

CHAPTER 10,11



CHAPTER

10

KINGDOM ANIMALIA

LONG QUESTIONS

DEVELOPMENT OF COMPLEXITY IN ANIMALS

Q.1: Give classification and development of complexity in animals.

Ans. Introduction

Kingdom animalia includes all the animals. The word animalia has been derived from Latin word, 'anima' meaning breathy or soul.

CLASSIFICATION OF ANIMALS

According to two kingdom system of classification, animals were classified into two groups i.e.

- i) **Protozoa:** Containing all unicellular (one celled) animals.
- ii) **Metazoa:** Containing all multicellular animals.

According to Five-Kingdom Classification

Now a days, five-kingdom classification of Robert Whittaker is used. According to this system:

- Traditional protozoans are placed in **Kingdom Protoctista**.
- Multicellular animals are placed in **Kingdom Animalia**.

Feature of Animals

Kingdom animalia consists of all animals, which are

- Multicellular
- Diploid
- Eukaryotic
- Ingestive heterotrophs
- Developed from two dissimilar haploid gametes, a large egg and a smaller sperm.

Origin of Animals

Animals are considered to be evolved from protoctists.

DEVELOPMENT OF COMPLEXITY IN ANIMALS

Although multicellularity is found in all the kingdoms i.e. Fungi, Plantae and Animalia but it has developed most impressively in animals-their cells are joined by complex junctions, this ensure control of communications and flow of material between cells.

CLASSIFICATION OF ANIMALS

The animals are diverse groups distinct in their form.

- The smallest are microscopic, which are smaller than many **protoctists**.
- Largest are whales (sea mammals), included in phylum **chordate**.

1) Parazoa

The simplest of the animals belong to subkingdom **Parazoa** (phylum Porifera).

These animals lack tissues organized into organ and have indeterminate shape and are asymmetrical.

Q. Write a note on development of complexity in animals. (LHR-2013)

The subkingdom **Eumetazoa** includes animals of other phyla. These animals have tissues organized into organs and organ systems.

Eumetazoa consist of nearly 29 phyla of animal kingdom and is divided into two grades i.e. **grade radiata** and **grade bilateria** depending upon the type of symmetry.

A) Grade Radiata

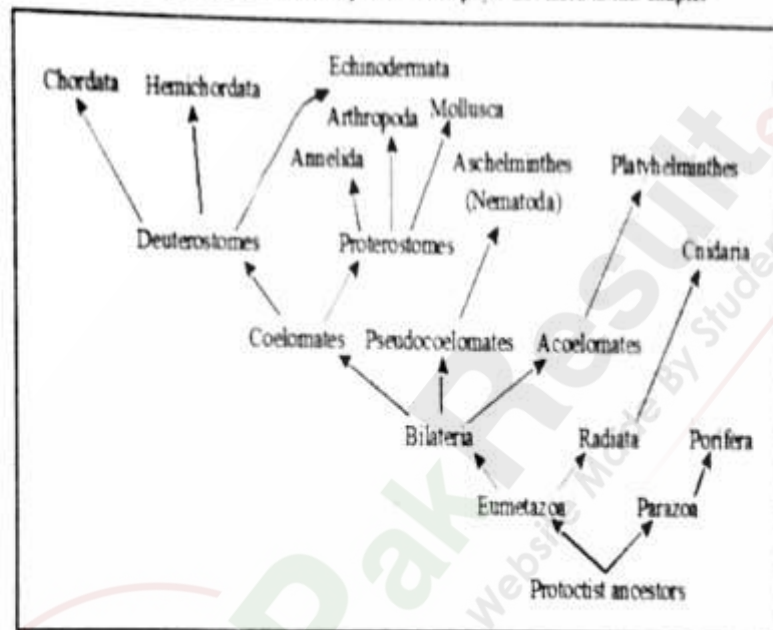
Grade Radiata includes simplest of the Eumetazoa (phylum Cnidaria) with radial symmetry.

They are much simpler in their organization and all are diploblastic.

B) Grade Bilateria

Animals present in this grade have bilateral symmetry. These animals have been divided into three groups on the basis of presence, absence of type of body cavity found in them. The animals, which do not have a body cavity, have been grouped under **Acoelomata**. The animals, which have a false coelom, the pseudocoel, have been grouped under **Pseudocoelomata**. The animals, which have a true coelom, have been grouped under **Coelomata**.

Table: The relationship of different phyla discussed in this chapter



GRADE RADIATA

Q.2: What are the features of Grade radiata and bilateria.

- Write a note on protostomes and deuterostomes.
- Distinguish between Radial and Bilateral symmetry.

Ans. In this group animals with radial symmetry are present.

Features

All the animals, which are present in this group, are **diploblastic**. Body parts are arranged around a central axis in such a way that any plane passing through the central axis divides the animal in halves that are almost mirror image of each other.

Example

Example includes **cnidaria (coelenterata)**. The cylindrical body of sea-anemone can be cut in two equal halves vertically in any plane.

GRADE BILATERIA

This group contains bilaterally symmetrical animals.

Features

The animals have bilateral symmetry. The animals can be divided into two equal parts by an imaginary line in one plane. The animals has right side, which is approximately the same as the left side and where there is a distinct anterior end.

In most multicellular animals, there is a clearly differentiated head present at the anterior end and a distinct posterior end. There are clearly defined dorsal and ventral surfaces. All the animals are triploblastic. These may be acoelomate, pseudocoelomate and coelomate.

Example

The animals belonging to phyla, Platyhelminthes, Nematoda, Annelida, Mollusca, Arthropoda, Echinodermata, Hemichordata and chordata are included in this grade.

Animals belonging to phylum Echinodermata have developed bilateral symmetry during their larval stages; however the adult Echinoderms have secondarily developed radial symmetry, due to their special mode of life.

Q. What is meant by grade radiata?

(GUJ-2014)

Q. Give a comparison between Protostomia and Deuterostomia.

(MTN-GI-2011) (FBD-G1)-14,
(LHR-G2)-15



Fig: Radial

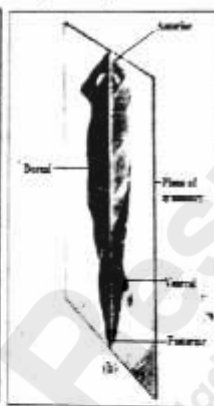


Fig: Bilateral symmetry

DIFFERENCE BETWEEN PROTEROSTOMES AND DEUTEROSTOMES

Difference	Proterostomia (Protosomes)	Deuterostomia (Deuterostomes)
1) Cleavage	Cleavage or division of the zygote is spiral and determinate.	Cleavage is radial and indeterminate.
2) Mesoderm	Mesoderm is derived from cells of lip of blastopore.	Mesoderm is derived from wall of developing gut (archenteron).
3) Mouth & Anus	During development process, the mouth in these animals arises from the blastopore or form its anterior margin.	During embryonic development, mouth is formed at some distance anterior to the blastopore and blastopore forms the anus.
4) Coelom	Coelom or body cavity is formed due to splitting of mesoderm (schizocoelous).	Coelom is developed as an outpouching of archenterons (enterocoelous).
5) Examples	This series proterostomia includes animals belonging to phyla, aschelminthes, annelida, mollusca and arthropoda.	This series deuterostomia includes animals belonging to phyla echinodermata, hemichordata and chordata.

Spiral Cleavage

A spiral and determinate cleavage is that in which.

- The lines or planes of cleavage are not symmetrical between poles.
- Lines are diagonal to the polar axis and produce unequal cells around the axis of polarity.
- All the blastomeres have determined role to play in the formation of embryo. The fate of each blastomere is foretold.

Q. Define term spiral cleavage.

(GUJ-G2)-16

Radial Cleavage

A radial or indeterminate cleavage is that in which.

- The planes of cleavage are symmetrical to the polar axis.
- These lines produce tiers of cells on top of each other.
- Fate of each blastomere is not pre-determined. In some, any one blastomere can produce a complete embryo.

Q. What is radial cleavage?

(DGK-G1)-15

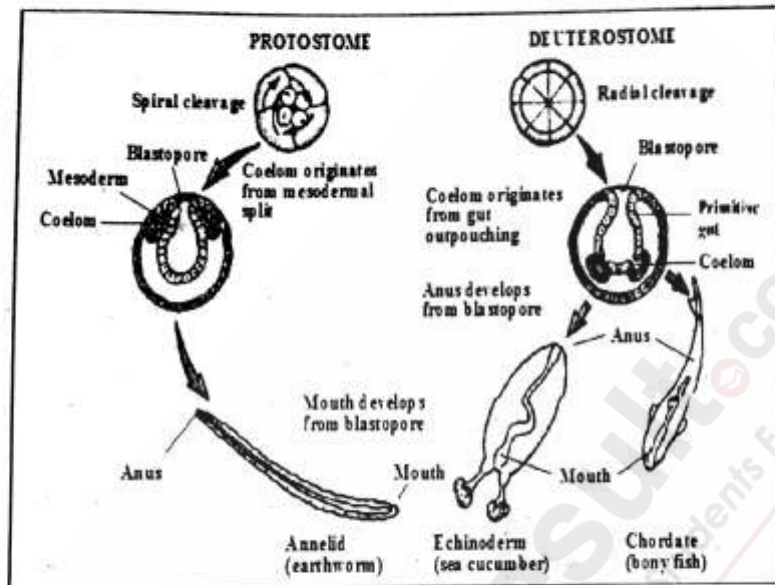


Fig: Patterns of embryonic development of coelom and the egg cleavage in protostomes and deuterostomes

Q.3: Give the distinguishing features of diploblastic and triploblastic organization

Ans. DIPLOBLASTIC AND TRIPLOBLASTIC ORGANIZATION

(I) Diploblastic Organization

Definition

Such an organization of body, in which there are two layers of cells, is called diploblastic organization and such animals are called diploblastic animals.

