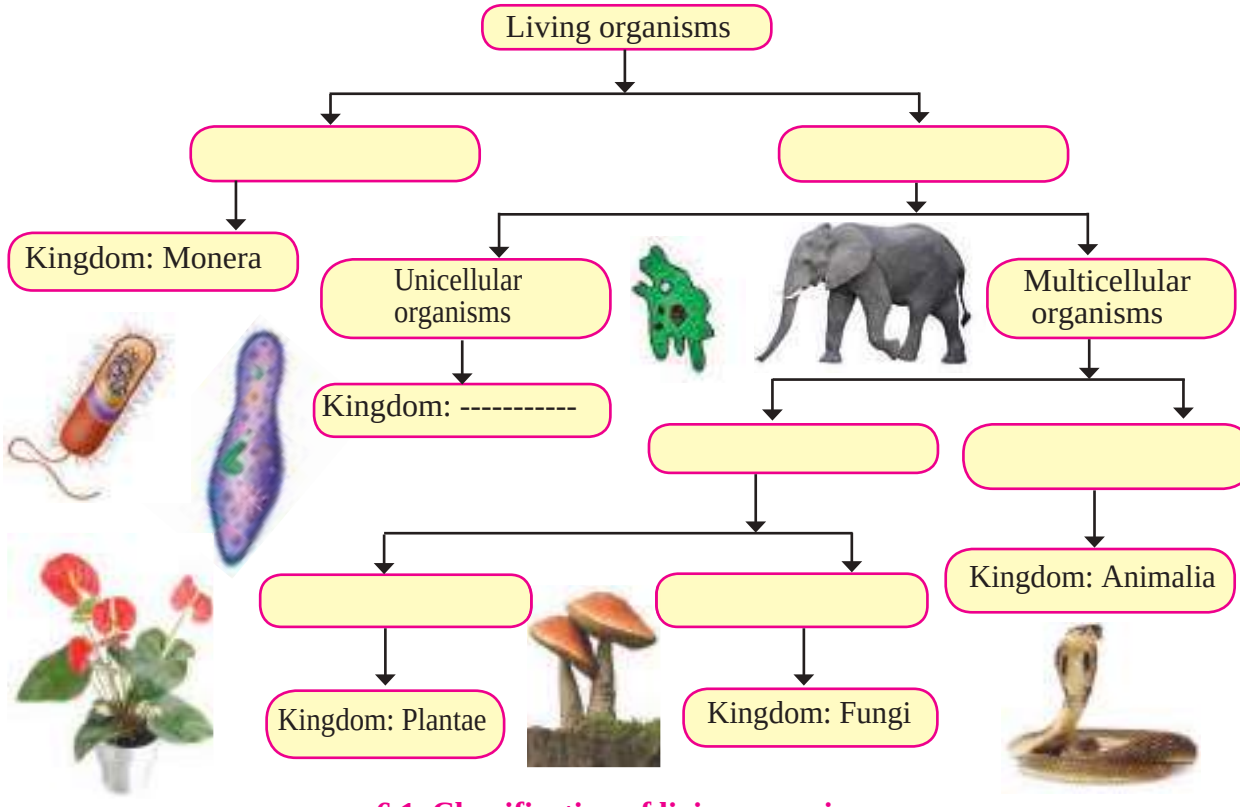
6. Animal Classification

- **History of animal classification**
- **New (method) system of animal classification.**
- **Kigdom- Animalia**.

Can you recall? Which criteria are used for classification of organisms?

You have studied the classification of living organisms in earlier classes. The living organisms present around us are mainly plants and animals. We have studied the criteria of their classification. With the help of that, complete the following chart.



6.1 Classification of living organisms

Can you recall? How the plants are classified?

We have studied the plants classification in last year. It helped us to understand the diversity of plants around us.

You must be looking varieties of animals around you. Some animals are too small whereas some are too big. Some animals are terrestrial where as some are aquatic. Some animals crawl on land, some swim in water whereas some fly in air. Some animals have scales on skin whereas some have feathers or hairs. In this way, there is huge diversity among the animals too. According to recent studies, estimated number of animal species on earth is approximately 7 millions. It is impossible to study each and every species. However, if groups and sub-groups of animals are formed depending upon the similarities & differences, it will make it very easy to study such vast variety of animals.

Formation of groups and sub-groups of animals depending upon similarities and differences among animals is called as animal classification.

History of animal classification

Time to time, different scientists have tried to classify the animals. Greek philosopher Aristotle was the first to perform the animal classification. Aristotle classified the animals according to the criteria like body size, habits and habitats. Further, as per the new developments in sciences, references were changed and thereby the criteria of animal classification too. Classification proposed by Aristotle is known as 'Artificial method'. Besides Aristotle, artificial method of classification was followed by Theophrastus, Pliny, John Ray, Linnaeus, etc. Later on, 'Natural system of classification' was followed. Natural system of classification was based on various criteria like body organization, types of cells, chromosomes, bio-chemical properties, etc. By the time, system of classification based on evolution was also brought into practice. It was used by Dobzhansky and Meyer. Recently, Carl Woese has also proposed the animal classification

Benefits of animal classification

1. Study of animals becomes convenient.
2. Study of few animals from a group helps to understand about that entire animal group.
3. It gives idea about animal evolution.
4. Animals can be easily identified with great accuracy.
5. It helps to understand the relationship of animals with other living organisms.
6. It helps to understand the habitat of each animal and it's exact role in the nature.
7. It helps to understand various adaptations shown by animals.

Traditional method of animal classification

Traditionally, depending upon presence or absence of the notochord, the animal kingdom has been divided into two groups- **Non-chordates and Chordates.**

A. Non-Chordates : Characters of non-chordate animals are as follows

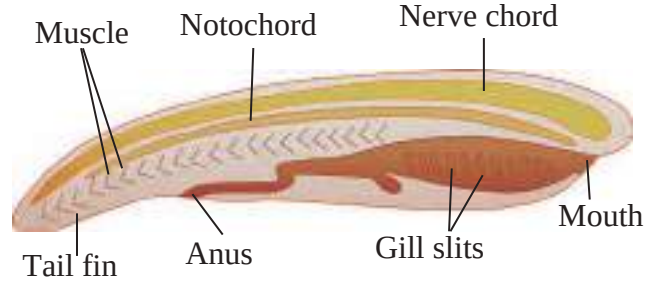
1. Body is not supported by rod-like notochord.
2. Pharyngeal gill-slits are absent.
3. Nerve cord; if present, it is on ventral side. It is solid & paired.
4. Heart, if present, it is on dorsal side.

Non-chordates are classified / divided into ten phyla. Those phyla are- Protozoa, Porifera, Coelentarata / Cnidaria, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Hemichordata

Chordates : Characters of chordates are as follows

1. Body is supported by notochord.
2. Pharyngeal gill-slits or lungs are present for respiration.
3. Nerve cord is present on dorsal side of body. It is hollow.
4. Heart is present on ventral side of body.

