

4. Kingdom Animalia



Can you recall?

1. What is the basis for classification ?
2. Who proposed Five Kingdom classification system?
3. What is the need and importance of classification?

You are familiar with animals, their general characteristics and great diversity observed in this group. Let us learn about how this diverse group is classified systematically.

4.1 Criteria used for animal classification:

Grades of organization - Cellular, Cell-Tissue, Tissue-Organ, Body Symmetry- Assymetry, Radial Symmetry, Bilateral Symmetry, Body Cavity - Acoelomate, Pseudocoelomate, Coelomate. Germ Layers -Diploblastic, Triploblastic. Segmentation- Unsegmented, Segmented.

4.2 Animal body plan :

a. Cell aggregate plan : In this body plan, cells do not form tissues or organs. Their is minimal differentiation and division of labour among cells. It is found in porifera.

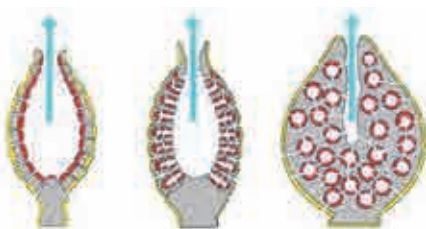


Fig. 4.1 Sponge

b. Blind sac body plan : In this body plan, body is like a sac with single opening. Digestion is carried out in this sac-like structure where ingestion and egestion takes place through same opening. e.g. Members of Phylum Cnidaria.

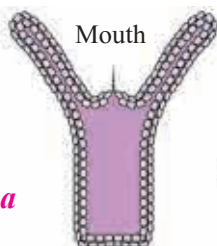


Fig. 4.2 Hyd a

c. Tube within tube body plan : Digestive system is present in tube-like body cavity. Mouth and anus are present at two separate ends of digestive system. Annelida onwards all phyla show this type of body plan.

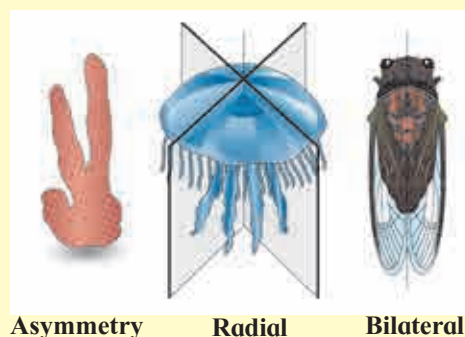
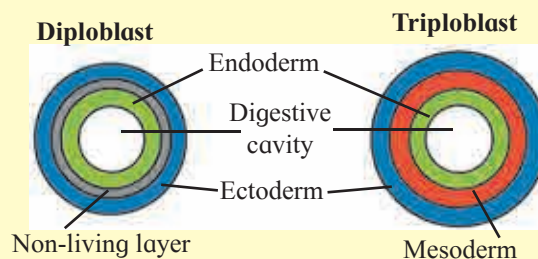


Fig. 4.3 Fish



Observe and Discuss

Observe the diagram given below and discuss the criterias of classification.



Types of Symmetry

4.3 Animal Classification :

1. Phylum : Porifera

(pori-pores; feron-bearing)

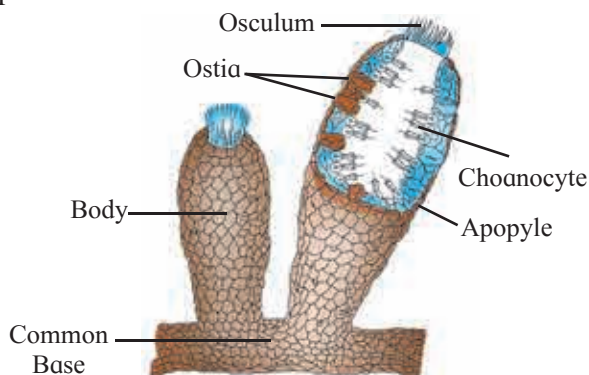
e.g. *Scypha*, *Euspongia* (Bath sponge), *Euplectella* (Venus' flower basket)

These are aquatic animals, most of them are marine and few are fresh water. They are also called 'sponges'.

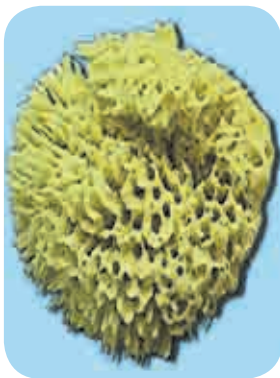
Most of them have asymmetrical body. Body of these animals consists of many cells with little division of labour. Hence their body is considered as a colony of different types of cells.

These are sedentary animals. On their body, they bear numerous minute pores called 'ostia' through which water enters in the body cavity- spongocoel. Water leaves the body through single large opening called 'osculum'.

Water is circulated in the body through the 'canal system'. During its circulation, cells of the animal body absorb food, exchange respiratory gases and release excretory products.



a. *Sycon*



b. *Euspongia*



c. *Euplectella*

Fig. 4.4 Animals - Porifera

Spongocoel is lined by special flagellated cells called 'choanocytes' or 'collar cells'. Beating of flagella creates water current.

Body of these animals is supported by calcareous or siliceous 'spicules' or proteinaceous 'spongin fibers'.

They reproduce asexually as well as sexually. Asexual reproduction is performed by fragmentation and gemmule formation. These animals have ability of regeneration. Sexual reproduction is performed by formation of gametes. Fertilization is internal. Development takes place through indirect larval stage.

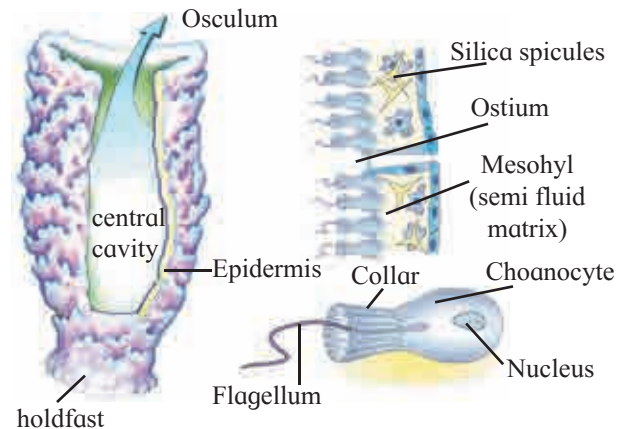


Fig. 4.5 Typical Sponge body



Internet my friend

Which are the larval stages of Porifera?