Features

- Diploblastic animals belong to division radiata.
- The body of these animals consists of two layers of cells i.e. ectoderm and endoderm.
- There is jelly-like non-cellular mesenchyma or mesogloea present between these two layers.
- These animals have radial symmetry.
- These animals show lesser degree of specialization and so they do not form specialized organs.
- There is no special transport system in these animals. Most substances are distributed within their body by the process of diffusion.
- There is no central nervous system in these animals. A neuron net is present.
- There is only one cavity in the body by called gastrovascular cavity, which has only mouth, which serves for the entry of food and water and also for the removal of wastes along with water. This is known as sea-like digestive system.

Example

Diploblastic animals are included in phylum Cnidaria (coelenterata).

Q. What are the diploblastic animals? (AJK-G1)-16

Q. What is mesogloea and spongocoel? (AJK-G1)-15

(II) Triploblastic Organization

Definition

Such an organization in which there are three body layers is called triploblastic organization and such animals are called triploblastic animals.

Features

- i) Triploblastic animals are placed in **grade bilateria**.
- ii) The body of these animals is made up of three layers i.e. **ectoderm, mesoderm and endoderm**. After embryonic development, these layers in most animals are not distinct as separate layers of cells, but are represented by the structures formed from them.
- iii) The cells of these animals show **greater degree of specialization**. They have specialized organs and systems.
- iv) Special transport system i.e. blood vascular system is present in most of the cases.
 - **Ectoderm** gives rise to integumentary and nervous systems.
 - **Mesoderm** gives rise to muscular, skeletal and reproductive systems.
 - **Endoderm** forms the lining of digestive tract and from other glands of digestive system such as liver.
- v) The digestive system is of tube-type i.e. having mouth at the anterior end and the anus at the posterior end.
- vi) These animals may be acoelomate, pseudocoelomate or coelomate.

Examples

All the animals of grade bilateria belong to this group.

ACOELMATES, PSEUDOCOELMATES AND COELOMATES

These are explained as follows.

1) ACOELMATES

They have no body cavity or coelom.

Q. Write a note on three groups of triploblastic animals.

(LHR-2013, 15: FED-12: GUJ-14)

Features

- i) In them, mesoderm forms a loose, cellular tissue called mesenchyma or parenchyma, which fills the space between the ectoderm and endoderm.
- ii) Mesenchyma or parenchyma forms a packing around the internal organs of the animals to support and protect them.
- iii) Gut is **sac-type**.
- iv) There is no special transport system.
- v) Excretory system is developed for the transport of excretory products. This system consists of flame cells, excretory ducts and excretory pores.
- vi) Nervous system is well developed.

Examples

Animals of phylum platyhelminthes are acoelomates.

2) PSEUDOCOELOMATES

Animals in which false body cavity or pseudocoelom is present are called pseudocoelomates.

Features

- i) In these animals, space between the body wall and the digestive tube is called pseudocoelom.
- ii) Pseudocoelom is not homologous to true coelom because it is not lined by coelomic epithelium (mesodermal cells).
- iii) It has no relation with the reproductive and excretory organs.
- iv) It develops from the blastocoel of the embryo.
- v) It is bounded externally by the muscles and internally by the cuticle of the intestine.

Examples

Animals of phylum Aschelminthes are pseudocoelomates.

3) COELOMATES

Animals, which have **true body cavity or coelom** are called coelomates.

Q. What is coelom? (LHR-G1)-14

Features

- This cavity is present between the body wall and alimentary canal and is lined by mesoderm.
- The mesoderm splits into outer parietal layer, which underlines the body wall and the visceral layers, which covers the alimentary canal and the cavity between them is the true coelom.
- Coelom is filled with coelomic fluid.
- Gut attains more complexity.
- Neurosensory, excretory, circulatory, respiratory and reproductive system are well developed.

Examples

Animals from annelids to chordates are coelomates.

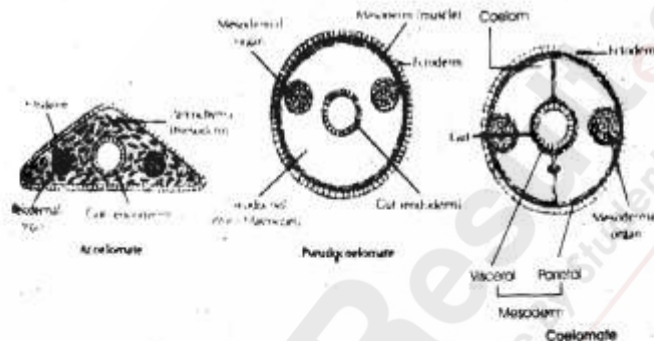


Fig: General body plan of acoelomates, pseudocoelomates and coelomates.

PARAZOA

Q.4: Discuss general characteristics, examples and importance of Phylum Porifera.

Ans. PARAZOA

PHYLUM-PORIFERA: (THE MOST PRIMITIVE ANIMALS)

Introduction

The word 'porifera' is derived from Latin 'porus' meaning 'pore' and 'ferra' meaning 'to bear'.

Thus they are pore-bearing animals, commonly called the sponges.

GENERAL CHARACTERISTICS

i) Habitat

All animals are aquatic. Out of total 5000 species, 150 species live in **fresh water** while all others are marine.

ii) Size

The poriferans range in size from few millimeters wide to more than one meter tall. They are macroscopic i.e. can be seen with naked eye. *Scolymastra joubini*, a barrel-like glass sponge of Antarctica is more than a meter tall.

iii) Mode Of Life

The adult sponges are stationary, spending their lives attached to the rocks at the bottom or other solid objects. However, their larvae are able to move (swim).

iv) Body Structure

- The animals are made up of **many cells**, but there is **no tissue organization** and have no organs.
- They **lack symmetry**.

Q. Discuss general characters of Parazoa

(BWP-2013: LHR-15: FED-13)

Q. Give the importance of Sponges

(FBD-2015: LHR-14: FED-12)

- In most sponges, the body wall is formed of an outer layer, **pinacoderm**, made up of cells called pinacocytes and an inner layer, **choanoderm**, made up of flagellated collar cells called choanocytes. Between these two layers is present gelatinous mesenchyme, which may contain amoeboid cells and spicules or sponging fibres.
- There is single cavity inside the body, the **spongocoel**. In the most sponges, it may be divided into flagellated chambers or canals, lined by flagellated choanocytes.
- The skeleton is in the form of variously shaped needle-like structure called **spicules**. These may be calcareous or siliceous. The bath sponge has a skeleton of spongin fibres.

The skeleton is present among pinacocytes and provides support. Spicules are also present around osculum and ostia.

v) Body Systems

- There are **no respiratory or circulatory systems**.
- There is **water vascular system**, which is made up of numerous pores present in the body wall. The pores, through which water enters the body are called **ostia** and pore through which water leaves the body known as **osulum** (main opening).
- There is no definite nervous system. However neurosensory and neuron cells are probably present, which seem to coordinate the flow of water.

vi) Feeding and Excretion

- As sponges are sessile, so they depend food coming to them along with water currents brought about by movement of flagella of choanocytes. This includes small animals (Zooplanktons) and plants (phytoplankton), which constitute about 20% of their food. 80% of their food consists of detrital organic particles. The food enters the spongocoel cavity through ostia. It is ingested by the flagellated cells, the choanocytes.
- The waste products either diffuse out of the sponges directly through the body wall or flow out through osculum.

vii) Reproduction

Sponges reproduce both asexually and sexually.

- The asexual reproduction in sponges is by budding. The buds may be external or internal.

The internal buds are called **gemmules**. Both types of buds develop into new sponges.

- Some sponge species reproduce sexually. These are mostly **hermaphrodite**, mostly **protandrous** i.e. male sex cells develop first. In some sponges, the sexes are separate.

Sperms released in water in are carried to the egg by amoeboid cells. Fertilization occurs in mesenchyme and zygote is formed. The embryo development includes blastula and larval stages.

