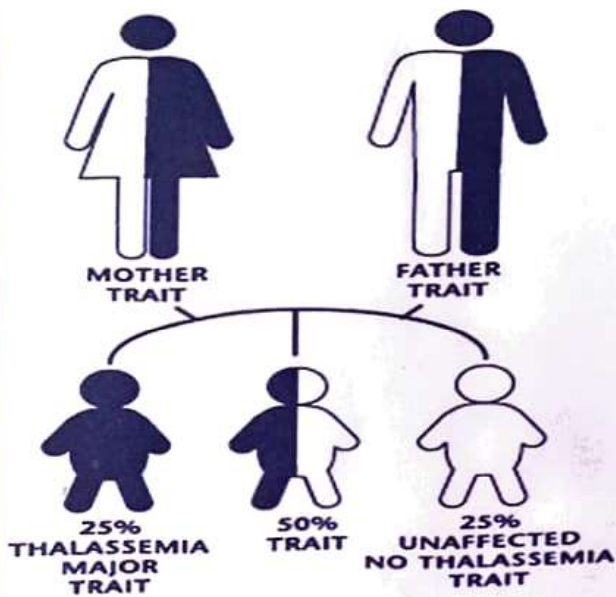
Types Of Thalassemia



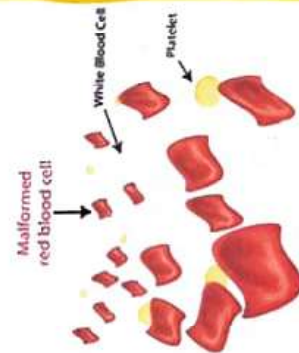
Alpha-Thalassemia



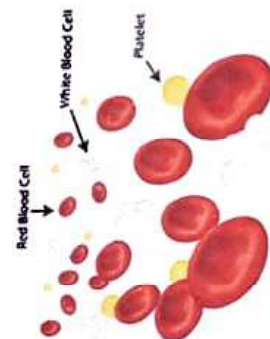
Beta-Thalassemia



Thalassemia



Normal



* Thalassemia is an inherited blood disorder that affects your body's ability to produce hemoglobin and healthy red blood cells.

* Types include **alpha** and **beta** thalassemia. Thalassemia may cause you to experience anemia-like symptoms that range from mild to severe.

HISTORY :-

* Thalassemia, or Mediterranean anemia was first described in 1925 by a Detroit physician who studied Italian children with severe anemia (low levels of RBCs), poor growth, huge abdominal organs and early childhood death. In 1946, the cause of thalassemia was found to be an abnormal Hemoglobin structure.

DIAGNOSIS :-

- * Blood test
- * Blood smear
- * Hb Electrophoresis

TREATMENT :-

- * Blood transfusion
- * Folic Acid Supplements
- * Iron Chelating therapy

Caru

REFERENCE :-

- 17 Hans-Hilger Ropers, New perspectives for the elucidation of genetic disorders. *The American Journal of Human Genetics*, 2007.
- 18 *The principles of Biochemistry* by Lehninger
- 19 *Elements of Genetics*

MAA BHARTI P. G. COLLEGE, KOTA



Submitted By :