2. Phylum : Cnidaria

e.g. *Hydra*, *Aurelia* (Jelly fish), *Physalia* (Portuguese man-of-war), *Adamsia* (sea anemone), *Diploria* (Brain coral), *Gorgonia* (sea fan).

They are aquatic, mostly marine and few are fresh water forms. They are sessile or free swimming. They show radial symmetry and are diploblastic with blind-sac body plan. Animals exhibit two body forms. Polyp is cylindrical form (*Hydra*) and medusa is umbrella-like (*Aurelia* - Jelly fish).

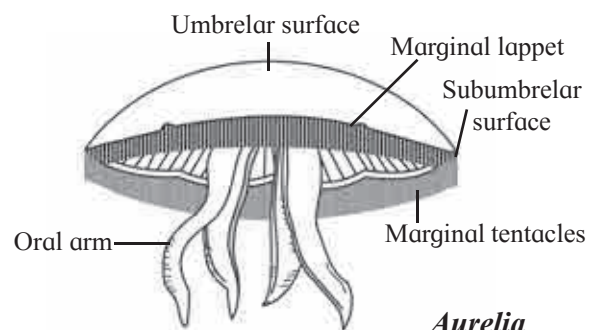


Fig. 4.6 Animal of Cnidaria

Body cavity is meant for circulation as well as digestion. Hence called gastrovascular cavity or coelenteron. Tentacles bear cnidoblasts or stinging cells which are meant for anchorage, offence and defence. Cnidarians reproduce both asexually and sexually. Asexual reproduction takes place by budding and regeneration. Sexual reproduction takes place by gamete formation. They exhibit alternation of polypoid generation with medusoid generation. This phenomenon is called metagenesis i.e. polyps produce medusae asexually and medusae produce polyps sexually. (e.g. *Obelia*)

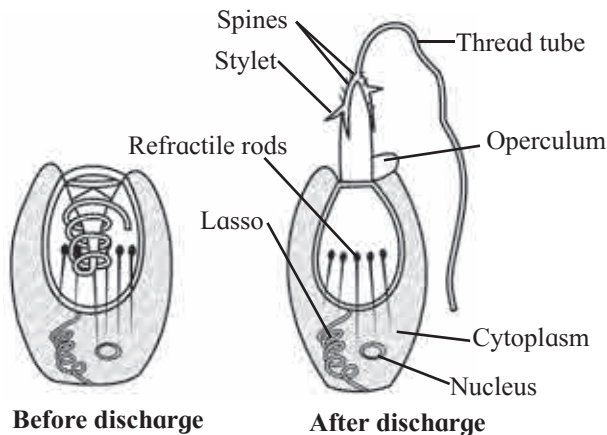


Fig. 4.7 Cnidoblast

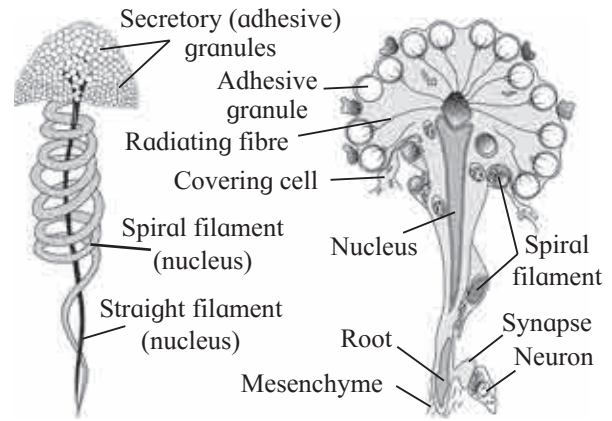


Find out

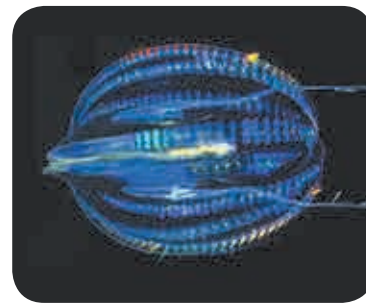
Information about coral reef and sea fan.

3. Phylum : Ctenophora

These are commonly called comb jellies or sea walnuts. These are exclusively marine, free swimming animals. Body is diploblastic, radially symmetrical with blind-sac body plan. Animals have tissue-level organisation. Locomotion is carried out by eight rows of ciliated comb plates. Characteristic feature of ctenophores is bioluminescence. Like cnidarians, ctenophores also exhibit extra and intracellular digestion. Reproduction is sexual with indirect development. Cnidoblasts are absent hence these are called acnidarians. Instead, they have colloblasts (sticky cells) to capture the prey. Ctenophora is represented by very few members, hence it is considered as one of the minor phyla. e.g. *Pleurobrachia*, *Ctenoplana*.



Colloblast



Pleurobrachia

Fig. 4.8 Animal of Ctenophora

4. Phylum : Platyhelminthes (platy-flat, helminth -worms)

e.g. *Planaria*, *Taenia* (Tapeworm), *Fasciola* (Liver fluke).

Body of these animals is dorso-ventrally flattened, hence are called as flat worms. Animals are acoelomate, triploblastic showing organ-system grade of organization. Mostly endoparasitic and few are free-living. Parasitic forms show presence of hooks and suckers for attachment to the body of host. Body is covered by cuticle (in parasites) or cilia (in free-living forms). Digestive system is generally absent in parasitic forms, but in free-living forms, it is incomplete (blind-sac plan). Animals have flame cells or protonephridia, helpful for excretion and osmoregulation. Animals are hermaphrodite (bisexual). Self fertilization is seen. Few have high power of regeneration and show polyembryony.