Q. Define gemmule and protandros.

(AJK-G1)-15, (SGD-G1), (RWP-G1)-16

Examples

Examples of sponges are:

- Sycon**: It is a typical marine sponge.

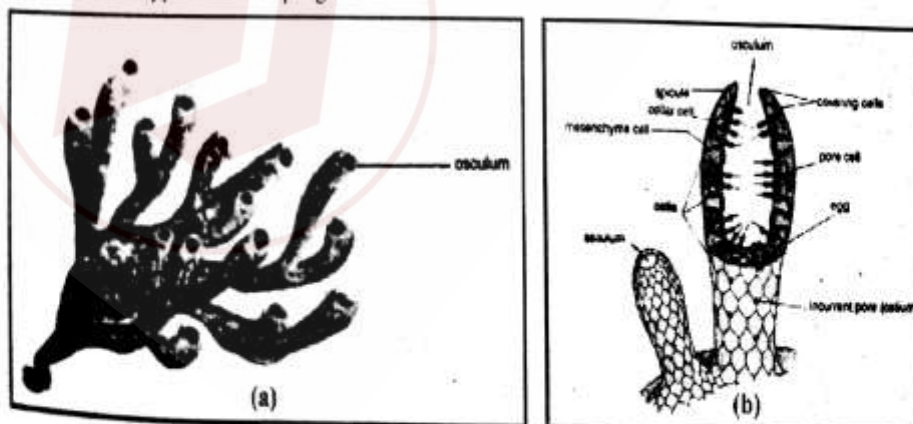


Fig. (a) A sponge, Sycon (b) Part of a colony of a simple sponge, the upper part is cut away to show the structure.

- ii) **Leucosolenia**: A sponge that consists of groups of erect branches.
- iii) **Euplectella**: It is beautiful and delicate sponge made up of glassy framework. It is commonly called venus flower basket.
- iv) **Spongilla**: It is fresh water sponge.

Importance of Sponges

- i) The skeletons of sponges have long been used by mostly for washing and bathing.
- ii) They have great capacity to absorb water. Thus they are used in surgical operations for absorbing fluids and blood.
- iii) They are also used for sound absorption in buildings.
- iv) The best commercial sponges are found in the warm water of Mediterranean Sea.
- v) Many artificial sponges have been made from synthetic material, still the natural sponges are in demand and are an important industry in many parts of the world.

Q. Write down the importance of sponges. OR How they reproduced.
 (BWP-G1) (GUJ-G1)-14, (GUJ-G1)
 (GUJ-G2)-15, (DGK-G2)(BWP-G1)-16
 (GUJ-G1)-17

GRADE RADIATA

Q.5: What are Cnidaria? Explain the diploblastic origin and alternation of generation in Cnidaria.

Ans. PHYLUM COELENTERATA/ CNIDARIA/DIPLOBASTIC ANIMALS

Introduction

The name Cnidaria has been given to this group of animals due to the presence of special cells called **cnidocytes**. These cells give rise to nematocysts (the stinging cells), which are characteristic of this group.

i) Habitat

The coelenterates are aquatic, found both in marine and fresh water.

ii) Size

The coelenterates range in size from microscopic (Hydra) to macroscopic (branchiocranthus), a hydrozoan polyp that may reach two meters in length.

Q. What are Cnidocytes? (LHR-G1)-15

iii) Body Structure

- Cnidarians have double layer organization and are therefore **diploblastic** having tissue grade organization and have organs.
- During the development, two germinal layers are formed. Outer layer is ectoderm and inner is endoderm from which their bodies are constructed.
- Ectoderm forms outer covering and some cells of this layer in most animals give rise to nematocysts. Endoderm becomes specialized for digestion of food. Between the two layers is a jelly-like mesoglea.
- In these animals, there is only one cavity, which serves as digestive as well as body cavity.

This cavity is called gastrovascular cavity or enteron and opens to the outside by only one opening the mouth. So the animals of this group have sac-like digestive cavity.

The mouth is surrounded by a series of tentacles. These bear stinging cells or nematocysts, which are organs of defense and offense.

- These animals are **radially symmetrical**.
- Many colonial coelenterates such as corals produce a hard exoskeleton formed of calcium carbonate (CaCO_3). It is secreted by epidermal cells that take lime from sea water. The skeleton of coral is responsible for formation of small coral islands or large coral reefs.

iv) Presence of Zooids

Cnidarians are found in two basic forms, the polyps and the medusa, which are called zooids.

- **Polyps** are cylindrical animal, which in most cases are nutritive in function, hence named as gastrozooids.
- The **medusa** are umbrella-like in form. These are free swimming and are involved in sexual reproduction as they have gonads.

v) **Body Systems**

- The nervous system is in the form of a network of neuron cells forming an irregular net or plexus in the body wall. There is no central nervous system.
- Digestive system is sac-like.
- They have no specific circulatory and respiratory systems.

vi) **Feeding**

The coelenterates are carnivores and feed upon small organisms, which come into contact with them. These organisms are immobilized by nematocysts and taken into the digestive cavity as food, where it is digested and then distributed by diffusion.

vii) **Reproduction:**

In coelenterates reproduction takes place by asexual as well as sexual means.

- *Hydra* reproduces asexually by the formation of buds on its surface. The bud after sometimes separate from the parent and develops into a new individual.
- *Obelia* reproduces both asexually as well as sexually. It has a kind of zooid known as blastostyle, which gives rise to individual zooids called medusae by asexual method. The medusae when released in water develop reproductive organs, which gives rise to gametes that unite to form zygote from which *Obelia* colony is again formed.

viii) **Alternation of Generations:**

The life cycle of coelenterates is characterized by the presence of alternation of generations. There are two generations, one reproduces by sexual means and the other by asexual means. Both generations are diploid. Often the two generations consist of one free-living and one attached stage. Therefore asexual generation and sexual generations alternate with one another. This is known as alternation of generations e.g. *Obelia*.

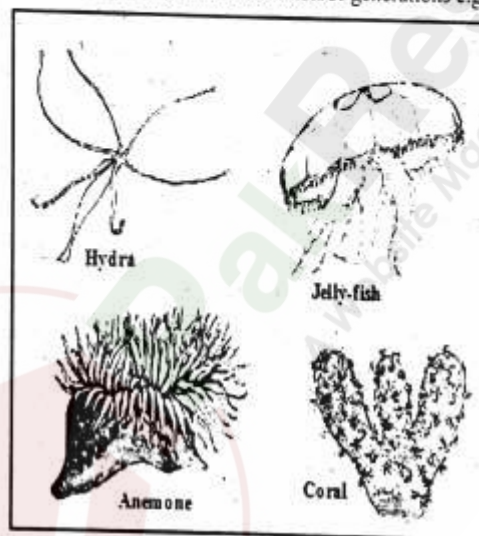


Fig: Coelenterates (Cnidarians)

POLYMORPHISM-A CHARACTERISTICS FEATURE OF COELENTERATES (CNIDARIA)

"The occurrence of structurally and functionally more than two different types of individuals, called the zooids within the same organism is called **polymorphism**."

For example:

In *Obelia*

- Feeding individuals (zooids) are gastrozooids.
- Asexually reproducing zooids called gonozooids (blastostyle).
- Free-living or sexually reproducing zooids called the medusae.

Some of the colonial members have up to five different types of zooids performing different functions for the colony e.g. *Physalia physalis* (Portuguese man of war).

Q. Define polymorphism. (LHR-G1)-14
(LHR-G1)(DGK-G1)(FBD-G1)
(MTN-G1)-15, (GUJ-G1)(SWL-G1)-16

Examples

The common examples of coelenterates are:

- (i) **Hydra**: A freshwater coelenterate. It exists only in polyp form, therefore alternation of generation is absent.
- (ii) **Obelia**: A marine colonial coelenterate that exhibits alternation of generations.
- (iii) **Aurelia** (Jelly fish): The polyp is reduced and medusa is dominant in jelly fish.
- (iv) **Actinia** (Sea anemone): The body consists of polyp only. Enteron is divided by large partitions called mesenteries.
- (v) **Medrepore** (Corals): The body is covered with hard calcareous skeleton formed of calcium carbonate. They are commonly called corals. The skeleton forms large coral reefs and even small islands.

CORAL REEFS

Corals are formed from the secretions produced by specialized polyps that are present in certain coelenterates. These polyps become covered by stony cups due to hardening of their secretions. From the mouth of stony cup a polyp can pass out its tentacle for the purpose of feeding and withdraw itself when not feeding.

Most such coelenterates are colonial. The stony network or mass of such coelenterates are called **corals**.

Living polyps are found on the surface layer of corals whereas underneath the mass are dead stony structures only and there are no polyps inside.

The stony masses that are formed in this way are called **coral reefs**. These are mostly formed of calcium carbonate (lime stone).

Coral reefs are found in the coastal waters of Florida, West Indies, East Coasts of Africa, Australia and Island of Coral Sea.