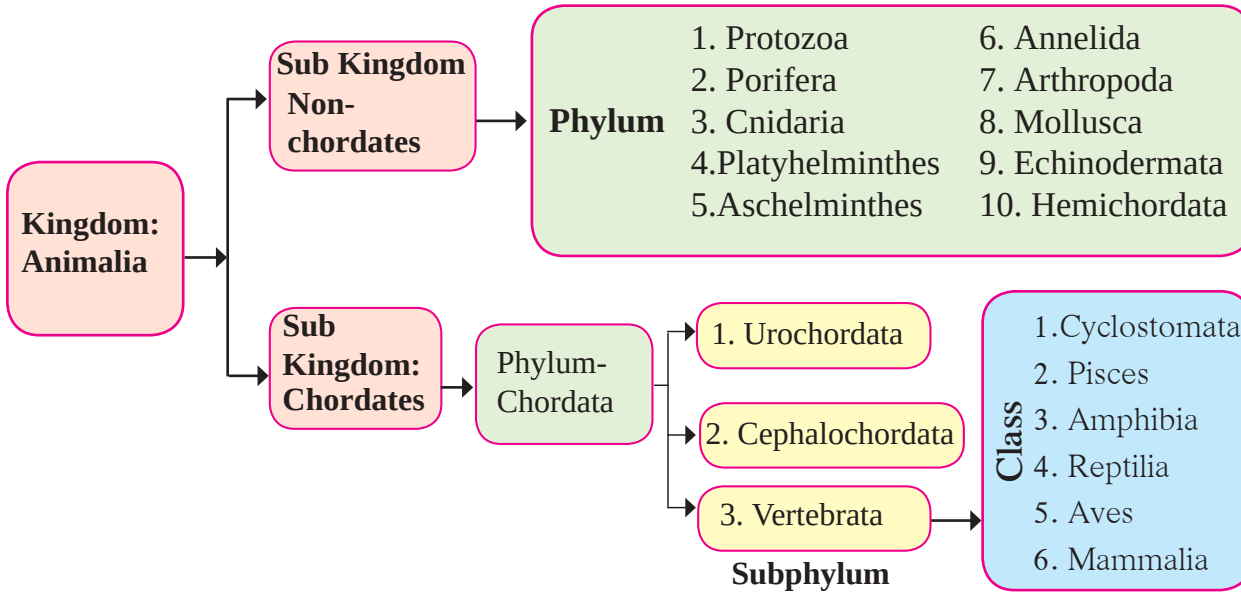
Notochord is a long rod like supporting structure present on dorsal side of animal body. It keeps the nerve tissue isolated from remaining body.



6.2 Charactristics of Chordates

Do you know?

All chordate animals are grouped together in a single phylum and the name of phylum is same i.e. Phylum- Chordata. This phylum has been divided into three subphyla as- Urochordata, Cephalochordata & Vertebrata. Sub-phylum Vertebrata has been further divided into six classes as- Class: Cyclostomata, Class: Pisces, Class: Amphibia, Class: Reptilia, Class: Aves and Class: Mammalia.



6.3 Conventional System of Animal Classification

This system of animal classification was in practice till now. However, now a days, new system of classification is followed. We will study this new system of animal classification in brief.

At present, according to the five kingdom classification system of Robert Whittaker, all multicellular animals are included in Kingdom: Animalia. This system of classification is based upon some criteria like Body organization, Body symmetry, Body cavity, Germinal layers, Segmentation, etc.

Criteria for new system of classification

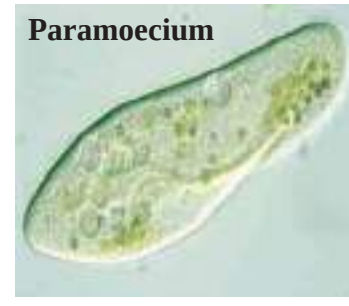
A. Grades of organization

Body of animals is made up of cells. In case of multicellular animals, many cells are performing different functions in their body while in unicellular animals, as their body is made up of single cell; all functions are performed by same cell only. Body organization of unicellular animals is referred as 'Protoplasmic grade' organization.

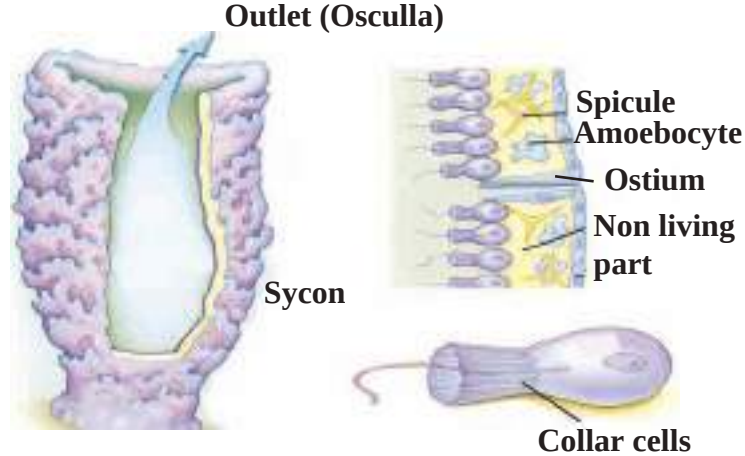
In case of multicellular animals, if tissues are not formed, their body organization is called as 'Cellular grade organization'. Ex. Phylum-Porifera.

In case of some animals, cells come together to form tissues with the help of which all the body functions are performed. Such animals show 'Cell - tissue grade' organization. Ex. Animals from phylum- Cnidaria.

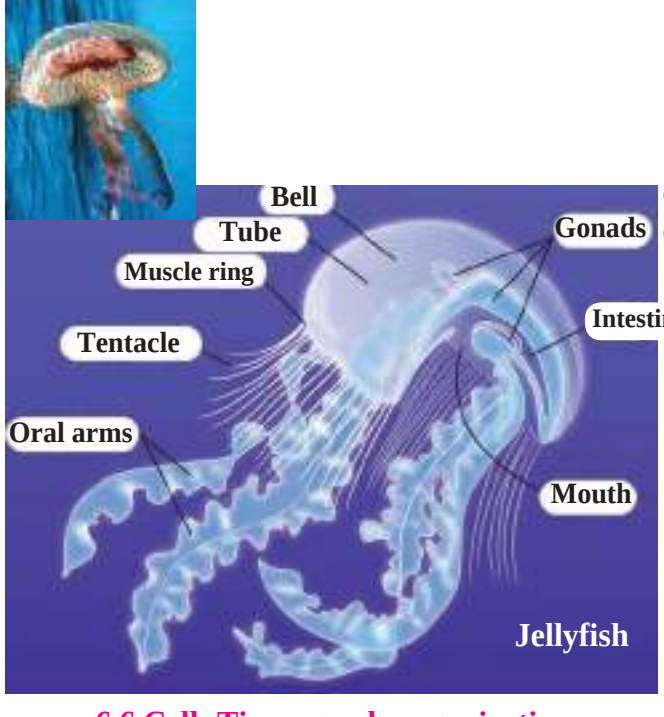
Flat worms show 'Tissue-Organ grade' organization. In this type of organization, tissues are organized to form some organs. However, complete organ-systems are not formed.