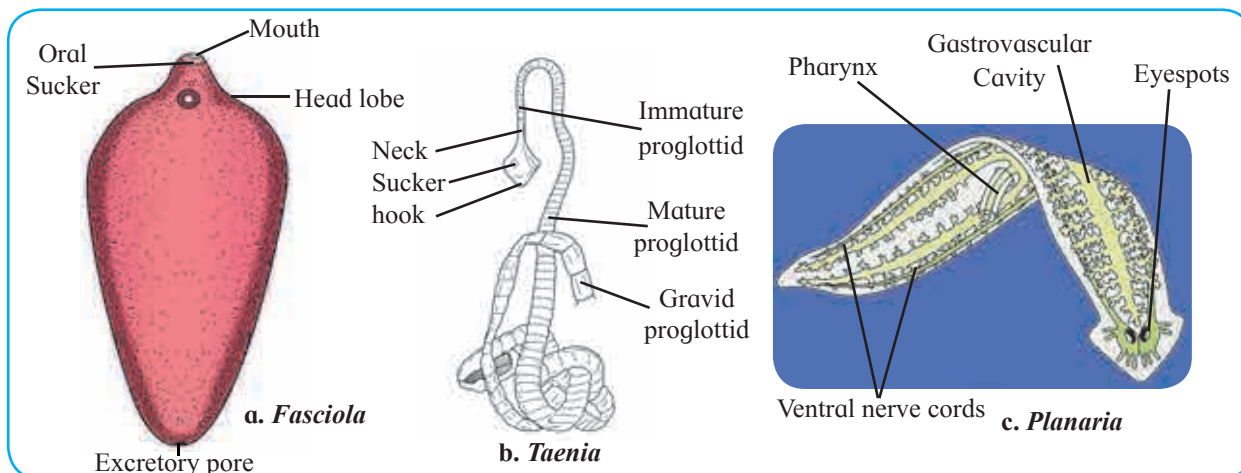


Fig. 4.9 Animals of platyhelminthes

5. Phylum : Aschelminthes (ascus-sac, helminth-worm) / Nematelminthes (nema-thread)

e.g. *Ascaris* (Roundworm), *Wuchereria* (filarial worm), *Ancylostoma* (hook worm).

These are mostly parasitic, few forms are free-living. Body is long, cylindrical, thread like, circular in cross-section, hence are called round worms. They are triploblastic, bilaterally symmetrical, pseudocoelmate, with tube within tube body plan. Body is covered by tough and resistant cuticle. Body wall has longitudinal muscles but no circular muscles. Alimentary canal is complete with mouth and anus at opposite ends. Pharynx is well developed and muscular. Excretion takes place by canals or gland cells. Excretory products are eliminated through excretory pore. Nervous system has nerve ring and nerves. Animals are unisexual i.e. sexes are separate. Animals like *Ascaris* shows sexual dimorphism. Usually female is longer and broader and have straight posterior end. Male is shorter and narrower and has curved posterior end with a pair of penial setae for copulation. Fertilization is internal. Development may or may not include larval stage.

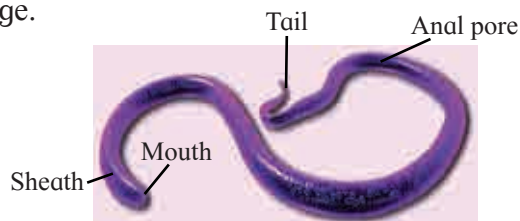
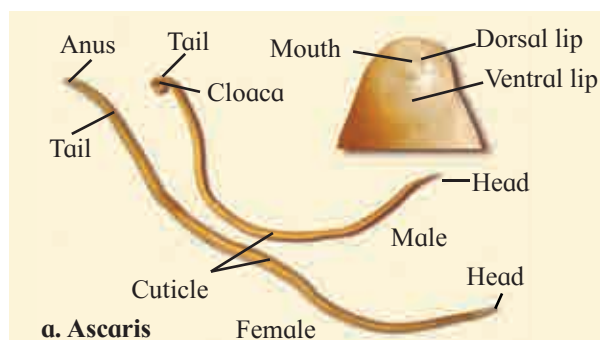


Fig. 4.10 Wuchereria



b. Ancylostoma hookworm

Fig. 4.11 Animals of Aschelminthes



Can you tell?

1. State parasitic adaptations in liverfluke and *Ascaris*.
2. Give example of free living platyhelminth.

6. Phylum : Annelida (Annulus : Ring)

e.g. *Nereis*, *Pheretima* (Earthworm), *Hirudinaria* (Leech).

They are commonly called ring worms or segmented worms. Animals may be aquatic and few may be ectoparasitic or free living or burrowing in moist soil. They show bilateral symmetry with metameric segmentation.

A special region of the body called - clitellum is present. Locomotion is with the help of longitudinal and circular muscles. Locomotory structures like setae (earthworm), parapodia (*Nereis*) or suckers (leech) are present. Alimentary canal is complete. Exchange of gases takes place through body wall. Circulatory system is of closed type. Excretion and osmoregulation is carried out with the help of nephridia. Nervous system consists of nerve ring and ventral nerve cord. Nerve cord is ventral, solid and ganglionated. Mostly hermaphrodites and few are dioecious (*Nereis*).

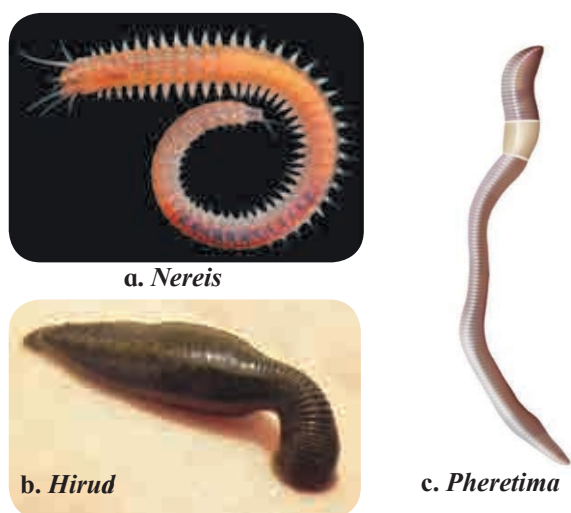


Fig. 4.12 Animals of Annelida



Always Remember

All animals from Annelida onwards are triploblastic, coelmate with organ system level of organization.