Importance

- (i) Corals are basic source of chalk and limestone.
- (ii) Because of their massive structure, they serve as living place for a variety of sea life.

Q. What are coral reefs? (SWL-G1)
(FBD-G1)-14, (DGK-G2)-15, (LHR-G1)-16
Q. What are Nematocysts? (GUJ-G2)-16

GRADE BILATERIA

Q.6: Describe the parasitic adaptation in phylum Platyhelminthes. How tapeworms affect a person?

Ans.

TRIPLOBLASTIC ANIMALS-THE ACOELOMATES

PHYLUM PLATYHELMINTHES-THE FLATWORMS

Introduction:

These animals are commonly called as flatworms.

General Characteristics

(i) Size

Their size ranges from few millimeters (10 mm in case of Planaria) to several meters (tapeworm).

(ii) Mode of Life

- ♦ With few exceptions the Platyhelminthes are parasites, mostly endoparasites (which live inside their host). The most common examples are *Taenia solium* (tapeworm), *Fasciola hepatica* (liver fluke) and *Schistosoma* (blood fluke).

Parasites are more common in tropics. In these species, movement is restricted. Some of these cause diseases in humans.

- ♦ A few species are free living and found in freshwater, for example *Dugesia* (planaria). The free-living forms are motile. They move by cilia present on their underside e.g. as in Planaria.

Q. What are adaptations for parasitic mode of life of Platyhelminthes
(LHR-2015: GUJ-03, 14) (MTN-G1)-16
Q. Write any two parasitic adaptation in flat worms. (AJK-G1)-15,
(DGK-G2)-16, (GUJ-G1)-17

(iii) **Body Structure**

- ♦ The body of these animals is soft and dorsoventrally compressed.
- ♦ These are triploblastic acoelomates.
- ♦ There is development of third layer, the mesoderm, which separates the ectoderm from endoderm.
- ♦ These animals exhibit bilateral symmetry and body is unsegmented.

(iv) **Body Systems**

- ♦ Much of the body space in these animals is taken up by a branching sac type digestive system. The digestive system is poorly developed in some species or may be absent as in tapeworms.
- ♦ The excretory system consists of branching tubes ending in bulb-like cells called flame cells.
- ♦ A well developed nervous system is present in Platyhelminthes. It is in the form of either a network of nerves or ganglia. The sense organs are present at the anterior end.
- ♦ Respiratory and circulatory system are absent.

(v) **Feeding:**

The parasitic species absorb nutrients from the host. The free-living species (Planaria) feed on small animals and bodies of dead and decaying animals.

(vi) **Reproduction**

The Platyhelminthes reproduce both by sexual and asexual means of reproduction.

- ♦ Asexual reproduction is by fission in which the animal constricts in the middle into two pieces, each of which regenerates the missing part.
- ♦ The sexually reproducing species are **hermaphrodite** i.e. both male and female reproductive organs are present in the same individual. Larval form is sometimes present.

Q. Give reproduction in platyhelminthes.

(MTN-G1)-14

Q. What is hermaphrodite animals.

(MTN-G1)-15, (SGD-G1)(DGK-G1)-16

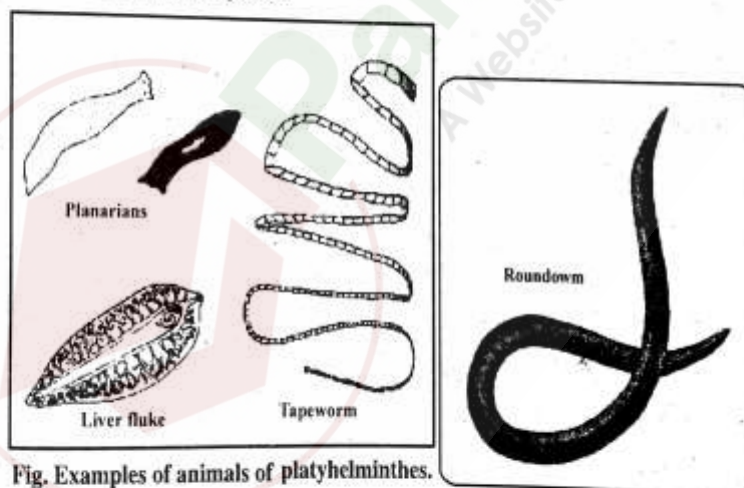


Fig. Examples of animals of platyhelminthes.

Examples

The common examples of flatworms are:

- Dugesia (Planaria):** A free-living flatworms with a ciliated outer surface.
- Fasciola (Liver fluke):** It is an endoparasite in sheep and occasionally in human beings. It has suckers used for attachment to host tissue. It completes its life cycle in two hosts, a snail and sheep or man. It lives in the bile duct of its hosts.

Q. Write two members of platyhelminthes. (SGD-G2)-15

Q. Write scientific name of pinworm and hookworm. (SGD-G1)-14

- (iii) **Taenia (Tapeworm):** An endoparasite of humans, cattle and pig that completes its life cycle in two hosts. The intermediate host is pig or cattle. The body is ribbon like and divided into segments called proglottids, which contain mainly sex organs. The segments continue to break off and are passed out from the intestine along with faeces.

ADAPTATIONS FOR PARASITIC MODE OF LIFE

The parasitic Platyhelminthes have completely adapted themselves to parasitic mode of life by the development of the following characteristics

1. The epidermis is absent and there is formation of resistant cuticle for protection.
2. They have developed adhesive organs, such as suckers and hooks, for attachment to the host.
3. There is degeneration of muscular system and nervous system.
4. The digestive system has become simplified due to increased dependence on host.
5. The reproductive systems are complicated and the ova are produced in huge numbers to ensure continuity of the species.
6. The complexity of life cycle and presence of more than one host during the life cycle is also an important parasitic adaptation.

INFESTATION AND DISINFESTATION

Infestation

- ♦ In *Taenia* (tape worm), the development of the zygote begins while it is still inside the uterus of female. The last segments or proglottids and their uteri contain completely developed embryo.
- ♦ The fully mature proglottids break off from the body and pass out of the body of man along with faeces (undigested waste).
- ♦ The embryo inside the egg is round in shape and has six chitinous hooks. It shows limited movement of contraction. In order to develop further, it must reach a second host, which may be a cow.
- ♦ The parasite remains embedded in the voluntary muscles of cow.
- ♦ If an improperly cooked beef is eaten by a person, the parasite which has not been killed begins to develop further in the intestine of man.

Disinfestation

- ♦ Once the parasite has entered the intestine of man, it is difficult to remove it completely. Care must be taken to cook beef properly before eating it, so that there is no chance of the parasite entering the digestive system.
- ♦ If parasite has entered then certain medicines are taken to remove it. Its complete removal is necessarily because if only head remains inside the intestine it can grow into new tape worm once again.
- ♦ Besides treatment with drugs, physician also give anema to the patient to fully remove the parasite.

Q.7: Give the general characteristics for the disease caused by certain nematods.

Ans. TRIPLOBLASTIC ANIMALS-PSEUDOCOELOMATES

PHYLUM NEMATODA-ASCHELMINTHES

Introduction

The name 'Nematoda' means 'pointed ends'. The animals included in this group have elongated worm like body with pointed ends.

These are also called as round worms.

General Characteristics

- (i) **Size:** The nematodes range from small microscopic forms to some form reaching a length of upto one meter.
- (ii) **Body Structure**
 - ♦ They exhibit bilateral symmetry. One end of body is anterior, however the head is not clearly marked and there are no special sense organs at this end.
 - ♦ The nematodes are triploblastic.

- ♦ They are pseudocoelomate. Body cavity is pseudocoelom it is derived from the hollow space, the blastocoels, situated in the blastula, an early stage in embryological development, and not from mesoderm. It consists of a number of vacuolated cells filled with a protein-rich fluid which develops high hydrostatic pressure.
- ♦ A fluid filled space is present between the body wall and alimentary canal. It provides 'tube within tube' type structure in nematodes.
- ♦ The body is unsegmented.

(iii) Body Systems

- ♦ The digestive system is in the form of alimentary canal with two openings. The opening at the anterior end is mouth and at the posterior end is the anus. In parasitic nematodes, the digestive system is simple.
- ♦ The excretory system consists of two longitudinally running excretory canals, which unite at the anterior end to form a single canal that opens to the exterior through an excretory pore on the ventral surface.
- ♦ There is a nerve ring around the pharynx, which gives rise to dorsal, ventral and lateral nerve cords running throughout the length of the worms. The sense organs are in the form of sensory papillae present on the lips at the anterior end.
- ♦ The circulatory and respiratory systems are absent. The gaseous exchange takes place through general body surface.
- ♦ Locomotion is by undulating waves of contraction and relaxation of muscles. These muscles are arranged in four bands, two dorso-lateral and two ventro-lateral. The circular muscles are absent, therefore the bending is dorso-ventral only.

(iv) Reproduction

The sexes are separate. The female gonads are ovaries and these produce eggs. The male gonads are testes, which produce sperms. A larval stage is present in the life cycle.

