

# **DIVERSITY IN LIVING ORGANISMS**

# Concepts Covered

- Biodiversity
- The animal kingdom, Hierarchy in classification
- Basic characteristics of Animal kingdom.

## **Kingdom Animalia**

- These are eukaryotic, multicellular, heterotrophic organisms.
- The mode of nutrition is holozoic and they are either herbivores or carnivores.
- Animals are made up of many organ systems, that aids in performing specific functions that are necessary for the survival of the organism.

#### **Classification of Animal Kingdom**

Classification of the Kingdom Animalia includes:

- 1. Non-Chordates
- 2. Chordates

#### Animals are classified based on:

(i) Body Symmetry

- Bilateral symmetry: When an organism can be divided into equal two halves, by a single vertical plane.
- Radial symmetry: When an organism can be divided into two halves by any vertical plane.
- Asymmetry: When an organism cannot be divided into equal halves by any plane.

#### (ii) Germ layers

- Ectoderm: It is the outermost layer that forms nails, hair, epidermis, etc.
- Endoderm: It is the innermost layer that forms the stomach, colon, urinary, bladder, etc.
- Mesoderm: It is the middle layer between ectoderm and endoderm which forms bones, cartilage, etc.







#### According to the number of germ layers present in the embryonic stage, an animal could be:

- Diploblastic Two embryonic germ layers (ectoderm and endoderm).
- Triploblastic: Three embryonic germ layers.

#### (iii) Coelom

- Acoelomates: Organisms having no body cavity.
- Coelomates: Organisms have a true coelom cavity.
- **Pseudo coelomate:** These are organisms having false coelom.



#### (iv) Notochord

- It is a long rod-like structure, which runs along the body between nervous tissues and the gut and provides a
  place for the muscle to attach for ease of movement.
- Organisms could be without a notochord, with a notochord, with a notochord in the initial embryonic stages and vertebral column in the adult phase.

#### **Non-Chordates**

It includes a group of animals that do not possess a vertebral column. Invertebrate is classified into different phyla:

| (i) Porifera   |
|----------------|
| (iv) Nematoda  |
| (vii) Mollusca |

- (ii) Coelenterata (v) Annelida
- (viii) Echinodermata
- (iii) Platyhelminthes

(vi) Arthropoda

Euplectella

(ix) Hemichordata

#### (i) Porifera

- These are non-motile animals attached to some solid support. They are called **sponges**.
- There are holes or pores all over the body.
- The canal system helps in circulating water throughout the body to bring in food and oxygen.
- These organisms are covered with a hard layer outside.
- The body design involves very little differentiation and division into tissue.
- They are mainly found in marine habitats.
- Examples: Euplectella, Sycon, Spongilla.

#### (ii) Coelenterata

- These are animals living in the water. Some of these organisms live in colonies while others live solitary.
- They lack an anus but have a mouth that is surrounded by short and thin tentacles (parts of the body used for feeling, holding, moving, and getting food).
- They show more body design differentiation.
- The body is made up of two layers of cells- one makes up cells outside the body, other makes up the inner lining of the body.
- Examples: Hydra, Jellyfish, Sea anemones, Obelia, Aurelia.

#### (iii) Platyhelminthes

- The body is bilaterally symmetrical i.e., the right and left halves of the body have the same design.
- They are triploblastic animals means that there are 3 layers of cells from which differentiated tissues can be made.
- There is no true internal body cavity.
- Examples: Planaria, Liver fluke, Tapeworm, Fasciola.

Sycon



Spongilla

Porifera

.







- Flatworms can stick its pharynx into their prey, like a vacuum cleaner hose, and suck out the prey's insides.
- One Fluke can produce over 500,000 embryos.

#### (iv) Ne matoda

- The organisms have a bilaterally symmetrical and triploblastic body.
- The body is cylindrical rather than flattened.
- The body has tissues but no real organs.
- Parasitic nematodes are pathogenic means they produce diseases in the host. Roundworm lives in the human intestine and causes diseases.
- Sexes are separate.
- The alimentary canal is complete with mouth and anus.
- Examples: Ascaris, Pinworm, Hookworm.