Find out

1. What are the merits and demerits of hermaphroditism?
2. Why are leeches used in Ayurveda?
3. What is the role of earthworms in agriculture? What is vermicompost?

7. Phylum : Arthropoda (Arthros : Joint, Podos : leg)

e.g. Cockroach, Butterfly, Scorpion, Millipede, Prawn.

This is largest phylum of kingdom animalia. These animals have jointed appendages, hence the name -Arthropoda. These are omnipresent and solitary or colonial, most of them are free-living (Barnacles are sedentary). Few are parasitic and sanguivorous (female mosquito, bed bug). Their body is bilaterally symmetrical, triploblastic, eucoelomate, metamerically segmented with tube within tube body plan and organ-system level of organization. Body is covered by tough, non-living chitinous exoskeleton. Hence, they need periodic moulting (ecdysis). Body is divided into head, thorax and abdomen.

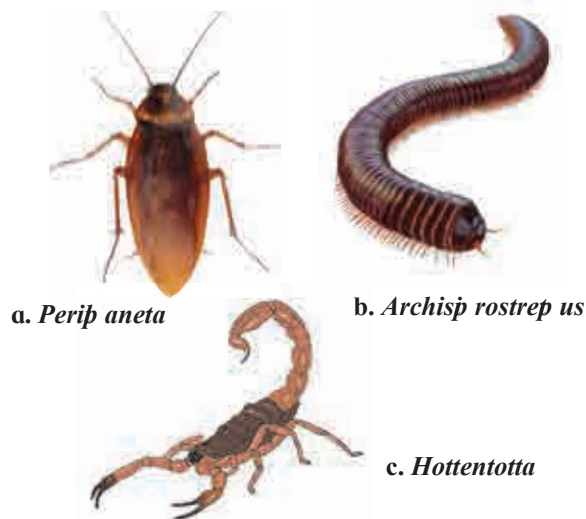


Fig. 4.13 Animals of Arthropoda

Digestive system is complete. Circulatory system is of open type, blood flows through body cavity (haemocoel). Respiratory organs are gills, trachea, book lungs, book gills. Excretion takes by green glands, Malpighian tubules or coxal glands. Nervous system is formed by nerve ring and double, ventral, ganglionated nerve cord. Sense organs are well developed in the form of antennae, simple or compound eyes, various receptors. Sexes are separate showing sexual dimorphism, fertilization is generally internal, development is direct or indirect by metamorphosis. In some arthropods like honey bees, bugs etc. offsprings are produced by parthenogenesis. Some insects exhibit polymorphism e.g. honey bee, ants, termites etc. Some arthropods are economically important such as *Apis* (honey bees) for their honey and wax.

Lac is produced by *Laccifer lacca* (Lac insect). Lobsters, prawns and crabs are edible, silk worms produce silk. Some arthropods are harmful which acts as vector e.g. mosquito. *Locusta* (locust) is a gregarious pest. *Limulus* (King crab) is known as living fossil.



Find out

1. Why is phylum arthropoda considered as most successful phylum?
2. What do we mean by parthenogenesis?
3. What do we mean by living fossil?
4. How the bees produce honey?
5. What will happen if arthropods do not moult?

8. Phylum : Mollusca (Mollis : soft)

e.g. *Pila*, Bivalve, *Octopus* (devil fish), *Sepia* (cuttle fish), *Chaetopleura* (Chiton), *Pinctada* (Pearl oyster), *Loligo* (Squid), *Aplysia* (Sea hare), *Dentalium* (Tusk shell).

This is second largest phylum. Molluscs are either free living or sedentary. They are aquatic or seen in marshy places. Few are terrestrial. These are soft bodied and show tube within tube body plan. These are bilaterally symmetrical, but few are asymmetrical due to torsion (twisting). Body is divisible into head, foot and visceral mass. Visceral mass is enclosed in thick muscular fold of body wall called mantle. Mantle secretes a hard calcareous shell, the shell may be external or internal or absent. Muscular foot is present on ventral side.

Digestive system is well developed, complete with anterior mouth and posterior anus. Buccal cavity has a rasping organ called radula which is provided with transverse rows of teeth. Aquatic forms show numerous feather like gills called ctenidia, useful for aquatic respiration. Gills are present in mantle cavity. (space between visceral mass and mantle) Terrestrial forms may show presence of lungs.

Circulatory system is of open type (except *Sepia*, which possesses closed type). Blood contains a copper containing blue respiratory pigment called haemocyanin. Excretion occurs by kidneys, also called as organ of Bojanus. Nervous system is formed by three pairs of ganglia. Ganglia are interconnected by commissures and connectives. Sense organs such as eyes for vision, tentacles for tactile sensation, osphradia for testing purity of water are present. Sexes are separate, animals are mostly oviparous, development is direct or indirect.

Economic importance -

Pearl oyster gives precious pearls. Many molluscs are edible. Shells of molluscs are rich source of calcium.



Can you tell?

1. Explain the term metameric segmentation.
2. Give characteristics of Arthropoda.
3. Enlist harmful Arthropods.
4. Why do Molluscs have shell?



a. *Spisula*



b. *Chaetopleura*



c. *Pila*



d. *Sepia*



e. *Octopus*

Fig. 4.14 Animals of Mollusca

9. Phylum : Echinodermata

(Echinus - Spines, derma - skin)

e.g. *Asterias* (Sea star), *Cucumaria* (Sea cucumber), *Echinus* (Sea urchin), *Antedon* (sea lily), *Ophiothrix* (Brittle star).

These are exclusively marine, solitary, sedentary or free-living and gregarious, benthic.

These are radially symmetrical animals with pentamerous symmetry. Body may be spherical, elongated or star-shaped. Endoskeleton is made up of calcareous ossicles. Spines are present on the body, hence the name echinodermata. The body is without definite body divisions, instead, there are two sides as oral and aboral.

