

UNIT

17

ANIMAL KINGDOM

 Learning Objectives

After completing this lesson, students will be able to:

- understand the classification of animal kingdom.
- identify and study the different groups of animals.
- list out the general characteristics of animals based on grades of organization, types of symmetry, coelom and various body activity.
- recognize that binomial classification has Latin and Greek words.
- identify the first name as genus and second name as species.
- recall the salient features of each phylum.



Introduction

The variety of living organisms surrounding us is incomprehensible. Nearly 1.5 million species of organism which have been described are different from one another. The uniqueness is due to the diversity in the life forms whether it is microbes, plants or animals. Every organism exhibits variation in their external appearance, internal structure and behavior, mode of living etc. This versatile nature among the living animals forms the basis of diversity. The diversity among the living organisms can be studied in an effective way by arranging animals in an orderly and systematic manner. The study of various organisms would be difficult without a suitable method of classification.

The method of arranging organism into groups on the basis of similarities and differences is called **classification**. Taxonomy is the science of classification which makes the study of wide variety of organisms easier. It helps us to

understand the relationship among different group of animals. The first systematic approach to the classification of living organisms was made by a Swedish botanist, Carolus Linnaeus. He generated the standard system for naming organisms in terms of genus, species and more extensive groupings using Latin terms.

17.1 Classification of Living Organisms

Classification is the ordering of organism into groups on the basis of their similarities, dissimilarities and relationships. The five kingdom classification are Monera, Protista, Fungi, Plantae and Animalia. These groups are formed based on cell structure, mode of nutrition, body organization and reproduction. On the basis of hierarchy of classification, the organisms are separated into smaller and smaller groups which form the basic unit of classification.

Species: It is the lowest taxonomic category. For example, the large Indian parakeet (*Psittacula eupatra*) and the green parrot (*Psittacula krameri*) are two different species of birds. They belong to different species *eupatra* and *krameri* and cannot interbreed.

Genus: It is a group of closely related species which constitute the next higher category called genus. For example, the Indian wolf (*Canis pallipes*) and the Indian jackal (*Canis aureus*) are placed in the same genus *Canis*.

Family: A group of genera with several common characters form a family. For example, leopard, tiger and cat share some common characteristics and belong to the larger cat family *Felidae*.

Order: A number of related families having common characters are placed in an order. Monkeys, baboons, apes and Man although belong to different families, are placed in the same order Primates. Since all these animals possess some common features, they are placed in the same order.

Class: Related or similar orders together form a class. The orders of different animals like those of rabbit, rat, bats, whales, chimpanzee and human share some common features such as the presence of skin and mammary glands. Hence, they are placed in class Mammalia.

Phylum: Classes which are related with one another constitute a phylum. The classes of different animals like mammals, birds, reptiles, frogs and fishes constitute Phylum Chordata which have a notochord or back bone.

Kingdom: It is the highest category and the largest division to which microorganisms, plants and animals belong to. Each kingdom is fundamentally different from one another, but has the same fundamental characteristics in all organisms grouped under that Kingdom.

The taxa of living organisms are in a hierarchy of categories as follows.

Kingdom
Phylum
Class
Order
Family
Genus
Species

17.1.1 Basis for Classification

We can divide the Animal kingdom based on the level of organization (arrangement of cells), body symmetry, germ layers and nature of coelom.

Level of organization: Animals are grouped as unicellular or multicellular based on cell, tissue, organ and organ system level of organization

Symmetry: It is a plane of arrangement of body parts. Radial symmetry and bilateral symmetry are the two types of symmetry. In radial symmetry the body parts are arranged around the central axis. If the animal is cut through the central axis in any direction, it can be divided into similar halves. e.g. Hydra, jelly fish and star fish. In bilateral symmetry, the body parts are arranged along a central axis. If the animal is cut through the central axis, we get two identical halves e.g. Frog.