#### (v) Annelida

- They are bilaterally symmetrical, soft, elongated, cylindrical, triploblastic, and have a true body cavity.
- Due to true body cavity, they have extensive organ differentiation.
- The body is segmented with segments lined up one after the other from head to tail.
- The alimentary canal is tube-like, complete, and extends straight from the mouth to the anus.
- True coelomate animal with closed blood vascular system.
- Excretion by paired segmental nephridia removes waste from the coelom and bloodstream directly to the exterior.
- Sexes may be united or separate.
- They live in a variety of habitats.
- Examples: Earthworm, Leeches, Sandworm

#### (vi) Arthropoda

- They are bilaterally symmetrical, segmented, and triploblastic.
- The circulatory system is open means blood does not flow in well-defined blood vessels.
- The body cavity is hemocoel ie filled with blood.
- They have jointed appendages.
- The body segment is divided into 3 regions-Head, thorax, and abdomen.
- The alimentary canal is complete.
- Examples: Spiders, Scorpions, and Crab.



Nobody knows how many species of insects exist; estimate range from a few million to over 30 million. At least 800,000 different species have been described and named formally.

Scorpion

#### Differences between Annelids and Arthropods are:

| Annelids  | Arthropods   |  |  |  |  |
|---|--|--|--|--|--|
| Animals are segmented both externally as well as internally | Animals are segmented externally, but not internally.            |  |  |  |  |
| They have unjointed appendages.                             | They have jointed appendages.                                    |  |  |  |  |
| The true coelom is well-developed.                          | In these blood-filled body cavities called haemocoel is present. |  |  |  |  |
| Exoskeleton is absent.                                      | The exoskeleton is made up of chitin.                            |  |  |  |  |
| Nephridia acts as excretory organs.                         | Green glands act as excretory organs.                            |  |  |  |  |
| A closed type of circulatory system is present.             | An open type of circulatory system is present.                   |  |  |  |  |
| Blood flows in closed blood vessels.                        | Blood flows through large sinuses.                               |  |  |  |  |





Cockroach Spider

Arthropoda

Butterfly



#### (vii) Mollusca

- Body is soft, bilaterally symmetrical, and segmented.
- The circulatory system is open.
- The coelomic cavity is blood-filled and reduced.
- They have kidney-like organs for excretion.
- Sexes are usually separate.
- There is little segmentation.
- They have a foot that is used for moving around. .
- Some are aquatic and some are terrestrial. .
- Examples: Chiton, Pila, Unio.

#### (viii) Echinodermata (Spiny skinned animals)

- They are star-like, spherical, or elongated.
- Body is triploblastic, coelomate, unsegmented, and radially symmetrical.
- Body lacks heads but has oral surfaces.
- . The body wall is covered by spiny hard calcium carbonate plates forming a rigid endoskeleton.
- Excretory organs are absent. .
- Sexes are separate. .
- Reproduction is asexual and sexual.
- They have a peculiar vascular system that they use for moving.
- Example: Starfish, Echinus, Sea Cucumber.



Echinoderms have a simple radial nervous system that consists of a modified nerve net of interconnecting neurons with no central brain, although some do possess ganglia.

#### (ix) Hemichordata

- Phylum hemichordata consists of a small group of worm-like marine animals.
- They have organ-system level of organization, bilaterally symmetrical, triploblastic, and coelomate animals.
- The body is cylindrical and is composed of an anterior proboscis, a collar, and a long trunk.
- The circulatory system is of open type, respiration takes place through gills and the excretory organ is the proboscis gland.
- Sexes are separate, fertilization is external and development is indirect.
- Examples: Balanoglossus and Sacoglossus.



**Check Your Concept - 1** 

- (i) Name the phylum of animals with pores on them.
- Name the phylum of Jellyfish. (ii)
- Name the phylum of the following animals: (iii) (i) Tapeworm (ii) Starfish (iii) Spongilla (iv) Octopus
- (iv) Give general characteristics of Porifera.
- (v) Give general characteristics of 'Platyhelminthes'?