IMPORTANCE-PARASITIC DISEASES

Round worms are important from the point of view of its parasites of which it has a great variety causing some very serious diseases in man and plants.

They are found everywhere outdoors, where they play an important role in breaking down organic matter. A single rotting apple may contain 90,000 worms. Billions thrive in each acre of topsoil.

- Ascaris lumbricoides* is an intestinal parasite of man.
- The genus *Rhabditis* contains numerous species normally found in soil, organic matter or water and faeces of man or animals.
- Enterobius vermicularis* commonly known as pinworm is cosmopolitan but more common in Europe and America. Pinworms are parasites in the human caecum, colon and appendix. Their movement causes intense itching of anus, inflammation of mucous membrane of colon and appendix resulting in insomnia and loss of appetite.
- Ancylostoma duodenale* is commonly known as hook worm. It is a parasite of human small intestine in Asia, North Africa and Europe. It is very dangerous because it holds the villi of intestine and sucks blood and body fluids. During feeding they produce an anticoagulant to prevent clotting of blood and after feeding leave the wound bleeding. In children it can cause severe anemia and retard physical and mental growth.

Q.8: Give the general characteristics, importance and classification of phylum annelida (the segmented worms).

Ans. TRIPLOBLASTIC ANIMALS-COELOMATES

PHYLUM ANNELIDA

Introduction:

Most of the worms with which we are familiar are included in this phylum. They are segmented and commonly called annelids (from Latin word for 'little ring').

GENERAL CHARACTERISTICS

(i) Habitat

Annelids may be marine (*Neries*), fresh water (*stylaria*) or found in damp soil (earthworm).

(ii) **Mode of Life**

- ♦ Mostly are free living e.g. earthworm.
- ♦ Some are parasites e.g. *Hirudo* (leech).

(iii) **Body Structure**

- ♦ The body is metamerically segmented.
- ♦ The body becomes divided transversely into a number of similar parts or segments.

Q. Name excretory organ of phylum Annelida.
(FSD-G1)-16

The subdivisions may be indicated externally by constrictions of the body surface and internally, the segments are separated from each other by septa extending across the coelom.

However, the various systems of the body such as gut, blood vessels and nerve cord are continuous throughout the length of body penetrating each individual segment.

- ♦ They show bilateral symmetry.
- ♦ They are triploblastic and coelomate.
- ♦ They have true coelom i.e. the mesoderm splits into particle layer, which lines the

Q. Give general characters of phylum Annelida.
(FED-2012: LHR-04)

body wall and visceral layer which covers the alimentary canal. The space between the two layers of mesoderm is coelom, which is filled in by coelomic fluid, which serves as hydrostatic skeleton also.

(iv) **Body Systems**

The annelids show specialization of body structures. The organ systems are well developed.

- ♦ Digestive system is in the form of alimentary canal, which is divided into distinct parts, each performing a specific function. It has two openings, the mouth at the anterior end and anus at the posterior end. The mouth is overhung by a lobed structure, the prostomium. In parasitic species, the digestive system is poorly developed.
- ♦ Excretion takes place by specialized structures called nephridia. These are ciliated organs present in each segment in the body cavity.
- ♦ They have closed circulatory system (annelids being first group of invertebrates developing closed circulatory system). It is a system in which a circulatory fluid called blood flows in a network of vessels known as blood vessels. It transports gases and nutrients.
- ♦ The respiratory system is absent. The exchange of gases is by diffusion through the skin into blood capillaries. The skin is kept moist by mucous and coelomic fluid.
- ♦ The body wall contains muscles, which help in locomotion. The muscles are of two types:
 - (A) **Circular Muscles:** These are arranged along the radius of the body.
 - (B) **Longitudinal Muscles:** These are arranged along the length of the body.

The locomotion is brought about by the interaction of muscles and hydrostatic skeleton. Contraction of circular muscle produces a pressure in the coelomic fluid and forces the body to elongate.

Similarly the contraction of longitudinal muscles produces a pressure in the coelomic fluid that would cause the body to widen.

The organs of locomotion in annelids are chitinous chaetae or setae embedded in sacs (earthworm) or on parapodia present in the body wall e.g. *Neries*. The chaetae are absent in leech.

(v) **Reproduction**

The common mode of reproduction is sexual.

- ♦ Most annelids (earthworm, leech) are hermaphrodite.
- ♦ Some annelids (*Neries*) are unisexual i.e. sexes are separate.

Fertilization is external and a free-swimming trochophore larva is produced during the life cycle.

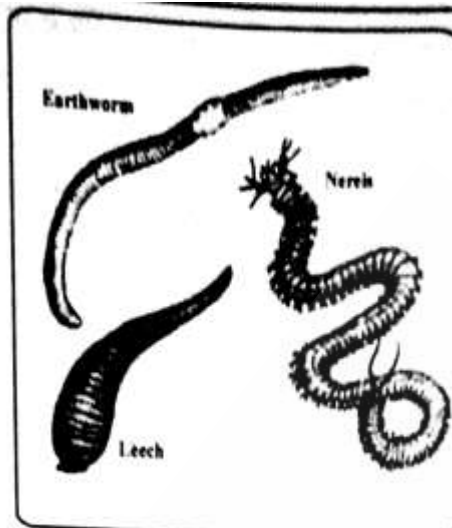


Fig. Examples of animals belonging to phylum annelida

Examples

Most common examples are *Neries*, Earthworm, (*Lumbricus terrestris*, *Pheretima posthuma*) and leech.

Leech is an Ectoparasite. It attaches itself with the skin of host (animal or man). It also has an anticoagulant secretion, which is passed into the wound to allow smooth flow of blood into its digestive system where it can be stored for a long time.

Importance

- ♦ Burrowing activity of earthworm permits greater penetration of air into the soil, and improve drainage capacity of the soil. It also enables the roots to grow downward through the soil more easily.
- ♦ Mixing and churning of the soil is brought about when the earth containing inorganic particles is brought up to the surface from lower regions. Earthworm is perhaps more active segmented worm in churning the soil, therefore it is commonly termed as natural plough.

Q. Give importance of Earthworm. (AJK-G1)-16

CLASSIFICATION

Phylum Annelida comprises of three important classes:

1. Class Polychaeta
2. Class Oligochaeta
3. Class Hirudinea

Q. Give silent features of Polychaeta.

(GUJ-G1)-14

Difference	(i) Polychaeta	(ii) Oligochaeta	(iii) Hirudinea
Habitat	Aquatic (marine)	Terrestrial or aquatic	Aquatic
Segmentation	Metamerical	Metamerical ♦ Internal and external segmentation	♦ Metamerical ♦ Fixed number of segments ♦ Each segment having additional circular ring or marking called annuli.
Head region	Distinct with eyes and this structure known as palps and tentacles	Not distinct or prominent	Not distinct head but leeches have chitinous jaws for making punctures in skin of host.
Organ of locomotion	Parapodia	Setae	No organ of locomotion, move with contraction of body and with the help of suckers
Sexes	Unisexual	Hermaphrodite (bisexual)	Mostly hermaphrodite
Development	Trochophore larva	No larva	Trochophore larva
Example	<i>Neries</i> , <i>Chaetopetrus</i>	<i>Lumbricus terrestris</i> , <i>Pheretima posthuma</i> and earthworms	<i>Hirudo medicinalis</i> (medicinal leech) which have anticoagulant secretions which is passed into the wound to allow smooth flow of blood into digestive system where, it can be stored for long time.

Q.9: Give an account of the major groups of Arthropods. What is the economic importance of insects?

Ans. PHYLUM ARTHROPODA (Animals with jointed legs)

Introduction

They are commonly called arthropods or joint-footed animals (arthron = jointed + pods = feet).

- ♦ This phylum contains more species than any other phylum.
- ♦ Insects (cockroaches, grasshoppers, butterflies, mosquitoes) are most common arthropods on the earth.

SIMILARITIES WITH ANNELIDS

Arthropods are believed to have common origin with annelids because both have some common characteristics such as:

- ♦ Segmented body
- ♦ Appendages
- ♦ Cuticle

GENERAL CHARACTERISTICS

(i) Habitat

Arthropods have exploited every type of habitat on land and in water. The aquatic species include both freshwater and marine. Many of these can fly, therefore visit air periodically.

(ii) Body Structure

- ♦ Arthropods are structurally variable. Some are worm-like e.g. centipedes while others are flying insects with the body divided into distinct regions, head, thorax and abdomen.
- ♦ The body is segmented. Each segment is attached to its neighbor by means of a modified portion of cuticle, which is thin and flexible.
- ♦ They possess jointed appendages, which have been modified for specialized functions.
- ♦ Their body is covered with waterproof chitinous cuticle secreted by the epidermis. It forms an outer covering acting as exoskeleton. This cuticle is light in weight and is formed chiefly of chitin. It provides surface for the attachment of muscles, which help in locomotion.
- ♦ Coelom is not present as main body cavity. Instead a haemocoel has developed. It is reduced coelom and communicates with blood vascular system.