6.4 Some animals with Protoplasmic-grade organization.

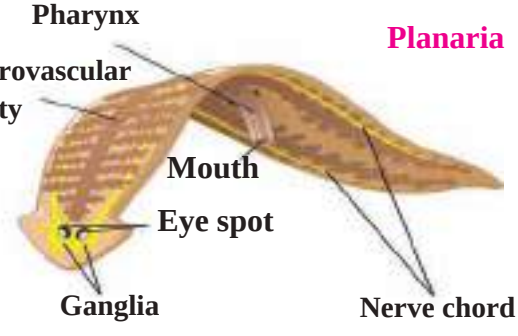


6.5 Cellular grade organization



6.6 Cell -Tissue grade organization

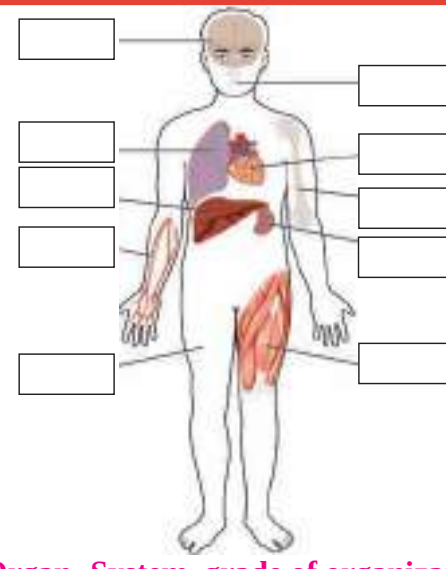
Planaria



6.7 Tissue -Organ grade organization

Observe

Body organization of human has been shown in the following figure. Use appropriate labels in that figure. Which organs are present in human body?



6.8 Organ- System grade of organization

Besides the four types of body organizations mentioned above, Remaining all animals show 'Organ-system grade organization' in which different organs are joined together to form organ-system that performs specific functions. Ex. Crab, Frog, Human, etc.

B. Body Symmetry

Take the pictures of human body and Amoeba and try to take an imaginary section through specific plane of their bodies so as to get two equal halves.

What did you observe?

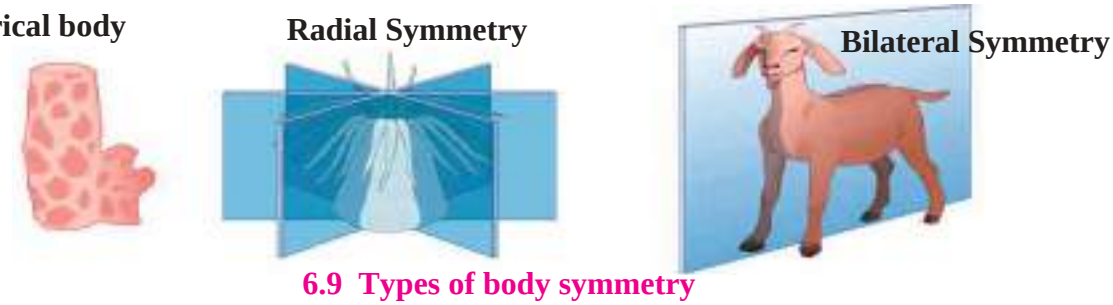
In imaginary sense, if body of any animal is cut through imaginary axis of body, it may or may not produce two equal halves. Depending upon this property, there are different types of animal bodies.

Asymmetrical Body : In case of such body, there is no any such imaginary axis of the body through which we can get two equal halves. Ex. *Amoeba, Paramoecium,* some sponges.

Radial symmetry : In this type of body, if imaginary cut passes through central axis but any plane of body, it gives two equal halves. Ex. Star fish. In case of this animal, there are five different planes passing through central axis of body through which we can get two equal halves.

Bilateral symmetry: In this type of body, there is only one such imaginary axis of body through which we can get two equal halves. Ex. Insects, fishes, frog, birds, human, etc.

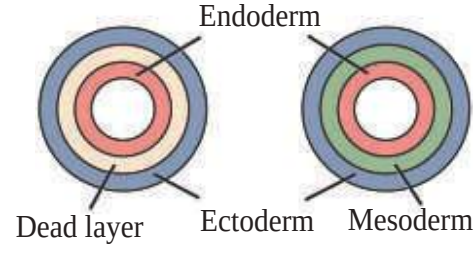
Asymmtrical body **Radial Symmetry** **Bilateral Symmetry**



6.9 Types of body symmetry

C. Germ Layers: Diploblastic and triploblastic

In case of multicellular animals, germ layers are formed during initial period of their embryonic development and from those germ layers only, different tissues are formed in the body. In case of some animals, only two germ layers [Endoderm & ectoderm] are formed. Ex.: All Cnidarians. In most of all the remaining animals, three germ layers are formed i.e. mesoderm besides endoderm & ectoderm.



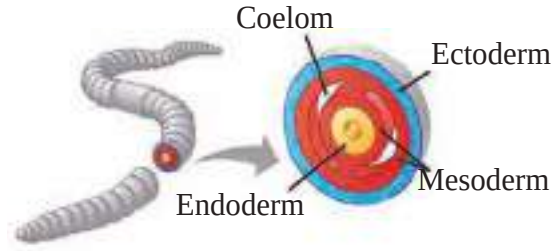
6.10 Diploblastic and triploblastic

D. Body cavity (Coelom)

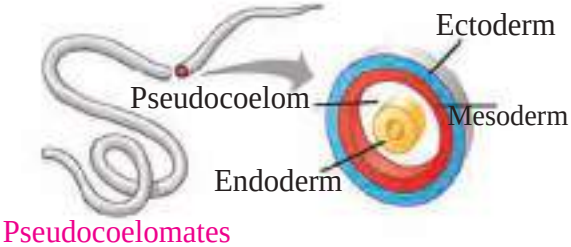
Cavity between the body and internal organs is called as body cavity/coelom. In case of multicellular animals, during initial period of their embryonic development, body cavity is formed from either mesoderm or gut. Such type of body cavity is present in animals of phylum Annelida and all phyla coming after Annelida. Such animals are called as eucoelomate (animals with true body cavity). Body cavity is absent in case of animals from phyla Porifera, Cnidaria and Platyhelminthes. Such animals are called as acoelomate. In case of animals from phylum Aschelminthes, they have body cavity but it is not formed by the above mentioned two ways. Hence those animals are called as pseudocoelomates.