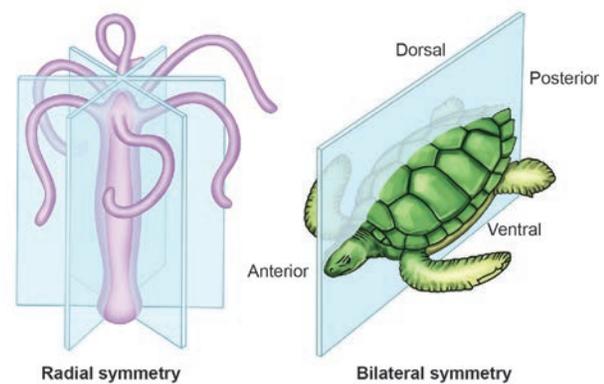
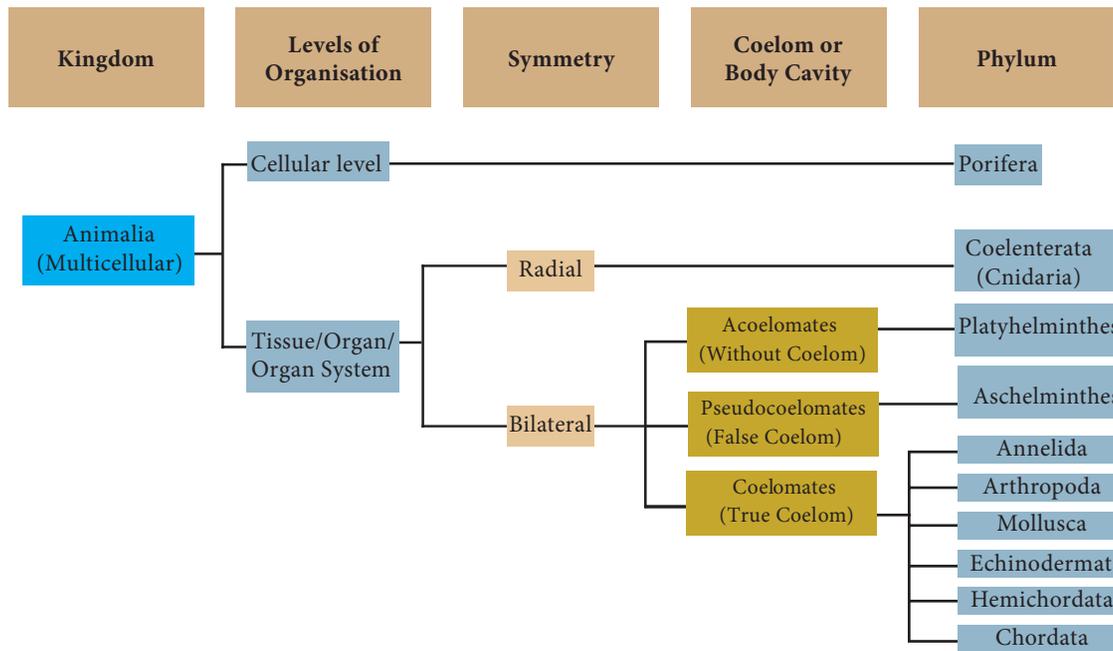


Figure 17.1 Radial and Bilateral Symmetry

Germ layers: Germ layers are formed during the development of an embryo. These layers give rise to different organs, as the embryo becomes an adult.

Organisms with two germ layers, the ectoderm and the endoderm are called

Classification of kingdom Animalia based on fundamental features



diploblastic animals. e.g Hydra. Organisms with three germ layers, ectoderm, mesoderm and endoderm are called **triploblastic** animals. e.g Rabbit

Coelom: It is a fluid-filled body cavity. It separates the digestive tract from the body wall. A true body cavity or coelom is one that is located within the mesoderm. Based on the nature of the coelom, animals are divided into 3 groups.

1. Acoelomates do not have a body cavity e.g Tapeworm.
2. Pseudocoelomates have a false body cavity e.g Roundworm.
3. Coelomates or Eucoelomates have a true coelom e.g Earthworm, Frog.

Animal Kingdom is further divided into two groups based on the presence or absence of notochord as below.

1. Invertebrata
2. Chordata-Prochordata and Vertebrata

Animals which do not possess notochord are called as **Invertebrates** or **Non- chordates**. Animals which possess notochord or backbone are called as **Chordates**. You have already studied the characters of single celled protozoans.

More to Know

Notochord is a rod like structure formed on the mid-dorsal side of the body during embryonic development. Except primitive forms in which the notochord persists throughout life in all other animals it is replaced by a backbone.