Vasudha Gautam

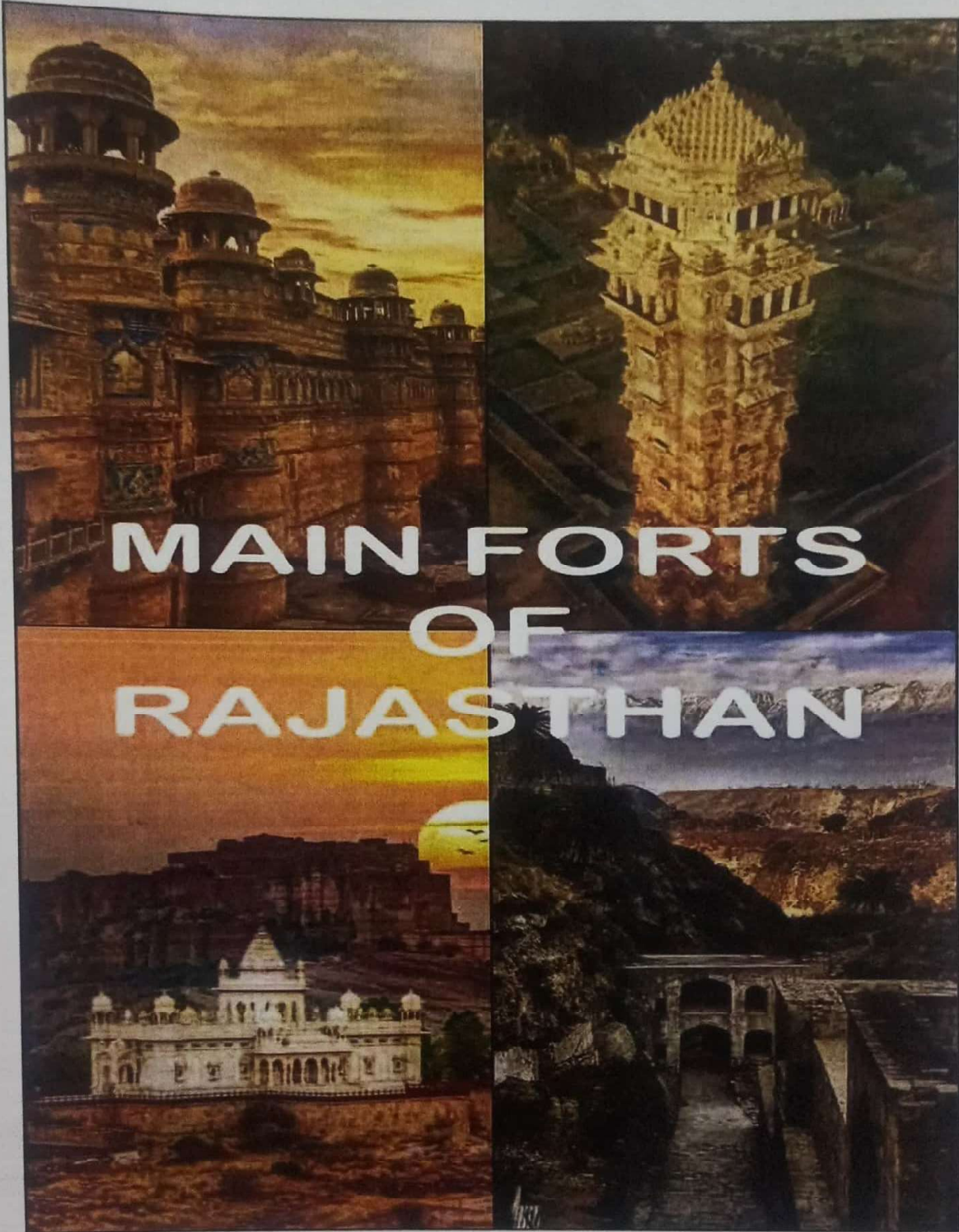
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Akanksha Malav