The peculiar character is presence of water vascular system in which water enters through madreporite. This system is used in locomotion, food capturing, respiration, etc. Digestive system is complete. Mouth is ventrally present on oral surface and anus on aboral surface.

Respiration is performed by peristomial gills, papillae, respiratory tree, etc. Circulatory system and excretory system is absent.



a. *Antedon*



b. *Ophiothrix*



c. *Asterias*



d. *Cucumaria*

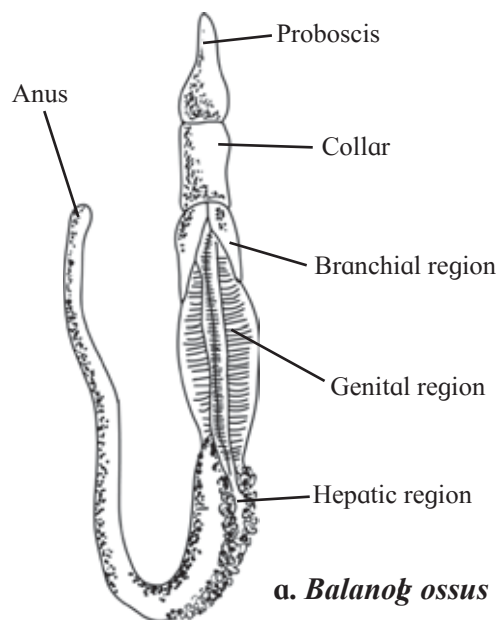
Fig. 4.15 Animals of Echinodermata

Nervous system is simple with a nerve ring around mouth and radial nerves in the arms. Sexes are separate (sometimes bisexual), fertilization is external, development is indirect. They show high power of regeneration.

10. Phylum : Hemichordata (Hemi : Half, Chordata : Rod)

e.g. *Balanoglossus*, *Saccoglossus*.

Earlier, this Phylum was considered as sub-phylum of Chordata because buccal diverticulum was considered as notochord. But, now it is placed as a separate phylum of Non-chordata. These are exclusively marine animals, usually living at the bottom of sea in burrows. Mostly these are free living but the animals like *Rhabdopleura* are sedentary. Body is soft, vermiform, unsegmented and divided into three parts - proboscis, collar and trunk. Buccal cavity gives rise to rod-like buccal diverticulum which is considered as notochord by some scientists.



a. *Balanoglossus*



b. *Saccoglossus*

Fig. 4.16 Animals of Hemichordata

Alimentary canal is complete, straight or 'U' shaped. Respiration occurs by numerous gills, arranged in two longitudinal rows, present in the pharyngeal region. Gills open by gill slits.

Circulatory system is simple and open type. Excretion occurs with the help of glomerulus. Nervous tissue is embedded in epidermis on both dorsal and ventral sides. The sexes are separate (sometimes bisexual). Fertilization is external and development is indirect through free swimming larva. This phylum is the connecting link between non-chordata and chordata.



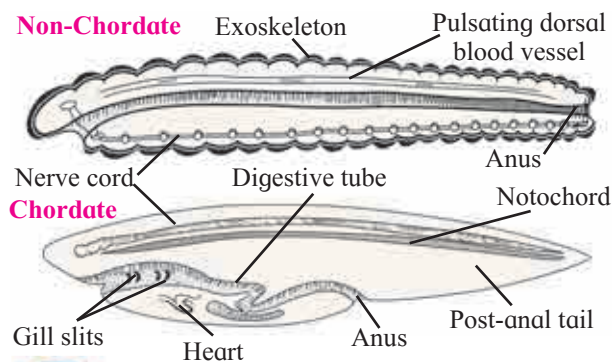
Can you tell?

1. Give salient features of Phylum Echinodermata.
2. Hemichordata is the connecting link between non-chordata and chordata. Give reasons.



Observe and Discuss

Compare and contrast between Chordates and Non-chordates.



Find out

Why *Balanoglossus* is considered as connecting link between Non-Chordates and Chordates?



Do you know ?

Notochord is flexible rod-like structure of vacuolated cells. It is located along the dorsal side of chordate embryos. It gives support to the body and provides attachment to muscles.

11. Phylum : Chordata

Chordates are characterised by presence of cartilagenous notochord at least in early embryonic life, presence of gill slits in the pharyngeal (neck) region, presence of hollow, dorsal nerve cord running through out the length of body and ventral heart.

Phylum Chordata is divided into three subphyla-Urochordata, Cephalochordata and Vertebrata. Urochordata and Cephalochordata are collectively called Protochordates.

a. Subphylum : Urochordata or Tunicata

e.g. *Herdmania*, *Salpa*, *Doliolum*.

These are also called as tunicates or ascidians. They are exclusively marine. Body is soft and covered by 'test' or 'tunic' which is made up of tunicine. Notochord is present only in the tail of larva, hence the name, urochordata. Notochord is lost during metamorphosis. Pharynx has many gill slits. Closed circulatory system is present. Development is indirect.



a. *Herdmania*



b. *Ascidia*

Fig. 4.17 Animals of Urochordata

b. Subphylum : Cephalochordata

e.g. *Branchiostoma* (*Amphioxus* or *Lancelet*)

They are exclusively marine. These are also called as lancelet, which are small fish like animals that rarely exceed 5 cm in length.

Lancelets partly live burried in soft marine sediments. Notochord extends throughout the length of body and present throughout the life. Myotomes (muscle blocks) are present. Post-anal tail is present. Closed circulatory system is present. Blood is without pigment.