#### Chordates

- to phylum Chordata are Animals belonging fundamentally characterized by the presence of a notochord, a dorsal hollow nerve cord, and paired pharyngeal gill slits.
- These are bilaterally symmetrical, triploblastic, and coelomate with an organ-system level of organization.
- They possess a post-anal tail and a closed circulatory system.
- Phylum Chordata is divided into three subphyla, which are Urochordata or Tunicata, Cephalochordata, and Vertebrata.
- Subphyla Urochordata and Cephalochordata are often referred to as protochordate.



#### Chordates

Echinodermata Proboscis

Sea urchin

Mantle Stomach

Intestine

Mollusca

Father star Sea cucumber

Star fish

cavity

Anus

Pila



# Hemichordata

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- In Urochordata, the notochord is present only in the larval tail, while in Cephalochordata, it extends from head to tail region and is persistent throughout their life.
- The members of Vertebrata possess a notochord during the embryonic period, which is replaced by a cartilaginous
  or bony vertebral column in the adult, and hence all vertebrates are chordates but all chordates are not
  vertebrates.

#### Comparison of chordates and non-chordates

- The notochord is present in chordates, on the other hand, absent in non-chordates.
- The central nervous system is dorsal, hollow, and single in chordates, whereas ventral, solid, and double in nonchordates.
- In chordates, the pharynx is perforated by gill slits, whereas gill slits are absent in non-chordates.
- The heart is ventral in chordates, whereas the heart is dorsal in non-chordates.
- A post-anal part (tail) is present in chordates but the post-anal tail is absent in non-chordates.

### Subphylum Vertebrata

- These are the most advanced group of animals with a true vertebral column and a strong endoskeleton.
- Subphylum Vertebrata is divided into 2 divisions, Agnatha, the division which lacks a jaw, and Gnathostomata, the division which bears the jaw.
- Agnatha has the Cyclostomata and Gnathostomata is classified into two super classes Pisces, which bear fins, and Tetrapoda, which bear limbs.
- Pisces is classified into class Chondrichthyes and class Osteichthyes.
- Tetrapoda is classified into Class Amphibia, Reptilia, Aves, and Mammals.



#### Cyclostomata

- They are parasitic, usually feeding on fish in their adult stage.
- They are known to be the only living vertebrates without true jaws, hence called Agnatha. Cyclostomata includes hagfishes and lampreys.
- Due to their circular mouth, they are named Cyclostomata.
- Example: Petromyzon

#### **Class Chondrichthyes**

- They are marine animals with a streamlined body and have a cartilaginous endoskeleton.
- The notochord is persistent throughout life and separated gill slits are without operculum.
- The skin is tough, containing minute placoid scales.
- Some of them have electric organs, such as torpedos and some possess poison stings such as Trygon.
- They are cold-blooded (poikilothermous) animals.
- Sexes are separate, fertilization is internal and they are mostly viviparous.
- Examples-Scoliodon (Dogfish), Pristis (Sawfish)

#### **Class Osteichthyes**

- Members of class Osteichthyes have four pairs of gills which are covered by an operculum on each side.
- Air bladder is present which regulates buoyancy.
- Heart is two-chambered and they are cold-blooded animals.
- Sexes are separate, fertilization is usually external, they are mostly oviparous and development is direct.
- The body is streamlined.
- Examples Marine Exocoetus (Flying fish), Freshwater Clarias (Magur)



Petromyzon



#### Amphibia

- These animals are found both in water and land.
- Respiration is through the gills or lungs.
- They are 4 legged vertebrates.
- They lay eggs.
- Skin is smooth or rough, moist, slimy, has mucus glands, and without scales.
- Three chambered heart is present.
- Example: Frogs, Toads, Salamander, and Hyla.

#### Reptilia

- They are cold-blooded terrestrial or aquatic vertebrates.
- Body is covered with a dry waterproof skin.
- Body is divided into head, tail, & neck
- Respiration is by the lungs only.
- Heart is three-chambered whereas crocodiles have a four-chambered heart.
- Most reptiles lay eggs with tough covering and do not need to lay their eggs
- Example: Snakes, Turtles, Lizards, Crocodiles, Chameleons.



- Longest poisonous snake King cobra
- Longest non-poisonous snake of India Python molurus
- Smallest non-poisonous snake Leptotyphlop
- Smallest non-poisonous snake of India Microtyphlop.