Neha Galav

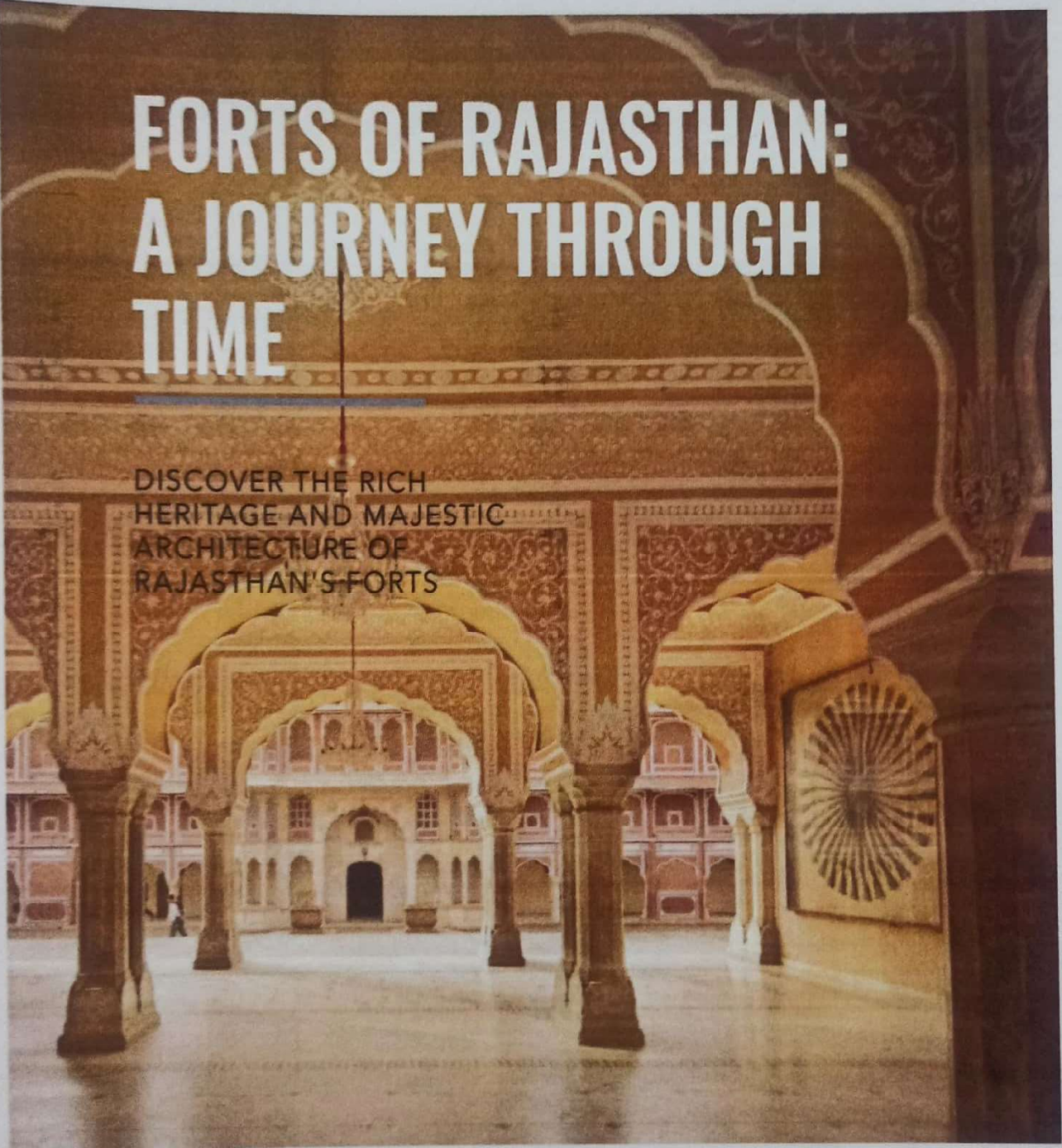
Satyendra Singh Solanki

Jorawar Singh



FORTS OF RAJASTHAN: A JOURNEY THROUGH TIME

DISCOVER THE RICH
HERITAGE AND MAJESTIC
ARCHITECTURE OF
RAJASTHAN'S FORTS



India since time memorial is known all over the world for its rich culture, art and exemplary architecture. Although, the temple architecture of India is highly sort after, little is known about the military architecture of ancient India.

The architecture of Indian forts was an important aiding element to the culture of warfare prevalent in the country. While some Indian forts were merely constructed for defence purposes, some massive fortresses were also built to display power and authority.

At the time of wars and sleges, these forts decided the fate of the kingdoms as they were the only thing that stood between victory and defeat. Thus, they were looked upon as symbols of both glory and bloodshed.

The forts were constructed in order to influence the people, showcase the wealth, power and glory of a king. Most of the forts were actually castles. But in 17-18 century British used the word forts for castles. Most of the forts were constructed between 1300-1800 A.D.