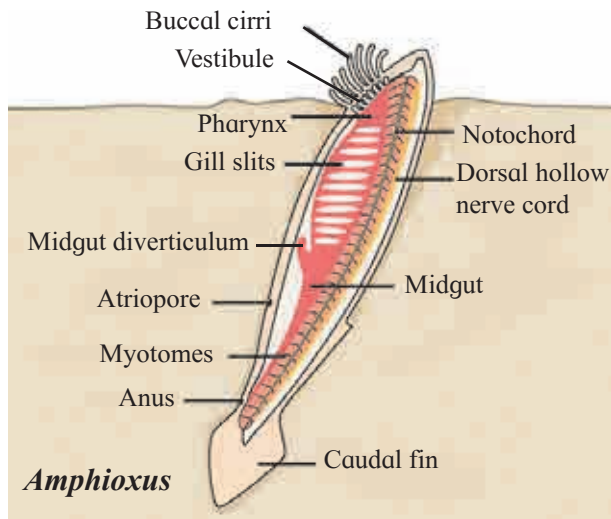


Fig. 4.18 Animal from Cephalochordata

c. Subphylum : Vertebrata

In these chordates, notochord is replaced by cartilaginous or bony vertebral column. It is divided into two divisions - *Ag athostomata* (no jaws) and *Gnathostomata* (jaws present).

1. Division : *Ag athostomata*

This division includes the lowest or most primitive vertebrates, which are without jaws. They include only one class of living vertebrates - the Cyclostomata.

Class : *Cyclostomata* (Cyclos : Circular, Stoma - mouth) Lat/Grk.

e.g. *Petromyzon* (Lamprey), *Myxine* (Hagfish).

Cyclostomes are jawless and eel-like animals. Skin is soft, smooth containing unicellular mucus glands, but no scales. Median fins are present but paired fins are absent. They are ectoparasites. They have sucking and circular mouth without jaws. Cranium and vertebral column made up of cartilage.



Sea lamprey



Detail of mouth

Fig 4.19 *Petromyzon*

Digestive system lacks stomach. Respiration occurs by 6 to 15 pairs of gills slits. Gills slits are without operculum. Heart is two chambered with one auricle and one ventricle. Gonad is single, large and without gonoduct. Fertilization is external. They are anadromous i.e. migrate for spawning to fresh water from their marine habitat. After spawning, they die within few days. Larvae metamorphose and then migrate to ocean.



Can you tell?

1. *Herdmania* is called a Chordate. Explain.
2. Give characteristics of *Petromyzon*.
Comment on its mode of nutrition.

2. Division : Gnathostomata

It is divided into two superclasses - Pisces (bear fins) and tetrapoda (bear four limbs).

A. Superclass : Pisces

These are aquatic animals. These are poikilothermic (body temperature changes according to the change in surrounding temperature). Lateral line system is present which shows presence of rheoreceptores for detection of water current. Locomotion is by body muscles and fins. Caudal fin acts as steering wheel. Exoskeleton is of dermal scales. Endoskeleton is either bony or cartilagenous. Body is streamlined and boat shaped. This feature offers minimum resistance during swimming. Respiration is by gills. Heart is two chambered and is ventral in position. It shows single and closed circulation. Heart always shows presence of deoxygenated blood, so it is described as venous heart. They have well developed brain with large olfactory lobes. Sexes are separate. Most fishes are oviparous and some are viviparous.

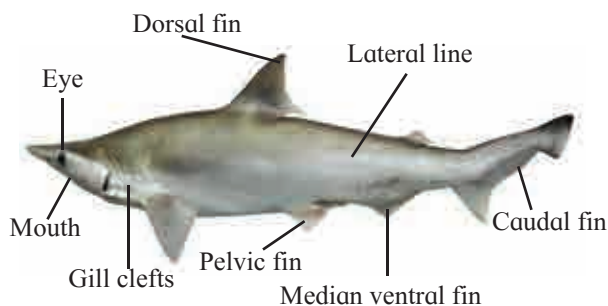
Superclass Pisces is divided into two classes as below.

1. Class Chondrichthyes :

(chondron : cartilage, ichthyes : fish)

e.g. *Scoliodon* (dog fish), *Pristis* (sawfish), Electric ray, Common skate, Hammer headed shark.

Carcanodon (great white shark), *Trygon* (Sting ray)



a. *Scoliodon*



b. *Anoxypristis*

Fig 4.20 Animals from chondrichthyes

Chondrichthyes includes the animals in which endoskeleton is cartilaginous. These are exclusively marine. Exoskeleton is formed of placoid scales. Teeth are modified placoid scales which are backwardly directed. Mouth is ventral in position. There is single dorsal fin and 2 pairs of lateral fins (pectoral and Pelvic). Caudal fin is heterocercal (Asymmetrical). Five to seven pairs of gill slits are present. They are not covered by operculum. Air bladder is absent hence these fishes need to swim constantly so that they do not sink. They are predatory fishes. Some of them have electric organs e.g. *Torpedo* - (electric ray) and some have poison sting e.g. *Trygon* - (sting ray) as organs of offence and defence. Male copulatory organs called claspers are present. Fertilization is internal. Many of them are viviparous.

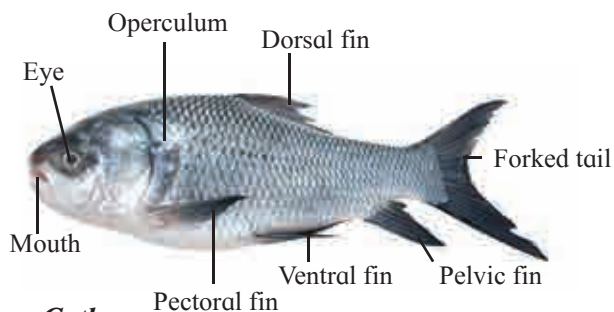
2. Class : Osteichthyes

(Osteon : bone , ichthyes : fish)

e.g. Bombay duck, Lung fishes (*Protopterus*, *Lepidosiren*)

Exocoetus (flying fish), *Hippocampus* (sea-horse), *Pomphret*, *Labeo rohita* (Rohu), *Catla* (Katla), *Clarias* (Magur), Aquarium fishes. *Betta* - (fighting fish), *Pterophyllum* (Angle fish).