(iii) Body Systems

- ♦ The digestive system is in the form of alimentary canal with two openings, the mouth and anus. It is divided into different parts each performing a specific function. The food comprises of small plants and animals.
- ♦ A well developed excretory system comprising of Malpighian tubules. The nitrogenous wastes are excreted in the form of solid uric acid.
- ♦ A highly developed nervous system is present. It consists of paired ganglia (simple brain) connected to a ventral double nerve cord. A ganglion is present in each segment. Nerves arise from these ganglia. Sensory organs are usually a pair of compound eyes and antennae etc.
- ♦ Most arthropods possess an extensive tracheal system formed of air tubes called trachea for the exchange of gases. Main tubes open to the exterior through openings called spiracles. Aquatic arthropods respire through gills and book lungs.
- ♦ The blood circulatory system in arthropods is unique. It is open circulatory. The blood flows in the body cavity bathing the tissues of the body. However, there is a primitive heart and a main blood vessel. Blood is colourless as it is without hemoglobin.

Q. Write distinguishing characters of phylum arthropoda.

(GUJ-2011, 14; LHR-15; BWP-12)

Q. Give classification of phylum arthropoda.

(GUJ-2015, 07; LHR, SWL-14; MTN -14 FED-08, 13)

Q. What is general organization of arthropods?

(SWL-2014: MTN-08, 13)

Q. Write economic importance of phylum arthropoda.

(BWP-2011; LHR-2015; GUJ-06, 07)

Q. Name the excretory system of arthropoda. (FSG-G1)-16

(iv) **Locomotion**

The arthropods exhibit active and swift movements. They swim, crawl or fly dependent upon the habitat, they occupy. The organs of locomotion are paired appendages and same case in paired wings also.

(v) **Reproduction and Development**

The sexes are separate. The testes and ovaries produce sperms and eggs respectively.

(vi) **Metamorphosis**

Life history of insects is characterized by metamorphosis (meta = change, morphé = form). Metamorphosis is an abrupt change of form or structure during the life cycle.

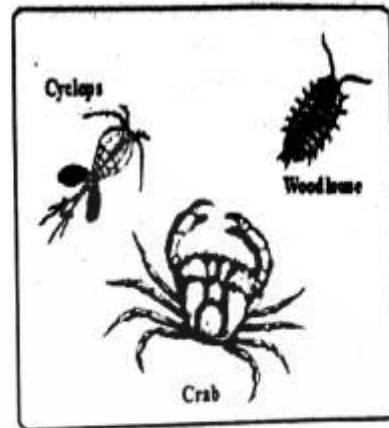


Fig. Examples of class crustacea

- ♦ In complete metamorphosis, there are three morphologically distinct stages in the life cycle; the egg finally develops into larva, which is converted into motionless pupa that finally develops into an adult.
- ♦ In some primitive insects, the metamorphosis is incomplete. The larva resembles adult and called nymph or instar. It lives in the same habitat as adult.

Q. What is metamorphosis.

(BWP-G1)(GUJ-G1)-14(SGD-G1)
(SGD-G2)-15, (GUJ-G2)

(LHR-G2)-15, (DGK-G1)-16,
(LHR-G2)-17

Q. Define nymph.

(BWP-G1)-15

CLASSIFICATION

Some of its important classes are as follows:

1. **CLASS CRUSTACEA**

Some of their important features are:

- These are aquatic and have gills for respiration.
- On dorsal side of the cephalothorax, the exoskeleton is in the form of carapace. In the exoskeleton, the deposition of salts in addition to chitin makes it firm.
- The appendages are modified for capturing food, walking, swimming, respiration and reproduction.
- Coelom is reduced and in the form of hemocoel.
- Head has two pairs of antennal appendages, one pair of mandibles (jaws) and two pairs of maxillae.
- Sexes are mostly separate.

Examples

Daphnia, Cyclops, crabs, lobsters, prawns, wood louse etc.

2. **CLASS INSECTA**

This is the largest group, not only of arthropoda but of all the animal kingdom and has great variety. Insects are found everywhere, many show social behavior.

Some of their important features are:

- Body is divided into head, thorax and abdomen.
- Head is vertical to body and jaws are ventrally placed.
- Compounds eyes with paired antennae on the head.
- Thorax has three segments with three pairs of jointed legs and in many one or two pairs of wings.
- Abdomen with varying numbers of segments.

Q. Name two harmful insects?

(SGD-G1)-15

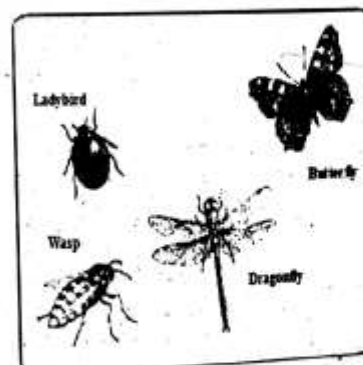


Fig. Insects

vi) Brain is formed of fused ganglia and double nerve cord is ventral.

vii) Sexes are separate and animals are oviparous.

viii) Metamorphosis takes place during development.

Examples

Dragon fly, mosquito, butterflies, wasps, beetles etc.

3. CLASS ARACHNIDA

Some of their important features are

- Body has the anterior segments that are fused to form a combined cephalothorax.
- With cephalothorax, some structures are present i.e. a pair of appendages called **chelicerae** with claws, two pairs as **pedipalps** and four pairs of legs.
- There are no antennae and no true jaws.
- Abdomen** may be segmented or unsegmented with or without appendages.
- Respiration** is by gills, lungs or by special structures called book lungs.
- Excretion** is by Malpighian tubules.
- Eyes** are simple.
- Sexes are separate.
- They are **oviparous** (lay eggs) and there is no true metamorphosis.

Examples

Scorpions, spiders, mites, ticks. Most spiders have eight eyes placed in such a way as to give them panoramic view of the predators and prey.

Q. Name four harmful effect of insects. (LHR-Q2)-16
(GUJ-Q1)-17, (DGK-Q1)-17
Q. Give the beneficial effect of insects. (GUJ-Q1)-14, (AJK-Q1)
(DGK-Q2)(GUJ-Q2)-16, (MTN-Q2)-17

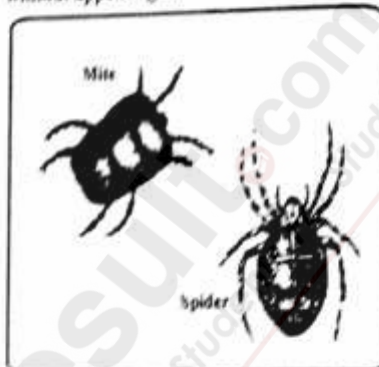


Fig. Arachnids

4. CLASS MYRIAPODA

Some of their important features are:

- The body is divided into large number of large number of segments, each having a pair of legs.
- A pair of antennae and a pair of eyes is present on head.

Examples

Q. Give character of Myriapoda.
(BGD-Q2)-15, (GUJ-Q2)-16

Centipedes, millipedes etc.

GENERAL ORGANIZATION OF ARTHROPODS

Arthropods have characteristics of higher forms such as bilateral symmetry, triploblastic, coelomic cavity and organ system and have reached the peak of invertebrates' evolution.

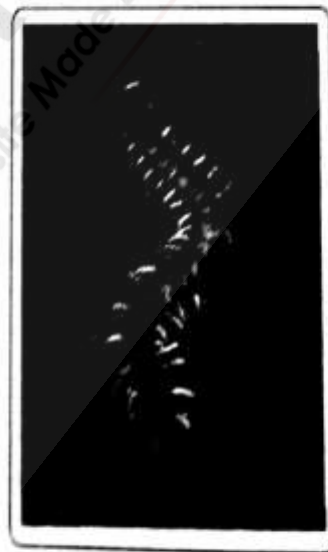


Fig. A Centipede

Similarities and Differences with Annelids

Arthropods share with annelids the characteristic of having the body divided into similar segments. In Arthropoda however segmentation is not metameric and organs are not repeated in the different segments. Each somite typically is provided with a pair of jointed appendages. But this arrangement is often modified with both segments and appendages specialized for different functions in different habitats. However, in all kinds of habitats the jointed appendages provides an efficient means of locomotion offence and defense and also help in reproduction.

Main Achievement of Arthropods

Two main achievements of arthropod are the

- (i) Chitinous exoskeleton
- (ii) Locomotory mechanism

(i) Chitinous Exoskeleton:

Chitin is non-living, non-cellular and secreted by the underlying epidermis. It is made of polysaccharides. On the other side of chitin, there is waxy layer.

In some Arthropods, chitin is soft and flexible while in others it is hard. Main functions performed by this structure are:

- ★ Protection
- ★ Serving as lever for the movement of muscles of jointed limbs.
- ★ For biting and crushing food (chitin in jaws).
- ★ Forming lens of the compound eyes.
- ★ Forming copulatory organ and organs of offense and defense.