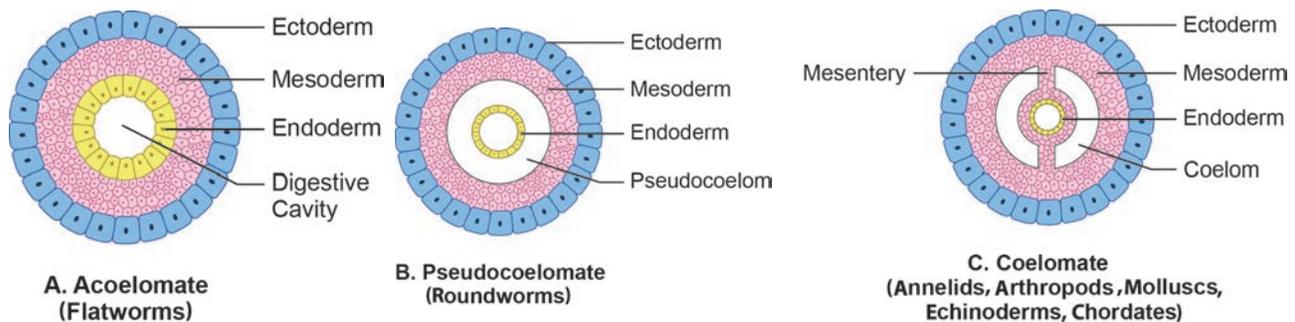


Figure 17.2 Types of Coelom

17.1.2 Binomial Nomenclature

Carolus Linnaeus introduced the method of naming the animals with two names known as binomial nomenclature. The first name is called **genus** and the first letter of genus is denoted in capital and the second one is the **species** name denoted in small letter. The binomial names of some common animals are as follows.

Common name	Binomial name
Amoeba	<i>Amoeba proteus</i>
Hydra	<i>Hydra vulgaris</i>
Tapeworm	<i>Taenia solium</i>
Roundworm	<i>Ascaris lumbricoides</i>
Earthworm	<i>Lampito mauritii</i> / <i>Perionyx excavatus</i>
Leech	<i>Hirudinaria granulosa</i>
Cockroach	<i>Periplaneta americana</i>
Snail	<i>Pila globosa</i>
Star fish	<i>Asterias rubens</i>
Frog	<i>Rana hexadactyla</i>
Wall lizard	<i>Podarcis muralis</i>
Crow	<i>Corvus splendens</i>
Peacock	<i>Pavo cristatus</i>
Dog	<i>Canis familiaris</i>
Cat	<i>Felis felis</i>
Tiger	<i>Panthera tigris</i>
Man	<i>Homo sapiens</i>

17.2 Invertebrata

17.2.1 Phylum Porifera (Pore bearers)

These are multicellular, non-motile aquatic organisms, commonly called as sponges. They exhibit **cellular grade of organization**. Body is perforated with many pores called **ostia**. Water enters into the body through ostia and leads to a **canal system**. It circulates water throughout the body and carries food, oxygen. The body wall contains **spicules**, which form the skeletal framework. Reproduction is by both asexual and sexual methods. e.g- *Euplectella*, *Sycon*.



Euplectella

Sycon

Figure 17.3 Pore bearers

17.2.2 Phylum Coelenterata (Cnidaria)

Coelenterates are aquatic organisms, mostly marine and few fresh water forms. They are multicellular, radially symmetrical animals, with **tissue grade of organization**. Body wall is **diploblastic** with two layers. An outer ectoderm and inner endoderm are separated by non-cellular jelly like substance called **mesoglea**. It has a central gastrovascular cavity called **coelenteron** with mouth surrounded by short **tentacles**. The tentacles bear stinging cells called **cnidoblast** or **nematocyst**.



Figure 17.4 Jelly fish

Many coelenterates exhibit **polymorphism**, which is the variation in the structure and function of the individuals of the same species. They reproduce both asexually and sexually. e.g. Hydra, Jellyfish.