E. Body Segmentation

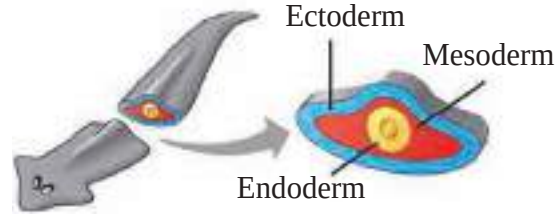
If the body of animals is divided into small, similar units, then such body is called as segmented body and each small unit is called as segment. Ex. Animals like earthworm from phylum Annelida



Eucoelomates

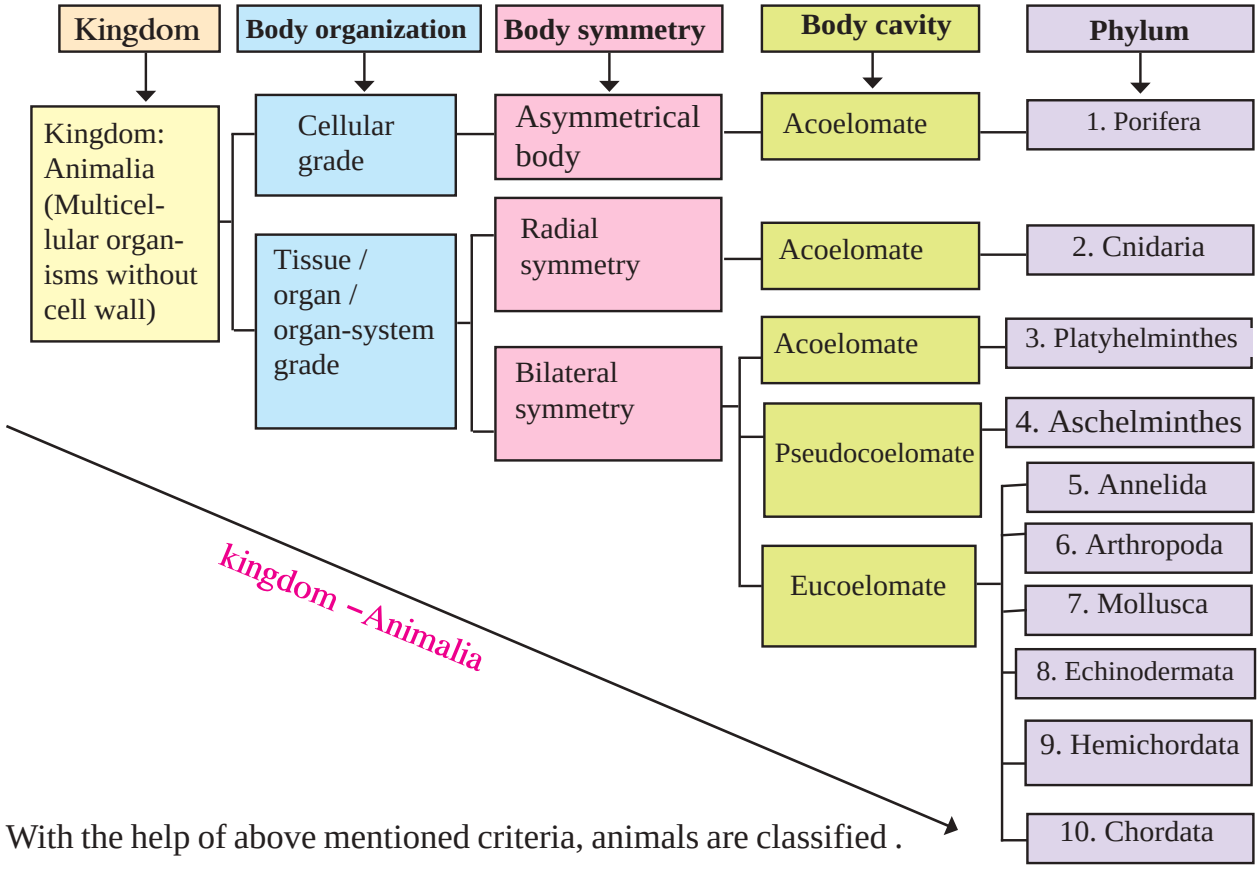


Pseudocoelomates



Acoelomates

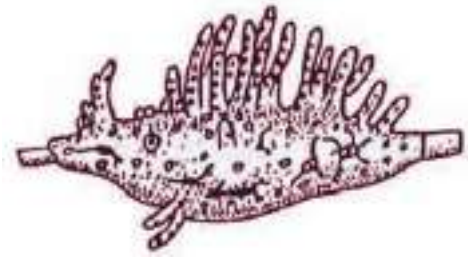
6.11 Animal types as per body cavity



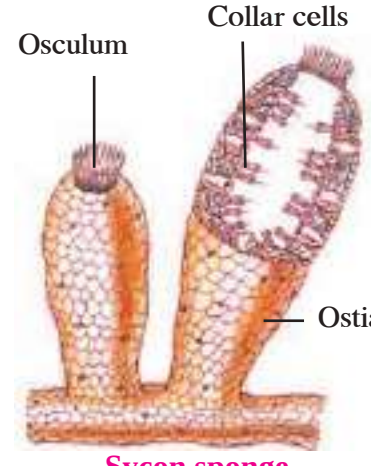
With the help of above mentioned criteria, animals are classified .

Phylum- Porifera

1. These animals are with simplest body plan and are called as 'Sponges'. They bear numerous pores on their body. Those pores are called as 'Ostia' and 'Oscula'.
2. These are aquatic animals. Most of them are marine and few are fresh water dwellers.
3. Most of the animals have asymmetrical body.
4. These animals have special types of cells- collar cells.
5. These animals are always attached to substratum, hence do not show locomotion. Hence, they are referred as sedentary animals.
6. Their spongy body is supported by spicules or spongin fibres. Spicules are made up of calcium carbonate or silica.
7. These animals feed upon small organisms taken in their body along with water. Water is taken in through ostia and given out through oscula.
8. These animals reproduce by budding, an asexual method and / or by sexual method. Besides, they have good ability of regeneration.
   Examples: *Sycon*, *Euspongia* (Bath sponge), *Hyalonema*, *Euplectella*, etc.



Spongila

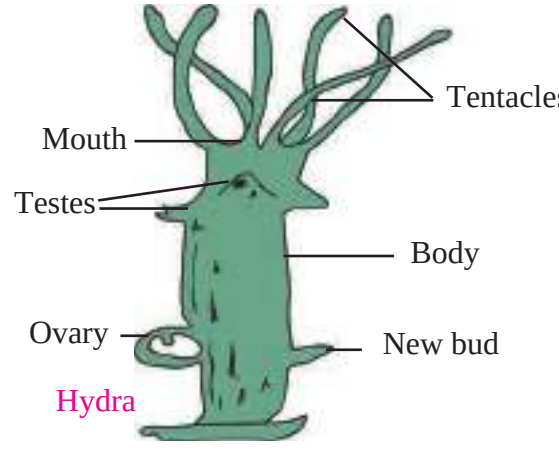


Sycon sponge

6.12 Animals in Porifera phylum

Phylum - Coelenterata/Cnidaria

1. Body of these animals is cylindrical or umbrella-like. If it is cylindrical, it is called as 'Polyp' and if it is umbrella like called as 'Medusa'.
2. Most of these animals are marine. Only few are fresh-water dwellers.
3. Body of these animals is radially symmetrical & diploblastic.
4. Cnidoblast bearing tentacles are present around the mouth. Tentacles are useful for capturing the prey whereas cnidoblasts inject the toxin in the body of prey.
   Those are useful for protection too.
   Examples: *Hydra*, *Adamsia* (Sea anemone), *Physalia* (Portuguese- man-of war), *Aurelia* (Jelly fish), Corals, etc.