MEHARANGARH
FORT, JODHPUR
- VARIOUS
GALLERIES



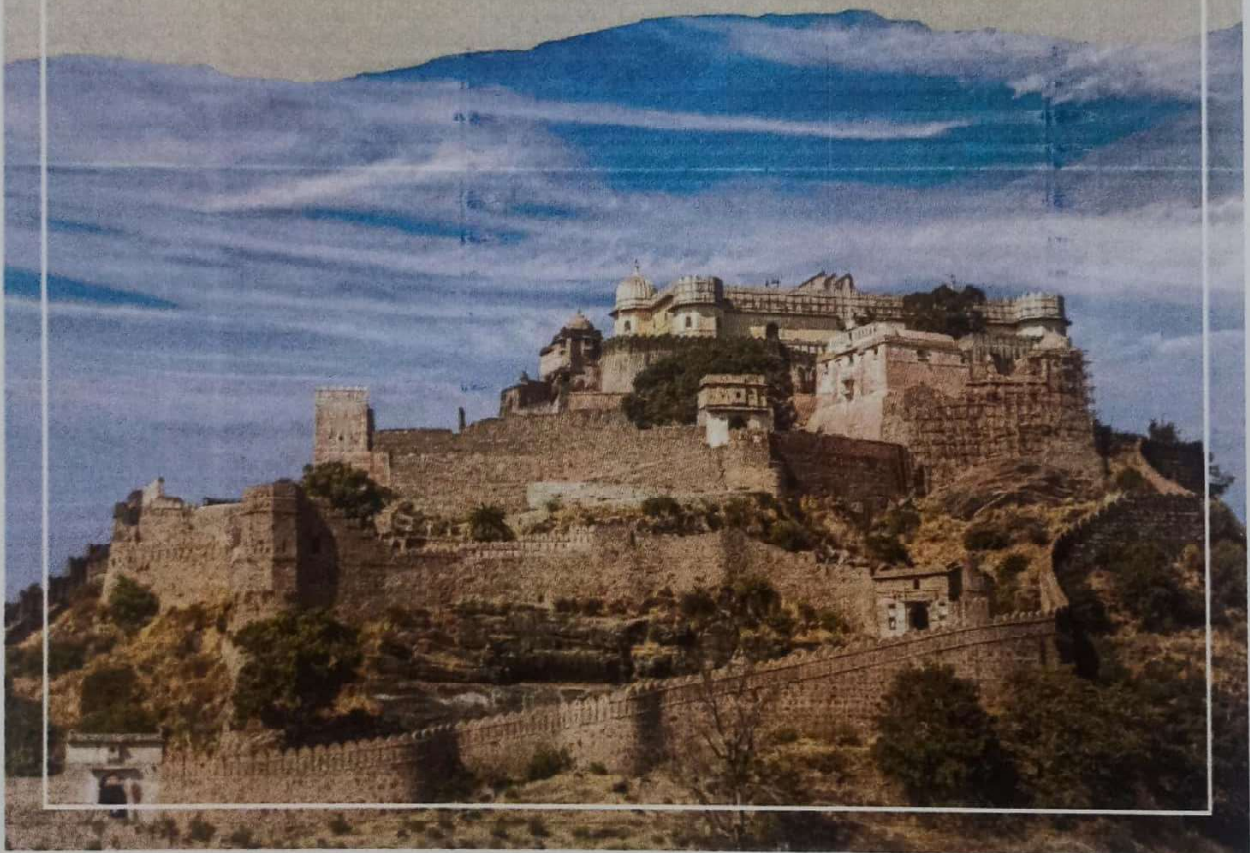
The mighty Mehrangarh Fort is truly one of the most famous historical forts in Rajasthan. The fort's foundation was laid way back in 1458 by Rathore ruler Rao Jodha. The Citadel of the Sun, Mehrangarh was the pride of the Jodhpur clan and was not once sieged.

It remains impregnable. The fort has hidden numerous mysteries and scandals intriguing people to visit. The fort is a museum where the lifestyle of the Rathore clan and even Mughals is preserved. Now that you are impressed with the magnificent sight let's get inside for the hidden treasures.

Attractions inside the Mehrangarh Fort

The introduction of the Mehrangarh fort is complete with the mention of its massive size. Inside the fort walls lurk many allures. The list of attractions in Mehrangarh fort is quite extensive. Start with the attractive Moti Mahal, Phool Mahal, Sheesh Mahal, Daulat Khana, and the Takhat Niwas. The Turban Gallery and Folk Musical Instruments Gallery are intriguing to explore. The exhibits are informative and offer insight into the culture of the olden days.