17.2.3 Phylum Platyhelminthes (Flat worms)

They are bilaterally symmetrical, triploblastic, **acoelomate** (without body cavity) animals. Most of them are **parasitic** in nature. **Suckers** and **hooks** help the animal to attach itself to the body of the host. Excretion occurs by specialized cells called **flame cells**. These worms are **hermaphrodites** having



Liver fluke

Tape worm

Figure 17.5 Flat worms

both male and female reproductive organs in a single individual. e.g- Liverfluke, Tapeworm.

17.2.4 Phylum Aschelminthes (Round worms)

Aschelminthes are bilaterally symmetrical, triploblastic animals. The body cavity is a **pseudocoelom**. They exist as **free-living soil forms** or as **parasites**. The body is round and pointed at both the ends. It is unsegmented and covered by **thin cuticle**. Sexes are separate. The most common diseases caused by nematodes in human beings are **elephantiasis** and **ascariasis**. e.g- *Ascaris*, *Wuchereria*.



Male

Female

Figure 17.6 Round worms

17.2.5 Phylum Annelida (Segmented worms)

These are bilaterally symmetrical, triploblastic, **first true coelomate animals** with **organ-system grade of organization**. Body is externally divided into segments called **metameres** joined by ring like structures called **annuli**. It is covered by moist thin cuticle. **Setae** and **parapodia** are locomotor organs. Sexes may be separate or united (hermaphrodites). e.g- *Nereis*, *Earthworm*, *Leech*.



Earthworm

Leech

Figure 17.7 Segmented worms

17.2.6 Phylum Arthropoda (Animals with jointed legs)

Arthropoda is the largest phylum of the animal kingdom. They are bilaterally

symmetrical, triploblastic and coelomate animals. The body is divisible into head, thorax and abdomen. Each thoracic segment bears paired **jointed legs**. Exoskeleton is made of **chitin** and is shed periodically as the animal grows. The casting off and regrowing of exoskeleton is called **moulting**.

Body cavity is filled with **haemolymph** (blood). The blood does not flow in blood vessels and circulates throughout the body (open circulatory system). Respiration is through body surface, **gills** or **tracheae** (air tubes). Excretion occurs by **malpighian tubules** or **green glands**. Sexes are separate. E.g., Prawn, Crab, Cockroach, Millipede, Centipedes, Spider, Scorpion.



Centipede

Millipede

Figure 17.8 Animals with jointed legs



Centipede means 'hundred legs'. But most species have only 30 pairs. Millipedes have two pairs of legs on each segment. This name means 'thousand legs'. But, most millipedes have only about a hundred.

Activity 1

Identify the following pictures of Arthropods.



17.2.7 Phylum Mollusca (Soft Bodied Animals)

They are diversified group of animals living in marine, fresh water and terrestrial habitats. Body is bilaterally symmetrical, soft and without segmentation. It is divided into **head, muscular foot** and **visceral mass**. The foot helps in locomotion. The entire body is covered with fold of thin skin called **mantle**, which secretes outer hard **calcareous shell**. Respiration is through gills (**ctenidia**) or lungs or both. Sexes are separate with larval stages during development. e.g- Garden snail, Octopus.



Figure 17.9 Garden Snail



Octopus is the only invertebrate that is capable of emotion, empathy, cognitive function, self awareness, personality and even relationships with humans. Some speculate that without humans, octopus would eventually take our place as the dominate life form on earth.



17.2.8 Phylum Echinodermata (Spiny Skinned Animals)

They are exclusively free-living marine animals. These are triploblastic and true coelomates with organ-system grade of organization. **Adult animals** are **radially symmetrical** but **larvae** remain **bilaterally symmetrical**. A unique feature is the presence of fluid filled **water vascular system**. Locomotion occurs by **tube feet**. Body wall is covered with spiny hard **calcareous ossicles**. e.g- Star fish, Sea urchin.



Star Fish



Sea Urchin

Figure 17.10 Spiny Skinned Animals

17.2.9 Phylum Hemichordata

Hemichordates are marine organisms with soft, vermiform and unsegmented body. They are bilaterally symmetrical, coelomate animals with **non-chordate** and **chordate features**. They have gill slits but **do not have notochord**. They are **ciliary feeders** and mostly remain as **tubicolous forms**. E.g- *Balanoglossus* (Acorn worms).