Coral

Tentacles

Sea anemone

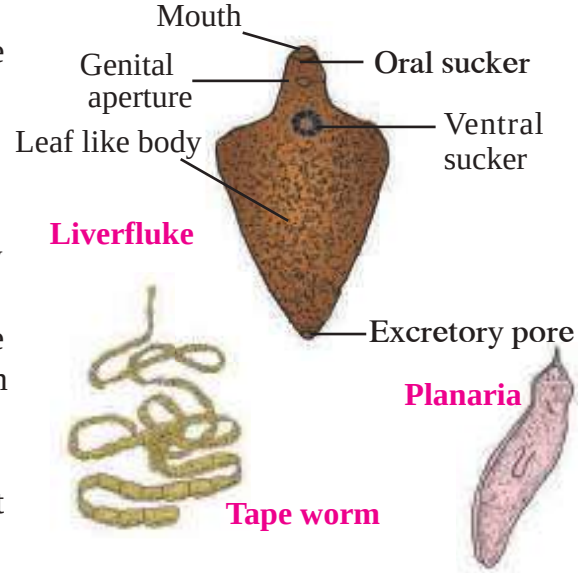
6.13 Animals in Cnidaria phylum

Do you know?

Bath sponge: This is black coloured and somewhat round-shaped animal. Its body is mainly made up of fibers of a protein- spongin and due to this, they have good water-holding capacity. It was used for bathing during old days. Besides, it was also used for manufacturing of pillows and cushions. These were also used as wetting material for sticking postal stamps and counting the currency notes.

Phylum - Platyhelminthes

1. Body of these animals is slender & flat like a leaf or strip. Hence, they are called as 'flatworms'.
2. Most of these animals are endoparasites. Few are free-living & aquatic.
3. Body is acoelomate & bilaterally symmetrical.
4. These are triploblastic i.e. their body is made up of three germ layers- endoderm, ectoderm & mesoderm.
5. These animals are hermaphrodite i.e. male and female reproductive systems are present in the same animal body.
   Examples: Planaria, Liverfluke, Tapeworm, etc.



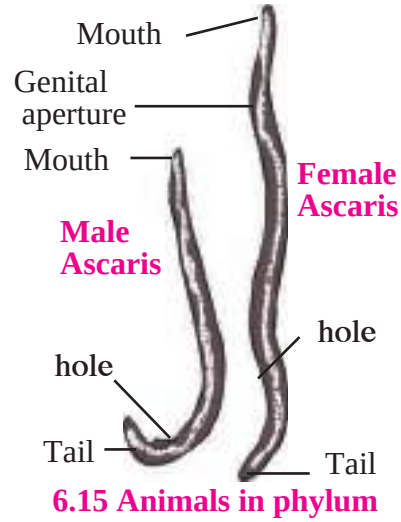
6.14 Animals in phylum Platyhelminthes

Surprising information

Coral reefs are present in ocean. These reefs are actually colonies of specific cnidarians. A precious stone called 'Coral' (पोवळा) and the coral powder (प्रवाळ भस्म) used in ayurveda is derived from these reefs. Collect more information about these corals from internet.

Phylum- Aschelminthes

1. Body of these animals is long thread-like or cylindrical. Hence, they are called as round worms.
2. These animals are either free living or endoparasites. Free living animals are either aquatic or terrestrial.
3. Body of these animals is triploblastic and pseudocoelomate.
4. Body of these animals is non-segmented and covered with tough cuticle.
5. These animals are unisexual.
   Examples: *Ascaris* (Intestinal worm), Filarial worm, *Loa loa* (Eye worm), etc.



6.15 Animals in phylum Ascheminthes

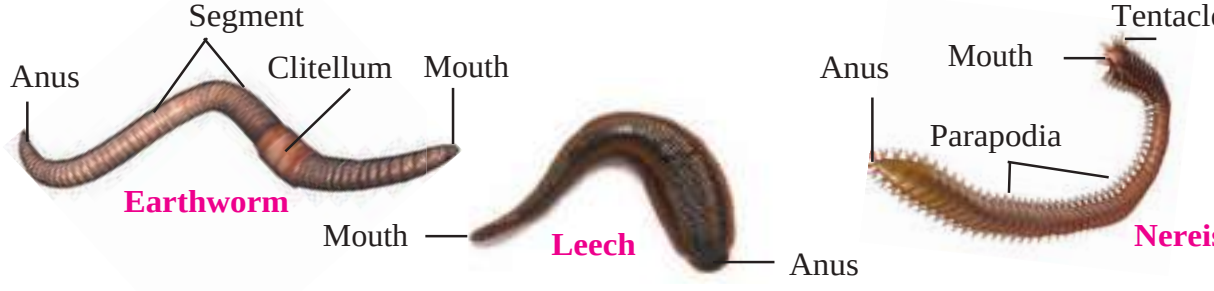
Internet is my friend

Collect the Information

1. How does the infection of tapeworm in man, liverfluke in grazing animals like goat and sheep occur and what are their preventive measures?
2. How does the infection of round worms like Ascaris, filiarial worm & plant nematodes occur and what are their preventive measures and treatment?

Phylum - Annelida

1. Body of these animals is long, cylindrical & metamerically segmented.
2. Most of the animals are free-living, but few are ectoparasites. Free-living animals may be marine or fresh water dwellers or terrestrial.
3. These animals are triploblastic, bilaterally symmetrical and eucoelomate.
4. They have setae or parapodia or suckers for locomotion.
5. Their body is covered with special cuticle.
6. These animals are either hermaphrodite or unisexual.
   Examples: Earthworm, Leech, *Nereis*, etc.