In the young Arthropods such as insect larva, chitinous exoskeleton is shed from time to time to allow the growth of the larva. This process of shedding of exoskeleton is called moulting or ecdysis. In short the exoskeleton of chitin in the arthropods helps them to adapt to a wide variety of habitat.

(ii) Locomotory organs

Due to locomotory organs, these animals can walk, swim or fly. The jointed appendages (limbs) have been modified or diversified for various uses in the different subgroups of arthropods.

ECONOMIC IMPORTANCE

Man and insects have been at war for the same food and some place to live in. Out of all arthropods, insects are of great importance to mankind because of their harmful and beneficial aspects. Insects attack man, his domestic animals and also his crops causing a number of diseases. They are not only a health hazard but also cause economic loss to man by destroying his property and crops. Since insects are also useful to him such as the honey bee or the silk worm. Insects are therefore of great importance to mankind.

1. Harmful Aspects

Acting as carrier for disease causing germs

Many types of mosquitoes, flies, fleas, lice and bugs transmit disease-causing organisms to man and domestic animals. Some of the most familiar examples are as follows.

- ★ Female of genus *Anopheles* mosquito transmits *Plasmodium* that cause malaria in man.
- ★ The Tsetse fly of African countries transmits *Trypanosoma*, the cause of sleeping sickness and skin disease. Some species of *Trypanosoma* cause disease in cattle also.
- ★ The common housefly carries disease-causing organisms to contaminate food and cause cholera, hepatitis etc.

Food Spoilage

A number of insects lay eggs on fruits and other commercial crops such as sugar-cane, maize, cotton and also on vegetable etc. The larvae of these insect damage fruits and the crops resulting in economic loss to farmers.

The locusts that move in large number from country to country cause damage to standing crops and other plants.

2. Beneficial Aspects

Some of the useful insects are as follows.

- ★ Honeybee provides honey and some wax to man.
- ★ Silkworm provides us silk.
- ★ Some insects are predaceous on other harmful insects.
- ★ Some insects are scavengers and they eat up dead animals and vegetable matter.
- ★ Insects' larvae are source of food for fish.

Q. Why annelids and arthropods are considered having same origin? (RWP-Q1)-18, (FBD-Q1)-18

Q.10: Give general characters and classification of mollusca. Discuss its economic importance.

Ans. PHYLUM MOLLUSCA (L. Molluscus-soft)

Introduction

They phylum includes over 50,000 living species and is the second largest phylum of invertebrates. Giant squid is the largest invertebrate animal reaching the length of 15 meters (almost 50 feet), including tentacles or arms. These are also called as 'soft-bodied animals' or 'shelled-animals'.

GENERAL CHARACTERISTICS

(i) Habitat

Molluscs are widely distributed. Some groups are **exclusively aquatic**, freshwater or marine e.g. cephalopoda. Others include terrestrial animals (land snail) living in moist places mostly.

(ii) Body structure

Molluscs show a great variety of form but all are built on the same basic plan.

- They are triploblastic coelomates with bilateral symmetry. Most animals possess shell.
- Body is soft and unsegmented.
- Body can be divided into head, a ventral muscular foot and a dorsal visceral mass containing most of the internal organs. Over the visceral mass mantle is present which secretes shell.
- The body is covered by a glandular epithelial envelope called mantle.
- Mantle secretes a calcareous shell. The shell is protective but handicap to locomotion, therefore some of the more active molluscs show a reduction or loss of shell.
- The space between the shell and mantle cavity contains gills in some animals.
- In the mouth cavity of many molluscs there is a rasping tongue-like radula provided with many horny teeth.

(iii) Body systems

The body is highly organized with complex digestive, respiratory, circulatory, excretory, nervous and reproductive systems.

- Digestive system consists of gut with two openings the mouth and the anus.
- The excretory organs are paired nephridia.
- There is open circulatory system except cephalopoda. The coelom is divided into sinuses or blood spaces. Heart pumps the blood into the sinuses. A blue colored respiratory pigment **hemocyanin** is present.
- Gaseous exchange is by gills mostly in some cases such as snail the mantle cavity is converted into a lung
- Nervous system consists of the three pairs of interconnected ganglia present in the head foot and body regions.

Q. What is hemocyanin?

(DGK-G1)-15

Q. What is mental in Mollusca?

(DGK-G1)-16, (SWL-G1)-16

(iv) Locomotion

- The organ of locomotion is a muscular foot however in many species the movement is slow.
- The other are sessile i.e. unable to move.

(v) Reproduction

- Sexes are separate Trochophore larva develops during embryological development.

CLASSIFICATION

The molluscs are classified into six classes. The major classes are:

(I) Gastropoda

Some of their features are.

- (i) These are asymmetrical.
- (ii) Their body is covered with usually single coiled shell the animal can withdraw itself into the shell.
- (iii) Both aquatic and terrestrial species are included in this class.
- (iv) The aquatic species have gills while in land forms the mantle cavity is converted into lungs the common examples are.

- *Helix aspersa* which is commonly termed garden snail.
- *Limax* (the slug)

(II) Bivalvia (Pelecypoda)

Some of their features are:

- (i) These animals are bilaterally symmetrical aquatic molluscs.
- (ii) The body is laterally compressed.
- (iii) Body is enclosed by two pieces of shell hence the name bivalves
- (iv) They respire by plate-like gills.

The common examples are:

- *Mytilus* (marine mussel)
- *Anodonta* (freshwater mussel)
- *Ostrea* (oyster)

ii) Cephalopoda

Some of their features are:

- (i) The members of this class are bilaterally symmetrical with dorso-ventrally flattened body.
- (ii) All species are aquatic.
- (iii) The shell is much reduced and internal. In most cases it is absent. the animals are highly developed and active.

The common examples are:

- **Loligo (Squid):** the giant squid is the largest invertebrate animal reaching a length 15 meters (almost 50 feet) including tentacles or arms.
- **Sepia:** (cuttlefish)
- **Octopus:** The brain of octopus is exceptionally large and complex as compare to invertebrate brain. It is enclosed in a shell-like case of cartilage and endows the octopus with highly developed capabilities to learn and remember. In laboratory, octopus can rapidly learn to associate certain symbols and can open a screw cap jar to obtain food.

Q. Write two example discuss class gastropoda. (MTN-G1)-14, (MTN-G1)-17

Q. Name any two harmful Molluscan. (SGD-G1)-14 (GUJ-G2)-15

Q. Write economical importance of Molluscan. (MTN-G1)-14

Q. Discuss brain of Octopus. (DGK-G1)-15

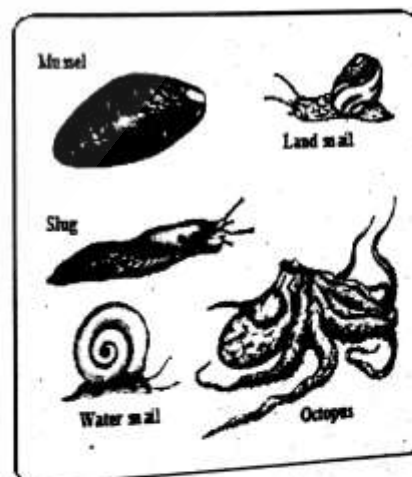


Fig. Examples of molluscs

ECONOMIC IMPORTANCE

Some insects are indirectly harmful to man but most of them are beneficial.

Harmful Aspects

- Slugs are injurious in gardens and cultivations. They not only eat leaves but also destroy plants by cutting up their roots and stems.
- Teredo, a shipworm damages wooden parts of ships.

Beneficial Aspects

- Many molluscs are great source of food for man in many parts of world. Large quantities of clams, oysters and mussels are eaten in Fareast, Europe and America. Oysters are regarded as delicacy.
- Shells of freshwater mussels are used in button industry.
- Shells of oysters are mixed with tar for marking roads in America.
- Shells in certain parts of the world are also used for making ornaments.
- Some oysters also make valuable pearls e.g. the pearl oyster.

Q.11: Discuss general characters of phylum echinodermata and hemichordate.

Ans. PHYLUM ECHINODERMATA (The spiny skinned animals)

Introduction

These are also called spiny skinned animal. There are over 5,000 known species of echinoderms.

GENERAL CHARACTERISTICS

(i) Habitat

They are exclusively marine and most of them are found at the bottom along shorelines in shallow seas. Most species are free-living however some are attached to the substratum.

(ii) Body structure

- The body may be flattened like biscuit (cake urchin) star shaped with short arms (starfish) globular (sea urchin), star-shaped with long arms (brittle star) or elongated (sea cucumber).
- They are triploblastic coelomate.
- All the larval forms of these animals exhibit bilateral symmetry but the adults show radial symmetry which is an adaptation for their special mode of life.
- There is a central disc from which arms radiate.
- Mouth is on lower surface (oral) and anus is on upper surface (aboral)
- The body is covered by delicate epidermis. The mesodermal cells develop a firm calcareous endoskeleton which may bear spines and because of its origin from mesoderm it may be called endoskeleton.