Figure 17.11 Balanoglossus

17.3 Chordata

Chordates are characterized by the **presence of notochord, dorsal nerve cord** and **paired gill pouches**. **Notochord** is a long rod like support along the back of the animal separating the gut and nervous tissue. All chordates are triploblastic and coelomate animals. **Phylum Chordata** is divided into two groups: **Prochordata** and **Vertebrata**.

17.3.1 Prochordata

The prochordates are considered as the forerunners of vertebrates. Based on the nature of the notochord, prochordata is classified into subphylum Urochordata and subphylum Cephalochordata.

Subphylum Urochordata

Notochord is present only in the **tail region** of free-living larva. Adults are sessile forms and mostly degenerate. The body is covered with a **tunic** or **test**. e.g. *Ascidian*



Figure 17.12 Ascidian

Subphylum Cephalochordata

Cephalochordates are small fish like marine chordates with unpaired dorsal fins. The notochord extends throughout the entire length of the body. E.g. *Amphioxus*

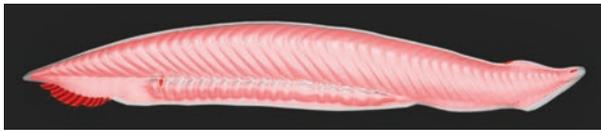


Figure 17.13 Amphioxus

17.3.2 Vertebrata

This group is characterized by the presence of vertebral column or backbone. Notochord in an embryonic stage gets replaced by the vertebral column, which forms the chief skeletal axis of the body. Vertebrata are grouped into six classes.

Class: Cyclostomata

Cyclostomes are jawless vertebrates (mouth not bounded by jaws). Body is elongated and eel like. They have circular mouth. Skin is slimy and scaleless. They are ectoparasites of fishes. E.g. *Hagfish*.



Figure 17.14 Lamprey

Class: Pisces

Fishes are poikilothermic (**cold-blooded**), aquatic vertebrates with jaws. The **streamlined**

body is divisible into head, trunk and tail. Locomotion is by **paired** and **median fins**. Their body is covered with **scales**. Respiration is through **gills**. The heart is two chambered with an auricle and a ventricle. There are two main types of fishes.

- (i) **Cartilaginous fishes**, with skeleton made of cartilages e.g. Sharks, Skates.
- (ii) **Bony fishes** with skeleton made of bones e.g. Carps, Mulletts.



Figure 17.15 Shark

More to Know

The smallest vertebrate, Philippine goby/dwarf pygmy goby is a tropical species fish found in brackish water and mangrove areas in south East Asia, measuring only 10 mm in length.



Class: Amphibia (amphi- both; bios- life)

These are the first four legged (**tetrapods**) vertebrates with **dual adaptation** to live in both land and water. The body is divisible into head and trunk. Their skin is moist and have **mucus glands**. Respiration is through **gills, lungs, skin** or **buccopharynx**. The heart is three chambered with two auricles and one ventricle. Eggs are laid in water. The **tadpole larva**, transforms into an adult. e.g-Frog, Toad.



The Chinese giant salamander



Andrias davidians is the largest amphibian in the world. Its length is about five feet and eleven inches. It weighs about 65 kg, found in Central and South China.

Class: Reptilia (repere- to crawl or creep)

These vertebrates are fully adapted to live on land. Their body is covered with **horny epidermal scales**. Respiration is through **lungs**. The heart is three chambered with an exemption of crocodiles, which have four-chambered heart. Most of the reptiles lay their eggs with tough outer shell e.g Calotes, Lizard, Snake, Tortoise, Turtle.



Figure 17.16 Calotes



Figure 17.17 Pigeon

More to Know

State bird of Tamil Nadu
Common Emerald dove.
(*Chalcophaps indica*)



Class: Aves (avis – bird)

Birds are **homeothermic (warm-blooded)** animals with several adaptations to fly. The **spindle or boat shaped body** is divisible into head, neck, trunk and tail. The body is covered with **feathers**. **Forelimbs** are modified into **wings** for flight. Hindlimbs are adapted for walking, perching or swimming. The respiration is through lungs, which have **air sacs**. Bones are filled with air (**pneumatic bones**), which reduces the body weight. They lay large yolk laden eggs. They are covered by hard **calcareous shell**. e.g. Parrot, Crow, Eagle, Pigeon, Ostrich .