6.16 Animals in phylum Annelida

Get Information

1. Why is earthworm called as friend of farmers?
2. How may be the leech used in ayurvedic system of treatment?

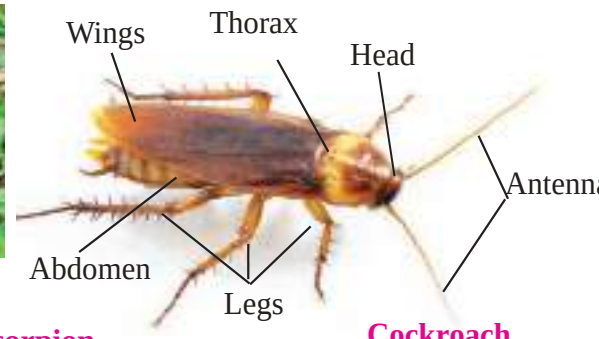
Phylum- Arthropoda

1. These animals have jointed appendages. Hence they are called as arthropods.
2. Planet Earth has highest number of animals from this phylum. Hence, this is largest phylum with highly successful animals in animal kingdom.
3. These animals are found in all types of habitats ranging from deepest oceans to highest mountains.
4. Body of these animals is triploblastic, eucoelomate, bilaterally symmetrical and segmented.
5. Chitinous exoskeleton is present around their body.
6. These animals are unisexual.
   Examples: Crab, spider, scorpion, millipede, centipede, cockroach, butterfly, honey bee, etc

Find out

What is chitin?

Centipede



Cockroach

Butterfly

Scorpion

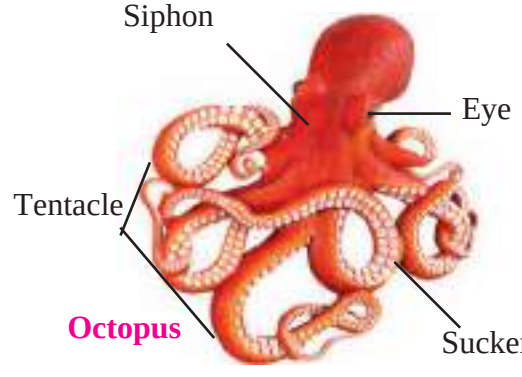
6.17 Animals in phylum Arthropoda

Lets Think

1. What types of benefit & harm occur to human from animals of phylum- Arthropoda?
2. Which are the animals from phylum Arthropoda those have shortest & longest lifespan?
3. Why has it been said that only insects directly compete with humans for food?

Phylum- Mollusca

1. Body of these animals is soft and slimy. Hence they are referred as mollusc.
2. This is second largest phylum in animal kingdom.
3. These animals are aquatic or terrestrial. Most of the aquatic molluscs are marine, but few are fresh water dwellers too.
4. Body of these animals is triploblastic, eucoelomate, non-segmented and soft. Except animals like snail, their body shows bilateral symmetry. Their body is divided into three divisions like head, foot and visceral mass.
5. Visceral mass is covered with mantle. This mantle secretes a hard, calcareous shell. This shell may be external or internal or even absent in some cases.
6. These animals are unisexual.
   Examples: Bivalve, Snail, Octopus, etc.



Octopus

Bivalve

Snail

6.18 Animals in phylum Mollusca

Surprising Information!

1. Octopus is most clever animal among all non-chordates. It can change its colour.
2. It can perform three types of locomotions like swimming, creeping & walking.

Books are my friend

Collect the information about pearl production from bivalves by reading appropriate books.

Phylum- Echinodermata

1. Calcareous spines are present on the body of these animals; hence they are called as echinoderms.
2. These animals are found only in ocean.
3. Their body is triploblastic, eucoelomate. And it is radially symmetrical in adult stage. However, they show bilateral symmetry in larval stage.
4. They perform locomotion with the help of tube-feet. Tube feet are also useful for capturing the prey. Some animals are sedentary.
5. They have skeleton made up of calcareous spines and / or ossicles (plates).
6. These animals have good ability of regeneration.
7. These animals are mostly unisexual.

   Examples: Star fish, sea-urchin, brittle star, sea-cucumber, etc.

Star fish

Sea-cucumber

Sea-urchin

6.19 Animals in phylum Echinodermata

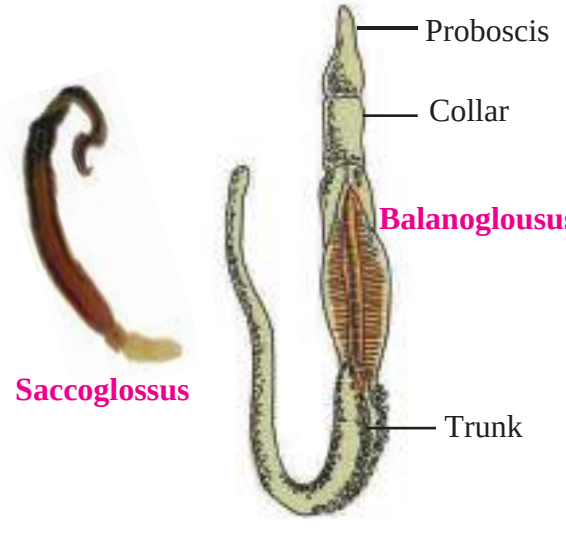
Do you know?

In certain situations, star fish can break apart its body parts and regenerate those later on.

Phylum- Hemichordata

1. Body of these animals is divided into three parts as proboscis, collar & trunk.
2. Notochord is present in proboscis region only. Hence, they are called as hemichordates.
3. These animals are also called as 'acorn worms'.
4. These are marine animals, live in burrows in sand.
5. They have one to many pharyngeal gill slits.
6. They are unisexual or some may be hermaphrodite.

   Ex.: *Balanoglossus, Saccoglossus.*



6.20 Animals in phylum Hemichordata

Through the view point of evolution, *Balanoglossus* is considered as connecting link between non-chordates and chordates. This animal shows the characters of both the groups.

Phylum- Chordata

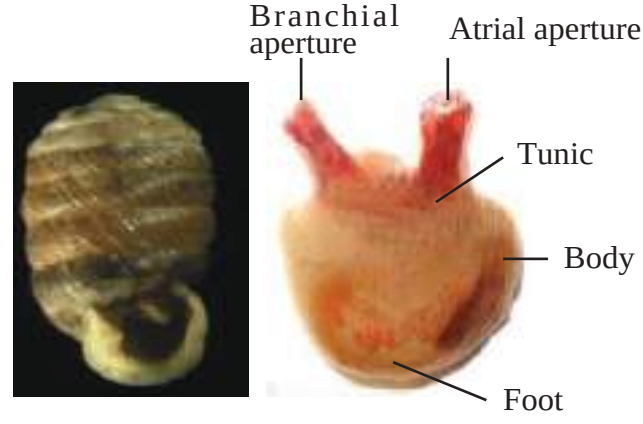
These animals have supporting notochord in their body. All chordates are included in the same phylum. The phylum Chordata is classified in to three subphyla. Following are important characters of phylum Chordata

1. Notochord is present in the body during at least any developmental stage.
2. Pharyngeal gill slits are present in the body during at least any developmental stage.
3. Single, tubular spinal cord is present on dorsal side of body.
4. Heart is present on ventral side of body.