#### Differences between Amphibians and Reptiles are:

| Amphibians                         | Reptiles                            |
|------------------------------------|-------------------------------------|
| They have slimy skin.              | They have an exoskeleton of scales. |
| They mostly lay eggs inside water. | They lay eggs outside water.        |
| Larvae have gills.                 | They don't have gills.              |

#### Aves

- They are warm-blooded and have a four-chambered heart.
- They lay eggs.
- There is an outside covering of feathers and 2 forelimbs are modified for flight.
- They breathe through the lungs.
- Boat shaped body is divided into head, neck, and tail.
- Forelimbs are modified into wings for flight.
- Hind limbs bear four clawed digits and are adapted for walking, and perching.
- They have a horny beak.
- Bones are light and spongy due to the presence of air cavities.
- Heart is 4 chambered.
- Example: Ostrich, sparrow, crow, pigeon, parrot, vulture, duck, etc.

#### Mammalia

- They are warm-blooded with 4 chambered heart.
- They are mammary glands for the production of milk to nourish their young ones.
- Their skin has hairs, sweat, and oil glands.
- Teeth are embedded in the socket in the jaws and differentiated into incisors, canines, premolars, and molars.
- 2 pairs of pentadactyl limbs are present.
- A muscular diaphragm separates the thoracic and abdominal cavity.
- Respiration is by the lungs only.
- Examples: Kangaroo, Fox, Rat, Squirrel, Cat, Lion, Dog, Tiger, etc.







Ostrich





Rhea



Penguin

Aves

Mammalia



# **Solved Examples**

#### (1) Give one point of difference between notochord and nerve cord.

Answer: The notochord is the flexible rod of turgid cells located along the back of chordate embryos ventral to the nerve cord. It is replaced by a jointed vertebral column. The nerve cord is a collection of nerve fibers inside the vertebral column.

#### (2) Why whales are not grouped in the fishes?

**Answer:** Whales can swim in water like the fishes but are not fish as they respire with lungs and have a fourchambered heart and mammary glands. So, they are mammals.

# (3) Give one example of each (i) Asymmetry, radial, and bilateral symmetry (ii) Acoelomates, pseudocoelomate, and haemocoelomate.

Answer: (i) Amoeba, Hydra, and a fish. (ii) Flatworms, Roundworms, and Arthropods

#### (4) In what way, amphibians are more advanced than the fishes?

**Answer:** Amphibians have a three-chambered heart and lungs for respiration, while fishes have two-chambered hearts and gills for respiration.

#### (5) Name the group of organisms that have a dicondylic skull.

Answer: Amphibia and mammals.

#### (6) What are reptiles?

**Answer:** Reptiles are crawling vertebrates that are cold-blooded and have dry horn scales. They are mostly terrestrial and live in warmer regions. They breathe through the lungs. The heart is three-chambered, except for crocodiles which have a four-chambered heart. Reptiles lay eggs with thick coverings. Examples: Snakes, Lizards, Crocodiles, and Turtles.

#### (7) List a few flight adaptations in birds.

- Answer: Flight adaptations in birds are:
  - (i) Forelimbs are modified into wings.
  - (ii) The body is covered by the exoskeleton of feathers.
  - (iii) The body is streamlined to reduce air resistance.
  - (iv) Well-developed flight muscles.
  - (v) The presence of air sacs helps in double respiration.
  - (vi) Tail feathers from a steering apparatus.
  - They have acute vision.

#### (8) Give two examples of the range of variations that you see in life forms around you.

**Answer:** These examples are as follows:

(i) Life Span: Mayfly lives for one day, most mosquitoes for a few days while some Pine trees live for thousands of years.

(ii) Color: Jellyfish and many worms are colorless. Birds, butterflies, and flowers are variously colored brightly.

#### (9) What is the basic difference that distinguishes a Simple and a Complex Organism?

Answer: Primitive organisms are those organisms that have simple ancient body designs. There has been little change over a long period. Specializations are fewer.

Advanced organisms are more recent organisms. They are also called higher organisms because they possess several specializations. They are hence, more complex.