Class: Mammalia (mamma-breast)

Mammals are **warm-blooded animals**. The skin is covered with **hairs**. It also bears **sweat** and **sebaceous** (oil) glands. The body is divisible into head, neck, trunk and tail. Females have **mammary glands**, which secrete milk for feeding the young ones. The **external ears** or **pinnae** is present. Heart is four chambered and they breathe through lungs. Except egg laying mammals (Platypus, and Spiny anteater), all other mammals give birth to their young ones (**viviparous**). Placenta is the unique characteristic feature of mammals.e.g Rat, Rabbit, Man.

Classification of Phylum Chordata

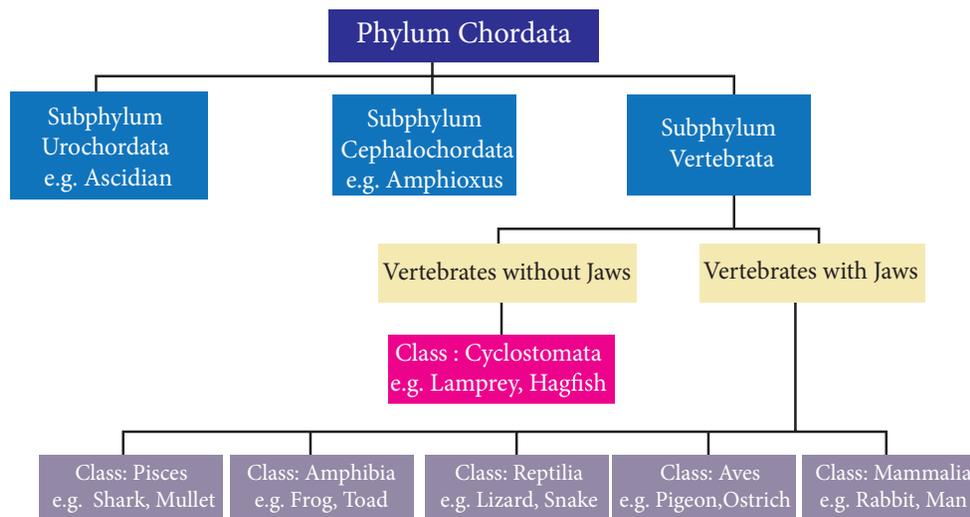




Figure 17.18 Rabbit

More to Know



The gigantic **Blue whale** which is 35 meters long and 120 tons in weight is the biggest vertebrate animal.

Points to Remember

- ❖ Classification is the ordering of organism into groups on the basis of their similarities, dissimilarities and relationships.
- ❖ Animals are grouped as unicellular or multicellular based on cell, tissue, organ and organ system level of organization.
- ❖ In radial symmetry the body parts are arranged around the central axis.
- ❖ In bilateral symmetry, the body parts are arranged along a central axis.
- ❖ Coelom is a fluid-filled body cavity. It separates the digestive tract from the body wall.
- ❖ Animals which do not possess notochord structure are called as Invertebrates or Non- chordates.
- ❖ Animals which possess notochord or backbone are called as Chordates.
- ❖ The prochordates are considered as the forerunner of vertebrates.

A-Z GLOSSARY

Acoelomates	Animals which do not have a body cavity.
Amphibian	Cold-blooded vertebrate animal of a class that comprises the frogs, toads, newts, salamanders.
Annelida	Phylum that comprises the segmented worms which include earthworms and leeches.
Aves	Vertebrates which comprises the birds.
Coelomates	Animals which have a true coelom e.g Earthworm, Frog.
Classification	Arrangement of groups of animals, the members of which have one or more characteristics in common.
Mammals	Warm-blooded vertebrate animals that possess hairs, mammary glands and feed their young ones.
Pseudocoleomates	False body cavity which is not bounded by true epithelial lining. e.g Roundworm
Toads	Anurans with smooth skin than that of frogs, terrestrial and leap rather than jump.