A. Sub phylum - Urochordata

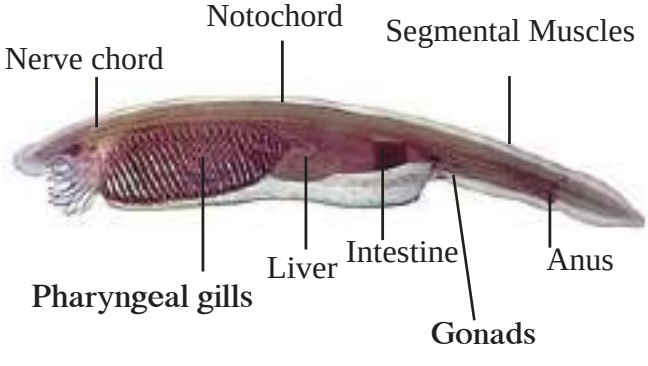
1. These are marine animals.
2. Their body is covered by skin-like test or tunic.
3. Larvae of these animals are freely swimming and notochord is present in only tail region of larvae. Hence, they are called as Urochordata.
4. Larvae metamorphose into adults after settling down at bottom of the sea.
5. Generally, these animals are hermaphrodite.

   Examples: *Herdmania*, *Doliolum*, *Oikopleura*, etc.



Doliolum **Herdmania**

6.21 Animals in Sub- phylum Urochordata



6.21 Animals in Sub- phylum Cephalochordata

B. Sub phylum -Cephalochordata

1. These are small, fish-like, marine animals.
2. Notochord is present throughout the body length.
3. Pharynx is very large and contains gill-slits.
4. These animals are unisexual.

   Ex.: *Amphioxus*.

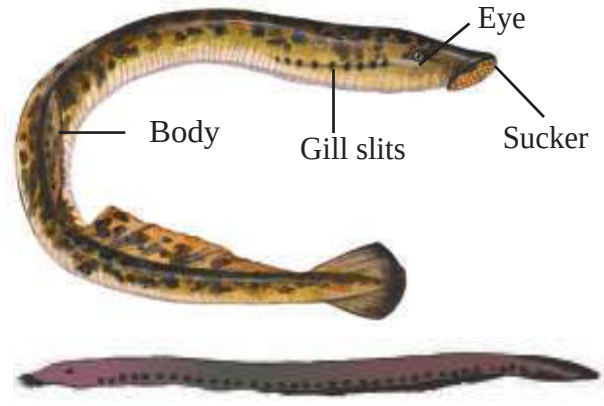
C. Sub phylum -Vertebrata/Craniata

1. In these animals, notochord is replaced by vertebral column.
2. In these animals, head is well developed.
3. Brain is protected by cranium.
4. Endoskeleton is either cartilaginous or bony.
5. Some chordates are jaw-less (Agnatha) whereas some are with jaws (Gnathostomata).

Subphylum- Vertebrata is divided into six classes as follows-

a. Class- Cyclostomata

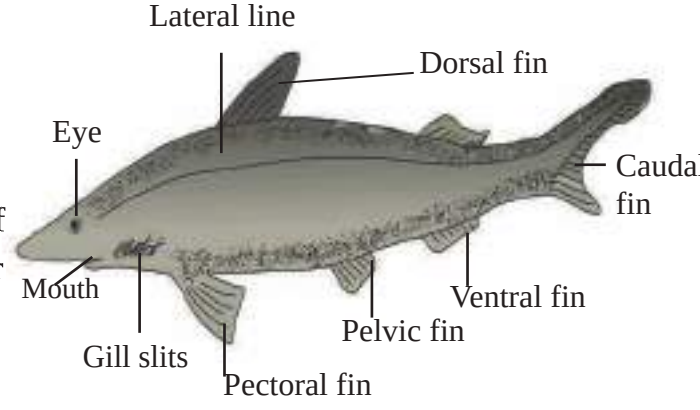
1. These animals have jaw-less mouth provided with sucker.
2. Their skin is soft and without any scale.
3. Paired appendages are absent.
4. Endoskeleton is cartilaginous.
5. Most of the animals are ectoparasites.
   Examples: Petromyzon, Myxine, etc.



6.23 : Class Cyclostomata-Petromyzon

b. Class- Pisces

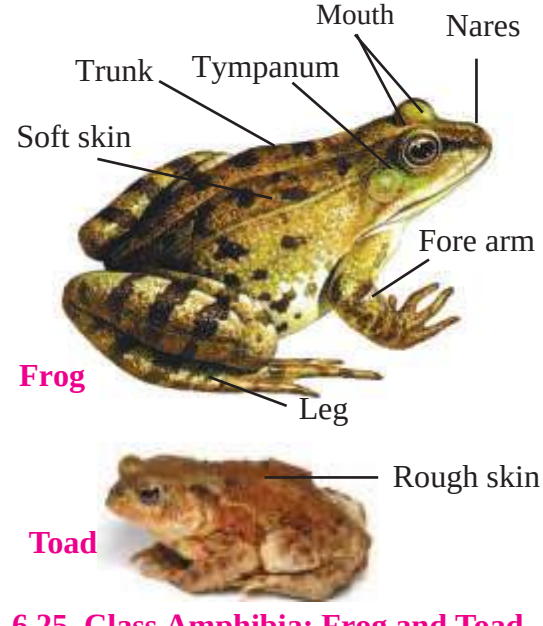
1. These are cold blooded (Poikilotherms) aquatic animals living in marine and fresh waters.
2. Body is spindle shaped to minimize water-resistance.
3. They have paired & un-paired fins for swimming. Tail fin is useful as a steering organ during swimming.
4. Exoskeleton is in the form of scales & endoskeleton is either cartilaginous or bony.
5. Respiration occurs with gills.
   Examples.: Rohu, Pomfret, Sea horse, Shark, Electric ray, Sting ray, etc.



6.24 Class Pisces : Scoliodon (Dog fish)

c. Class- Amphibia

1. These animals are strictly aquatic during larval life and perform only aquatic respiration whereas they can live in water as well as on land during adult life and can perform aquatic as well as aerial respiration.
2. They have two pairs of appendages. Digits are without claws.
3. Exoskeleton is absent. Skin is without any derivative and usually kept moist for respiration.
4. External ear is absent but tympanum is present.
5. Neck is absent. Eyes are prominent with eye lids.
   Ex.: Frog, Toad, Salamander, etc.

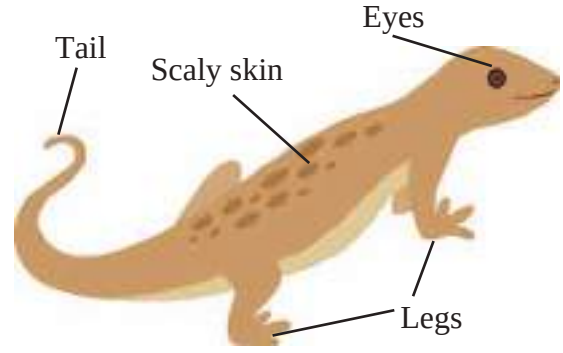


6.25 Class Amphibia: Frog and Toad

d. Class- Reptilia

1. According to the course of animal evolution, these are first true terrestrial animals with creeping movement.
2. These are cold blooded (poikilotherms) animals.
3. They creep on the land as their body cannot be lifted up.
4. Their skin is dry and scaly.
5. Neck is present between head & trunk.
6. External ear is absent.
7. Digits are provided with claws.