KUMBHALGARH FORT,
UDAIPUR - 2ND LONGEST
CONTINUOUS WALL



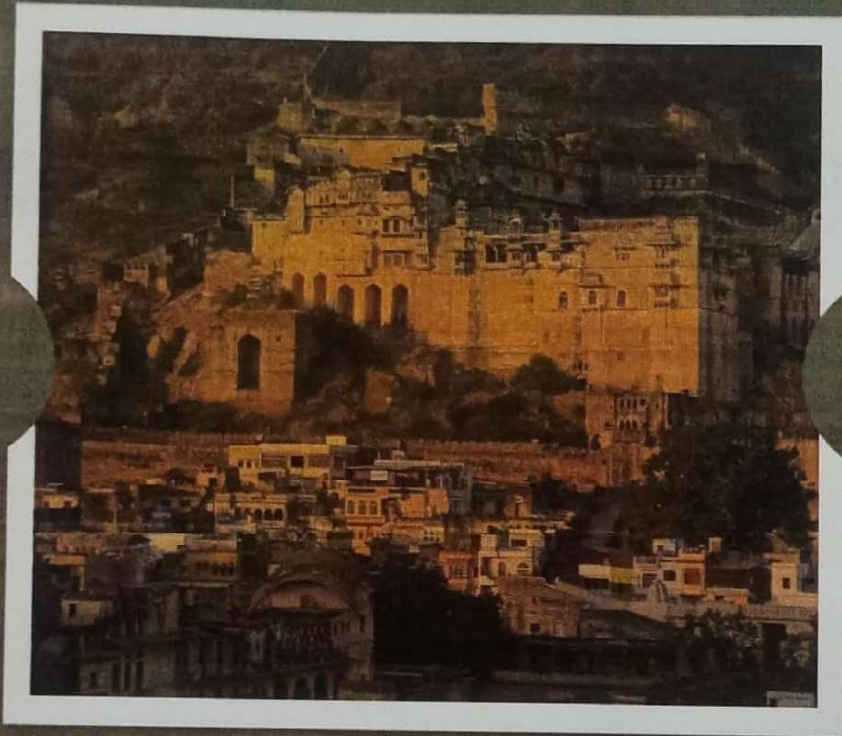
The massive Mewar Fortress, Kumbhalgarh Fort, dates back to the 15th century. It is among the best historical fort of Rajasthan. Built by Rana Kumbha on an impregnable hill, Kumbhalgarh is also the birthplace of the legendary Maharana Pratap, the great warrior king of Mewar.

The fort has a 36 kilometers long continuous wall, the second-longest continuous wall after the Great Wall of China. The colossal Kumbhalgarh has a host of attractions waiting to be explored.

Attractions inside the Kumbhalgarh Fort

Step inside the massive fortress of Kumbhalgarh and gather your senses. The huge fort has so much to be seen. The recommended attractions to check out are the remnants of incredible royal mansions, which take you on a trip to the ancient days.

Walk by the lush green gardens, of note see the wells known as 'baoris'. The architecture of the Kumbhalgarh fort is excellent. Do not miss the remarkable 'Badal Mahal' and the Shiva Temple.



TARAGARH FORT, BUNDI -
STUNNING ARCHITECTURE

Taragarh Fort in Bundi is one of the magnificent forts of Rajasthan. The fort overlooking the city of Bundi has sadly been ravaged by time. Built in 1354 A.D., the fort was a marvelous creation of the Chauhan dynasty.

The gateway to the fort, Lakshmi Pol, Gagudi ki Phatak, and Phuta Darwaza, is decked with stone statues of elephants. The architecture is an interesting display of Rajputana glory. You will feel transported to the olden days as you discover the fort.

Attractions inside the Bundi Fort

Though Taragarh Fort has been ravaged by time, the attractions housed in the fort still retain their appeal. First, visit the beautiful Rani Mahal. You can marvel at the interesting murals, artwork, and lattice artworks.

The Bhim Burj and Garbha Gunjan, the vast field cannons, are a reminder of the excellent military efficiency. Do not miss the excellent water reservoirs and an excellent network of tunnels.