Osteichthyes includes fishes in which bony endoskeleton is present, hence called as bony fishes. These are aquatic, present in both fresh and marine waters. Exoskeleton is formed of cycloid and ctenoid scales. Mouth is mostly terminal in position. They show two dorsal fins. Tail fin is formed by two equal lobes i.e. homocercal (symmetrical). Four pairs of gill slits are present, covered with operculum. Air bladder is present to maintain buoyancy. Claspers are absent. Fertilization is external. These fishes are oviparous.



a. *Catla*



b. *Exocoetus* (flying fish)



c. *Hippocampus* (sea-horse)

Fig 4.21 Animals from Osteichthyes



Can you tell?

1. Differentiate between Chondrichthyes and Osteichthyes on the basis of scales and caudal fin.
2. What is the lateral line system?
3. Why Piscean heart is called a venous heart?

B. Superclass : Tetrapd

These animals bear two pairs of appendages. Some animals like snakes are secondarily limbless.

Superclass tetrapoda includes four classes namely, Amphibia, Reptilia, and Mammalia.

1. Class : Amphibia

(Amphi : both, bias : life)

e.g. *Rana* (Frog), *Bufo* (Toad), *Salamandra* (Salamander), *Ichthyophis* (Limbless amphibian), *Hyla* (Tree frog).

Amphibia include the animals which live on land as well as in water (fresh water only). They are poikilothermic animals. Body is differentiated into head and trunk. Neck and tail is usually absent in many adults with few exceptions. Two pairs of limbs arise from pectoral and pelvic girdles respectively. These help in locomotion. Skin is moist, glandular with mucous glands. Exoskeleton is absent. Eyelids are present. Tympanum represents the ear. Excretory products, digestive wastes and gametes are released through common chamber called cloaca. Circulatory system is of closed type. Heart is three chambered and ventral in position. RBCs are biconvex and nucleated. Respiration is by skin, lungs and buccopharynx. Nervous system is well developed. Sexes are separate. These are oviparous. Fertilization is external. Development is indirect through aquatic larval stage. They show metamorphosis.



a. *Anura*



b. *Bufo*



c. *Salamander*

Fig 4.22 Animals from Amphibia

2. Class : Reptilia

(Repere : to creep or to crawl)

e.g. *Naja naja* (Cobra), *Hemidactylus* (Wall lizard), *Chelonia* (Turtle), *Crocodylus* (Crocodile), *Testudo* (Tortoise), *Chameleon* (Tree lizard), *Bangarus* (Krait), *Vipera* (viper).



a. *Lizard*



b. *Crocodile*



c. *Tortoise*

Fig 4.23 Animals from Reptilia

Reptilia includes crawling animals. These are the first true terrestrial vertebrates. Few may be aquatic or semi-aquatic, also found in marshy area. Locomotion occurs by limbs. The limbs are pentadactyl and digits bear claws. Limbs help the animal to walk or creep. Snakes are limbless. Snakes crawl on their belly. Reptiles are poikilotherms. Skin is dry, non-glandular and covered by exoskeleton of epidermal scales or scutes, shields or plates. Lizards and snakes shed their skin periodically. Tympanum is present. Heart has two complete auricles, but ventricles are incompletely partitioned. So heart is not perfectly four chambered (except crocodile). Brain is well developed. The olfactory lobes and cerebellum are better developed than those of amphibians. Sexes are separate and show prominent sexual dimorphism. Fertilization is internal. They are oviparous (except viper, it is viviparous) and show parental care. .



Can you tell?

1. Amphibians do not have exoskeleton. Give reason.
2. Why are amphibians and reptilians called poikilotherms?

3. Class : Aves (Avis : bird)

e.g. *Columba* (Pigeon), *Psittacula* (Parrot), Flight less birds like *Struthio* (ostrich), *Kiwi*, *Aptenodytes* (Penguin), *Corvus* (crow), *Neophron* (Vulture), *Passer* (sparrow).

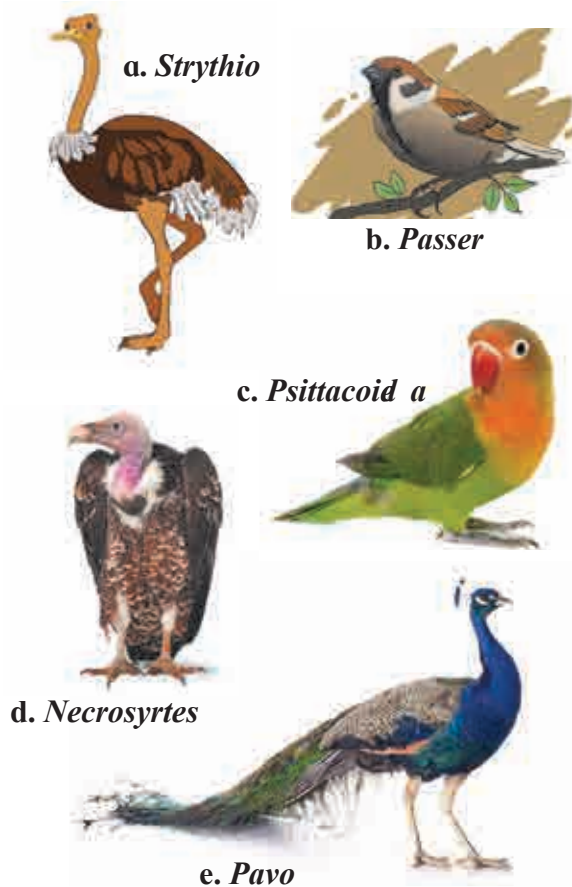


Fig 4.24 Aves

Forelimbs are modified into wings for flying (some birds have lost the capacity to fly e.g. Ostrich), hind limbs are used for walking, clasp tree branches and running. Aquatic birds have webs between their toes (e.g. Duck). Body is streamlined (Boat shaped) to reduce resistance during flight. These are homeotherms i.e. their body temperature remains constant. Exoskeleton is made up of feathers. Scales are present on hind limbs.