   Examples: Tortoise, Lizard, Snake, etc.

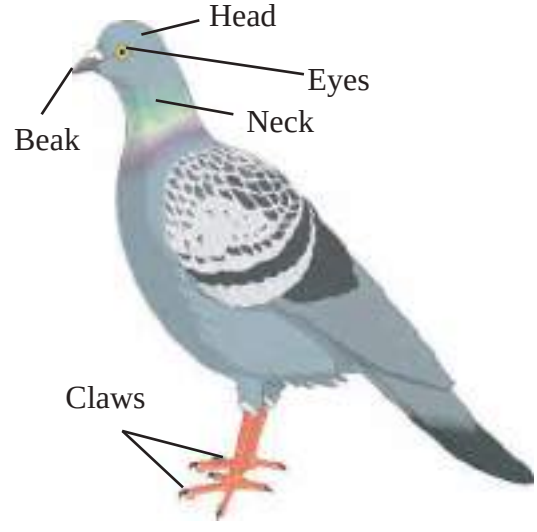


6.26 Class-Reptilia : Wall lizard

e. Class- Aves

1. These vertebrates are completely adapted for aerial life.
2. These are warm blooded (Homeotherms) i.e. they can maintain their body temperature constant.
3. Their body is spindle-shaped to minimize air resistance during flight.
4. Forelimbs are modified into wings. Digits are covered with scales and bear claws.
5. Exoskeleton is present in the form of feathers.
6. Neck is present between head and trunk.
7. Jaws are modified into beak.

   Examples: Peacock, Parrot, Pigeon, Duck, Penguin, etc

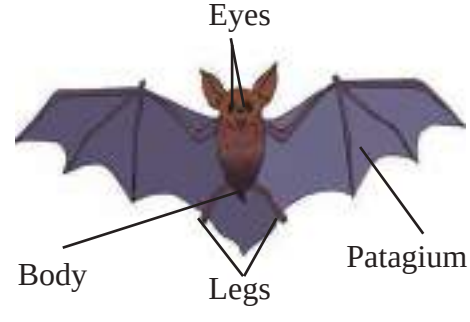


6.27 Class- Aves: Pigeon

f. Class- Mammalia

1. Presence of mammary glands is typical character of mammalia.
2. These animals are warm blooded.
3. Body is divided into head, neck, trunk and tail.
4. Digits are provided with nails, claws, or hooves.
5. Exoskeleton is in the form of hairs or fur.

   Examples: Elephant, Human, Kangaroo, Dolphin, Bat, etc.



6.28 Class-Mammalia: Bat

Use your brain power

1. Animals like ghariyal & crocodile live in water as well as on land. Are they amphibians or reptiles?
2. Animals like whale, walrus live in water (ocean). Whether they are included in pisces or mammalia?

Use of Information Technology

Prepare the presentation of animal classification using video clips downloaded from internet.

Books are My Friends

Read the book- The Animal Kingdom: Libbie Hyman and some other similar books.

Always remember

Varieties of animals are found in our surroundings. We should be cautious about not causing any harm to animals during their studies and observations.

Exercise

1. Identify me.

a. I am diploblastic & acoelomate. Which phylum do I belong to?

b. My body is radially symmetrical. Water vascular system is present in my body. I am referred as fish though I am not. What is my name?

c. I live in your small intestine. Pseudocoelom is present in my thread like body. In which phylum will you include me?

d. Though I am multicellular, there are no tissues in my body. What is the name of my phylum?

2. Write the characters of each of the following animals with the help of classification chart.

Bath sponge, grasshopper, rohu, penguin, frog, lizard, elephant, jellyfish.

3. Write in brief about progressive changes in animal classification.

4. What is the exact difference between grades of organization and symmetry? explain win examples.

5. Answer in brief.

a. Give scientific classification of shark upto class.

b. Write four distinguishing characters of phylum- Echinodermata.

c. Distinguish between butterfly and bat with the help of four distinguishing properties.

d. To which phylum does Cockroach belong? Justify your answer with scientific reasons.

6. Give scientific reasons.

a. Though tortoise lives on land as well as in water, it cannot be included in class- Amphibia.

b. Our body irritates if it comes in contact with jelly fish.

c. All vertebrates are chordates but all chordates are not vertebrates.

d. Balanoglossus is connecting link between non-chordates & chordates.

e. Body temperature of reptiles in not constant.

7. Answer the following questions by choosing correct option.

a. Which special cells are present in the body of sponges (Porifera)?
1. Collar cells. 2. Cnidoblasts.
3. Germ cells. 4. Ectodermal cells.

b. Which of the following animals' body shows bilateral symmetry?
1. Star fish. 2. Jelly fish.
3. Earthworm. 4. Sponge.

c. Which of the following animals can regenerate it's broken body part?
1. Cockroach. 2. Frog.
3. Sparrow. 4. Star fish.

d. Bat is included in which class?
1. Amphibia. 2. Reptilia.
3. Aves. 4. Mammalia.

8. Complete the following chart.

Body cavity	Germ Layer	Phylum
Absent	----------	Porifera
Absent	Triploblastic	----------
Pseudocoelom	----------	Aschel-minthes.
Present	----------	Arthropoda

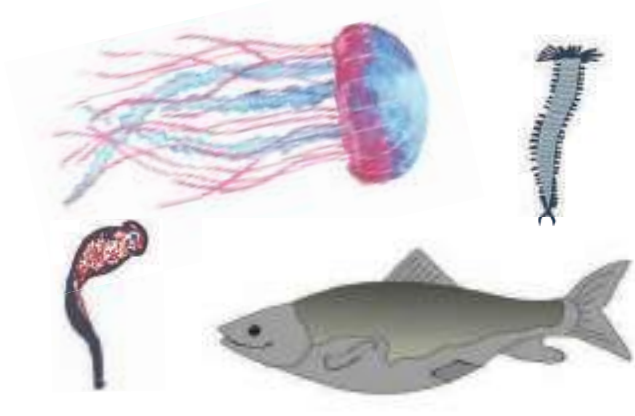
9. Complete the following chart.

Type	Character	Example
Cyclostomata		
	Gill respiration	
Amphibia		
		Whale
	Poikilotherms	

10. Sketch, labell and classify

Hydra, Jellyfish, Planaria, Round worm, Butterfly, Earthworm, Octopus, Star fish, Shark, Frog, Wall lizard, Pigeon.

11. Label the following.



Project :

In each week, on a specific day of your convenience, observe the animals present around your school & residence. Perform this activity for six months. Keep datewise record of your observations. After the observation period of six months, analyze your observations with respect to seasons. With the help of your teacher, classify the reported animals.

KYVY2P

Photos with courtesy of : Shri .Suresh Isave