# (10) How are criteria for deciding divisions in plants different from the criteria for deciding subgroups amongst animals?

**Answer:** The body design of plants is quite different from that of animals. Plants are anchored. They require organs for fixation and absorption. Plants are autotrophic. Reproductive organs, mechanical tissues, and conducting tissues have evolved in higher plants. In animals, the requirement is mobility for obtaining food and other necessities. Their evolution has occurred towards greater mobility, protection divisions or subgroups are different for plants and animals.



## **FILL IN THE BLANKS**

- Animals with three pairs of legs belong to phylum (1)
- Hyphae are present in (2)
- (3)
- In insects, the body is divided into\_\_\_\_\_, \_\_\_\_ and \_\_\_\_\_ Snails, oysters, mussels, clams, squids belong to the phylum (4)
- (5) Crab, butterfly, scorpion, and centipede, spiders all belong to the phylum \_
- (6) The presence of spicules pores in the body, and a single cavity is the characteristics of phylum\_
- have unregimented body, exoskeleton and a spiny surface and tube feet. (7)
- (8) are those animals which have no backbone.
- (9) Nematocysts are found in animals belong to phylum
- Warm-blooded with (10) chambered Heart.

## **TRUE OR FALSE**

- The diaphragm is found in reptiles. (1)
- (2) A whale lives in water, it is a fish.
- (3) Amphibians live partly on land and partly in the water.
- Echinodermata have an unregimented radially symmetrical body. (4)
- (5) Most reptiles lay eggs with tough covering and do not need to lay their eggs in water.

#### **OBJECTIVE TYPE QUESTIONS**

| (1)  | Which one of the following is incorrectly pairs<br>(A) Ascaris – Arthropoda<br>(C) Tapeworm – Platyhelminthes | ed?<br>(B) Sponges – Porifera<br>(D) Leech – Annelida  |  |  |  |
|------|---|--|--|--|--|
| (2)  | What is the exclusive marine phylum?<br>(A) Echinodermata<br>(C) Cnidarians                                   | (B) Porifera<br>(D) Protozoa   |  |  |  |
| (3)  | What is the phylum of Octopus?<br>(A) Arthropoda<br>(C) Annelida  | (B) Mollusca<br>(D) Cnidarian  |  |  |  |
| (4)  | In which organism flame cells form the excre<br>(A) flatworms<br>(C) Insects                                  | tory system?<br>(B) Earthworms<br>(D) crabs  |  |  |  |
| (5)  | In which group of animals, coelom is filled wi<br>(A) Arthropoda<br>(C) Nematoda                              | th blood?<br>(B) Annelida<br>(D) Echinodermata   |  |  |  |
| (6)  | Which one is the most striking or (common)<br>(A) Presence of gill pouches<br>(C)Presence of notochord        | character of the vertebrates?<br>(B) Presence of triploblastic condition<br>(D) Presence of coelom |  |  |  |
| (7)  | Identify a member of porifera<br>(A) Hydra<br>(C) Penicillium   | (B) Euglena<br>(D) Spongilla   |  |  |  |
| (8)  | The locomotory organs of Echinodermata are<br>(A) tube feet<br>(C) jointed legs                               | e<br>(B) muscular feet<br>(D) parapodia  |  |  |  |
| (9)  | Two chambered heart occurs in<br>(A) Crocodiles<br>(C) Aves   | (B) Fish<br>(D) Amphibians   |  |  |  |
| (10) | One of the following is not an Annelid?<br>(A) Nereis<br>(C) Leech  | (B) Earthworm<br>(D) Urchins   |  |  |  |
|      |   |  |  |  |  |



# Answer Key

# FILL IN THE BLANKS

Porifera

(10) 4

Coelenterata

- (1) Arthropoda (6)
- (2) Fungi (7) Echinoderms
- (3) Head, Thorax & Abdomen (8) Invertebrates
- (4) Mollusca (9)
- (5) Arthropoda

# TRUE OR FALSE

- (1) False
- (2) False
- (3) False
- (4) True
- (5) False

## **OBJECTIVE TYPE QUESTIONS**

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| (B) | (A) | (B) | (A) | (A) | (C) | (D) | (A) | (B) | (D)  |