NAHARGARH FORT,
JAIPUR - GORGEOUS
ARAVALLI HILL VIEWS



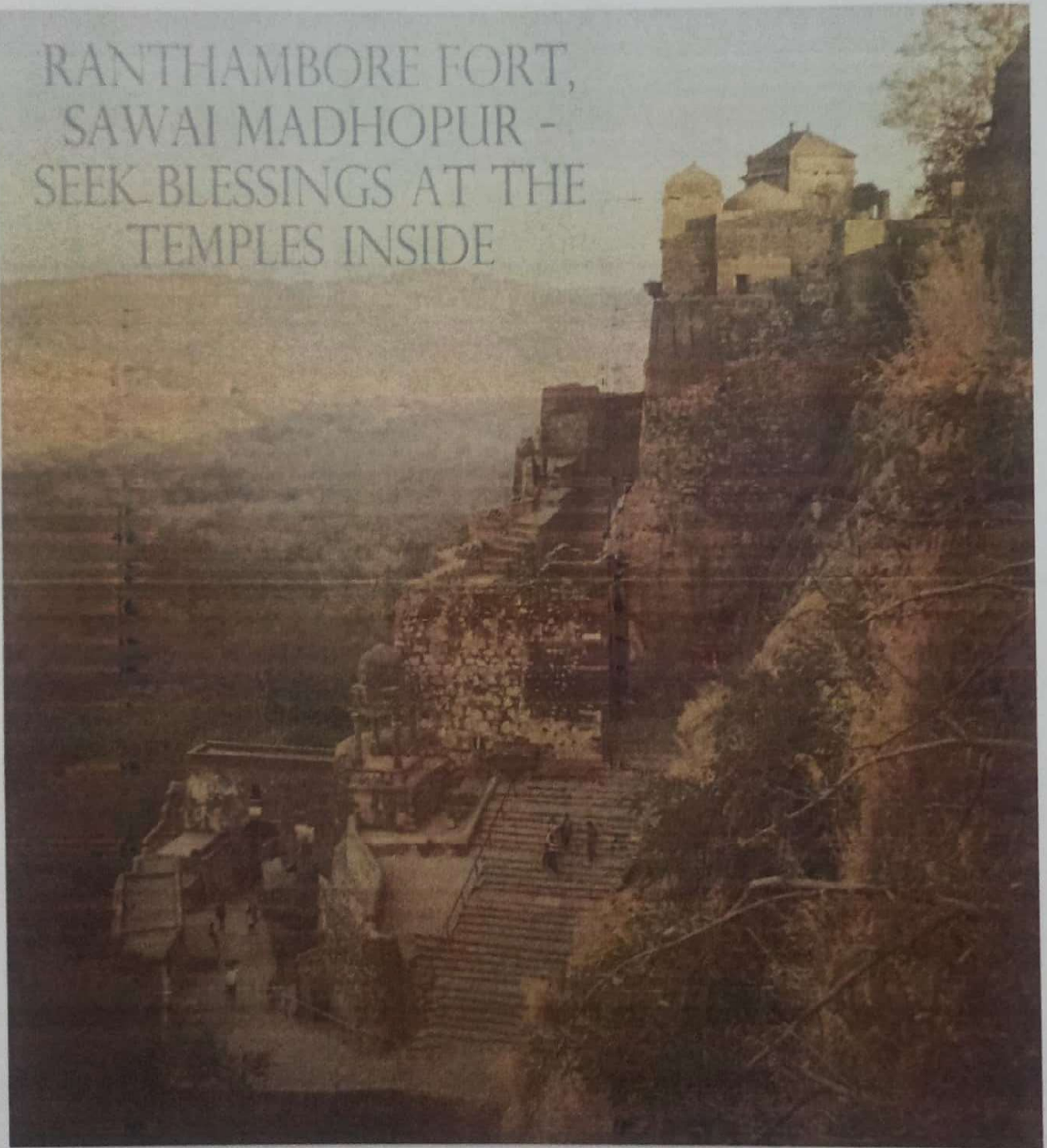
Overlooking the Pink city of Jaipur, the Nahargarh Fort is perched on the Aravalli Hills. It was built in 1734 as a summer retreat by Maharaja Sawai Jai Singh II. Tigers and other animals even frequented the fort that royalty hunted for leisure.

Throughout its history, the fort has never witnessed any attacks. It was built to strengthen the military prowess of the royal family. It is one of the famous forts of the royal Rajasthan, with amazing attractions within the fort.

Attractions inside the Nahargarh Fort

Explore the attractions of Nahargarh Fort. From here, the beautiful view of Jaipur City will impress you. The 'Madhavendra Bhawan' is a two-story building built by Sawai Madho Singh for the king and his twelve queens. Also, learn the art of warfare at the weapons museum.

RANTHAMBORE FORT,
SAWAI MADHOPUR -
SEEK BLESSINGS AT THE
TEMPLES INSIDE



Ranthambore Fort is housed in Sawai Madhopur. It was built on the former hunting grounds of the royalty and was used as a game sanctuary. Nagil Jats built this fort in the 10th century, and thus, it is among the oldest remnants of the royalty of Rajasthan..

Currently, the Ranthambore fort is mainly in ruins. Do not get alarmed by the calls or a view of the royal Bengal Tiger or other wild animals as the area is possessed by wilderness.

Attractions inside the Ranthambore Fort

Ranthambore Fort has a horde of forgotten relics. The attractions to be explored include Hammir's Court, Badal Mahal, Dhula Mahal, and Jogi Mahal. They represent the forgotten glory of the royalty that used to visit for a game.

In addition, the Ganesha Temple, Shiva Temple, Ramlalji Temple, and temple of Lord Sumatinath and Lord Sambhavanath are interesting to explore.