TEXTBOOK EXERCISES



I. Choose the correct answer.

- Find the group having only marine members.
 - Mollusca
 - Coelenterata
 - Echinodermata
 - Porifera
- Mesoglea is present in
 - Porifera
 - Coelenterata
 - Annelida
 - Arthropoda
- Which one of the following pairs is not a poikilothermic animal?
 - Fishes and Amphibians
 - Amphibians and Aves
 - Aves and Mammals
 - Reptiles and Mammals
- Identify the animal having four chambered heart.
 - Lizard
 - Snake
 - Crocodile
 - Calotes
- The animal without skull is
 - Acrania
 - Acephalia
 - Apteria
 - Acoelomate
- Hermaphrodite organisms are
 - Hydra, Tape worm, Earthworm, Amphioxus
 - Hydra, Tape worm, Earthworm, Ascidian
 - Hydra, Tape worm, Earthworm, Balanoglossus
 - Hydra, Tape worm, Ascaris, Earthworm
- Poikilothermic organisms are
 - Fish, Frog, Lizard, Man
 - Fish, Frog, Lizard, Cow
 - Fish, Frog, Lizard, Snake
 - Fish, Frog, Lizard, Crow

- Air sacs and Pneumatic bones are seen in
 - fish
 - frog
 - bird
 - bat
- Excretory organ of tape worm is
 - flame cells
 - nephridia
 - body surface
 - solenocytes
- Water vascular system is found in
 - Hydra
 - Earthworm
 - Star fish
 - Ascaris

II. Fill in the blanks.

- The skeletal framework of Porifera is _____.
- Ctenidia are respiratory organs in _____.
- Skates are _____ fishes.
- The larvae of an amphibian is _____.
- _____ are jawless vertebrates.
- _____ is the unique characteristic feature of mammal.
- Spiny anteater is an example for _____ mammal.

III. State whether true or false. If false, correct the statement.

- Canal system is seen in coelenterates.
- Hermaphrodite animals have both male and female sex organs.
- Trachea are the respiratory organ of Annelida.
- Bipinnaria is the larva of Mollusca.
- Balanoglossus is a ciliary feeder.
- Fishes have two chambered heart.
- Skin of reptilians are smooth and moist.

8. Wings of birds are the modified forelimbs.
9. Female mammals have mammary glands.

IV. Match the following.

PHYLUM	EXAMPLES
(A) Coelenterata	(i) Snail
(B) Platyhelminthes	(ii) Starfish
(C) Echinodermata	(iii) Tapeworm
(D) Mollusca	(iv) Hydra

V. Answer very briefly.

1. Define taxonomy.
2. What is nematocyst?
3. Why coelenterates are called diploblastic animals?
4. List the respiratory organs of amphibians.
5. How does locomotion take place in starfish?
6. Are jellyfish and starfish similar to fishes? If no justify the answer.
7. Why are frogs said to be amphibians?

VI. Answer briefly.

1. Give an account on phylum Annelida.
2. Differentiate between flat worms and round worms?
3. Outline the flow charts of Phylum Chordata.
4. List five characteristic features of fishes.
5. Comment on the aquatic and terrestrial habits of amphibians.
6. How are the limbs of the birds adapted for avian life?

VII. Answer in detail.

1. Describe the characteristic features of different Prochordates.
2. Give an account on phylum Arthropoda.



REFERENCE BOOKS

1. Manual of Zoology Vol. I. Part I. (Invertebrata), M. Ekambaranatha Ayyar and T.N. Ananthakrishnan, Reprint 2003. S. Viswanathan (Printers and Publishers) Pvt. Ltd Chennai.
2. Manual of Zoology Vol. I. Part. II. (Invertebrata), M. Ekambaranatha Ayyar and T.N. Ananthakrishnan, Reprint 2003. S. Viswanathan (Printers and Publishers) Pvt. Ltd Chennai.
3. Manual of Zoology Vol. II. Chordata M. Ekambaranatha Ayyar and T.N. Ananthakrishnan, Reprint 2003. S. Viswanathan (Printers and Publishers) Pvt. Ltd Chennai.
4. Chordate Zoology E. L. Jordan and P. S. Verma. Reprint 2003. S. Chand .and Company, New Delhi.



INTERNET RESOURCES

- <http://home.pcisys.net/~dlblanc/taxonomy.html>
- [http://can-do.com/uci/lessons 98/Invertebrates.html](http://can-do.com/uci/lessons%2098/Invertebrates.html)
- <http://www.student.loretto.org/zoology/chordates.html>

Concept Map