Body is differentiated into head, neck, trunk and tail. Skin is thin, dry, non-glandular except oil gland at the base of tail (uropygial gland). Bones are hollow (pneumatic) with air cavities to reduce body weight. Jaws are without teeth and modified into beak. Crop and gizzard are present in digestive system. Blood is red in colour due to presence of red blood cells. RBCs are biconvex and nucleated. Heart is perfectly four chambered. They show double circulation. Respiration takes place by lungs, having air sacs to increase the buoyancy. Brain is enlarged and has well developed cerebellum for equilibrium. Sexes are separate with prominent sexual dimorphism. These are oviparous. Fertilization is internal. Parental care is very well developed. Seasonal migration is seen in some birds.

Special features :- The urinary bladder is absent. The female shows presence of only left ovary and left oviduct. This helps to reduce body weight.

4. Class : Mammalia (mammas : breasts, nipples)

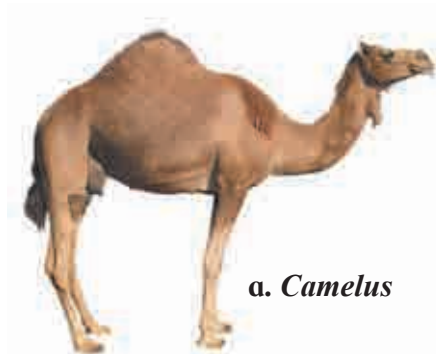
e.g. Bat, *Rattus* (Rat), *Macaca* (Monkey), *Camelus* (Camel), Whale, Human being, *Cannis* (dog), *Felis* (Cat), *Elephas* (Elephant), *Equus* (Horse), *Pteropus* (flying fox).
Oviparous - *Ornithorhynchus* (Platypus).
Viviparous - *Macropus* (Kangaroo).

Mammalia includes the animals having mammary glands (milk producing glands) for the nourishment of young ones. These are omnipresent. Mostly terrestrial, some are aquatic and few are aerial and arboreal. Limbs are the organs of locomotion and used for walking, flying, climbing, burrowing, swimming, etc. Body is differentiated into head, neck, trunk and tail. These are homeotherms. Exoskeleton is in the form of hair, fur, nails, hooves, horns, etc. Skin is glandular having sweat glands and sebaceous glands (oil glands). Mammary glands are modified sweat glands.

They have external ear (pinna). They show heterodont dentition. RBCs are biconcave and enucleated. Blood is red in colour. Heart is ventral in position and four chambered. Respiration takes place by lungs. Brain is highly developed. Cerebrum shows a transverse band called corpus callosum. Few mammals are oviparous (e.g. Duck billed platypus). Some have pouches for the development of immature young ones, these are called marsupials e.g. Kangaroo. Majority of mammals are placental and viviparous.



d. *Macropus*



a. *Camelus*



b. *Ornithorhynchus*



c. *Trachypithecus*

Fig 4.25 Mammals



Can you tell?

1. Give adaptations in aves for flying.
2. Aves and mammals are homeotherms. Give reason.
3. How mammals differ from other groups of animals.

Do yourself

Observe different animals in your surrounding, write detailed classification and write down the characteristics of animals in following format.

Picture / Photograph	Classification	Characteristics



Exercise

1. Choose correct option

- A. Which of the following belongs to a minor phylum?
a. Comb jelly b. Jelly fish
c. *Herdmania* d. *Salpa*
- B. Select the animal having venous heart.
a. Crocodile b. Salamander
c. Rohu d. Toad
- C. In *Ascaris*, _____.
a. mesoglea is present
b. endoderm is a discontinuous layer
c. mesoderm is present in patches
d. body cavity is absent
- D. Which of the following is incorrect in case of birds?
a. Presence of teeth
b. Presence of scales
c. Nucleated RBCs
d. Hollow bones
- E. Chitinous exoskeleton is a characteristic of _____.
a. *Dentalium* b. *Antedon*
c. Millipede d. Sea urchin

2. Answer the following questions

- A. Reptiles are known for having three chambered heart. Which animal shows a near four chambered condition in reptiles?
- B. The circulatory system has evolved from open to closed type in Animal kingdom. Which Phylum can be called first to represents closed circulation?
- C. Pinna is part of external ear and it is found in mammals. Do aves and reptiles show external ear in any form?
- D. Fish and frog can respire in water. Can they respire through their skin? If yes, why do they have gills?

- E. Birds need to keep their body light to help in flying. Hence, they show presence of some organs only on one side. How their skeleton helps in reducing their weight?
- F. Cnidarians and Ctenophorans are both diploblastic. Which other character do they have in common, which is not found in other Phyla?
- G. Crab and Snail both have a protective covering. Is it made up of the same material?
- H. Sponge and sea star show calcareous protective material. Do they belong to the same Phylum?
- I. Fish and snake both have scales. How do these scales differ from each other?
- J. Lower Phyla like Arthropods and Cnidarians show metamorphosis. Is it also found in any class of Phylum Chordata?

3. Draw neat labelled diagram

- A. *Sycon*
B. *Aurelia*
C. *Amphioxus*
D. *Catla*
E. *Balanoglossus*
F. *Scolidon*

4. Match the following

Phylum	Characters
i. Annelida	a. Tube feet
ii. Mollusca	b. Ostia
iii. Ctenophora	c. Radula
iv. Porifera	d. Parapodia
v. Echinodermata	e. Comb plates

5. Identify the animals given in pictures and write features of its phylum / class



A



B



C



D



E



F



G

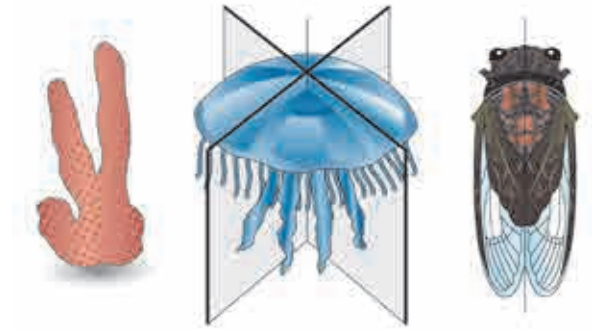


H



I

6. Observe and identify body symmetry of given animals



Practical / Project :

Study different animals in kingdom animalia and prepare the chart with detail scientific information.