(iii) Body systems

The echinoderms exhibit low degree of organization

- Digestive and reproductive systems are well developed with specialized organs.
- Respiratory, excretory, nervous and circulatory system are poorly developed with no specialized organs.
- In nervous system there is no brain however a nerve ring is present around the pharyngeal region.
- The most unique characteristic of echinoderms is that a water vascular system is present in their coelom. It is complex system of tubes and space surrounding the mouth and passing into the arms and tube feet. Water circulates through these channels. Water enters these canals through a sieve like plate called madreporite present on the aboral body surface.

Q. Define water vascular system in Echinoderms. (AJK-G1)-16

(vi) **Reproduction**

The sexes are separate and fertilization is external. The larvae such as bipinnaria and brachiolaria are complex exhibit bilateral symmetry and resemble those of chordates.

(v) **Regeneration**

The ability to reform lost organs is common among echinoderms especially starfish sea cucumber, sea lily, brittle star and sea-urchin.

Examples

The common examples are *Asterias* (starfish) sea urchin, sea cucumber, cake urchin, brittle star etc.



Fig. Various kinds of Echinoderms

SIMILARITIES WITH CHORDATES

The echinoderms are comparatively simple in structure organization and physiology and deserve a place slightly below the annelids worms. However, these are placed at the top of list of invertebrate phyla. This is because there are a number of striking resemblances, between the echinoderms and chordates, such as:

- (i) They are coelomates.
- (ii) There is radial cleavage during the development of embryos in both phyla.
- (iii) Blastopore forms the anus in echinoderms as well as in chordates (Deuterostomes).
- (iv) Mesoderm is derived from the cells close to the blastopore. There is mesodermal exoskeleton.
- (v) There are certain common biochemical peculiarities among echinoderms and chordates e.g. phosphocreatin is present in both.

Q. Define term regeneration.

(LHR-G1)-14, (SGD-G1)-14

Q. What is madreporite? (SGD-G1)-14

ECHINODERMATA / AFFINITIES

Echinodermata do not show close relationship to most invertebrates, but they do show affinities with hemichordata. Both these have a number of common features among which are the formation of coelom and retention of blastopore as the site for future anus. In both mesoderm is derived from the cells close to the blastopore. Both possess mesodermal endoskeleton where as the exoskeleton is ectodermal in origin while in invertebrates the blastopore develops into mouth.

Q. Write down the affinities of echinoderms with hemichordata.

(GUJ-G1)-15

The above resemblances between two phyla are neither accidental nor due to convergent evolution but are because the two are closely related and both emerged from the same (common) ancestor. Echinoderms also show very close resemblance with chordates because both have mesodermal skeleton, are deuterostomous, in both lower chordates and echinoderms the early development is almost similar. That is why they have been placed closest to phylum chordata.

PHYLUM HEMICHORDATA

Introduction

It is a group that is present in between echinoderms and chordates.

Hemichordates have combination of both invertebrates (echinoderms) and chordates characteristic. Hemichordates echinoderms and chordates belong to the group deuterostome branch of animal kingdom.

Because of their close relationship to chordates these animals are also called as pre-chordates.

GENERAL CHARACTERS

1. Soft bodied animals which are worm-like.
2. Body is divided into an anterior proboscis, collar and trunk.
3. Body wall is made of unicellular epidermis with mucus-secreting cells.
4. Digestive tract is straight and may show variations.
5. Coelomic cavities correspond to each of the three body regions i.e. proboscis, collar and trunk coelomic pouches.
6. Circulatory system consists of a median dorsal and a median ventral vessel.
7. Respiratory system is composed of gill slits forming a dorsal row behind collar.
8. Excretory system has single glomerulus connected to blood vessels.
9. Nervous system has a sub-epidermal plexus of cells and fibers.

Q. What are unique characteristics of Phylum echinodermata.

(LHR-2012: RWP-13: GUJ-03, 06)

Q. Describe general characters of Phylum hemichordata

(BWP-2011: LHR-03, 15: GUJ-06, 07)

Q. Describe general characters of Phylum chordata.

(RWP-2013, BWP-11: LHR-15: GUJ-07, 14)

Q. What are two major divisions of Phylum chordata.

(BWP-2011: LHR-13, 15: GUJ-14)

Q. Name any two hemichordates.

(LHR-G2)-15

Examples

The common examples of this phylum are *Balanoglossus* and *Saccoglossus*.

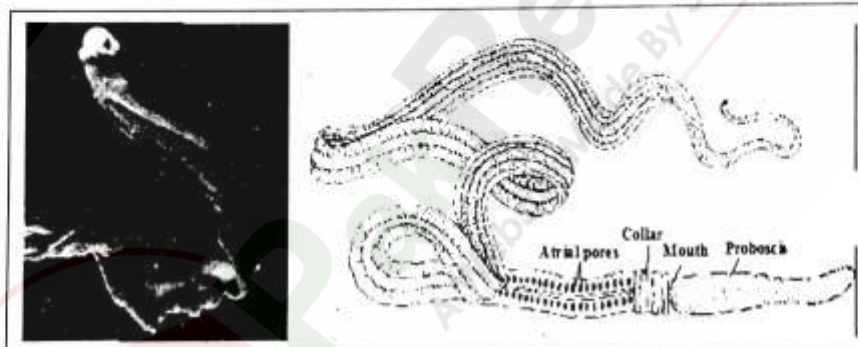


Fig. *Balanoglossus* and *Saccoglossus*

Q.12: Give general characters and classification of phylum chordata.

→ Give the two major classes of the Pisces and explain adaptations of aquatic mode of life in fishes.

Ans. **PHYLUM CHORDATA**

Introduction

This great phylum derives its name from one of the few common characteristics of the group i.e. notochord.

Basic Characters

Notochord is a rod-like semi rigid body of vacuolated cells, which are filled with proteinaceous material, which extends in most cases the length of the body between enteric canal and the dorsal hollow central nervous system. Its primary function is to support and to stiffen the body and thus acts as skeletal axis. All members of the phylum possess this structure either in the larval or embryonic stages or throughout life.

It seems that the endoskeleton is the chief basic factor in the development and specialization of higher animals. The animals most familiar to us belong to chordates including man himself. The chordates show great variety and inhabit all kinds of habitat.

All chordates possess three basic characters:

- (1) All members possess notochord.
- (2) All chordates have central nervous system that is dorsal in position and hollow.
- (3) All chordates develop paired gill openings in embryonic stage. In some these are non-functional, while in other are functional for some period in their life history (frog) in still others these are functional throughout life (amphioxus and fishes).

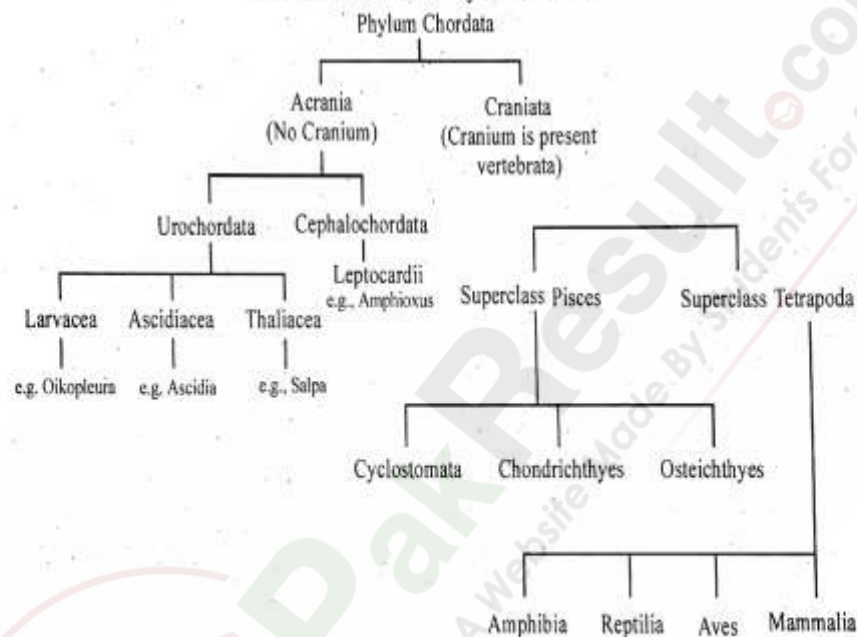
**Q. Write two basic character of chordata. (GUJ-G1)-14, (MTN-G1)-15
(RWP-G1)(LHR-G2)(LHR-G1)-16
(LHR-G2)-17**

Classification of Chordates

Chordates have been divided into:

- ★ Lower chordates or protochordates or acrania
- ★ Higher chordates or Craniata.

Table: Classification of Phylum Chordates



PROTOCHORDATA (Acrania / Lower Chordates)

(i) Subphylum: Urochordata

Notochord and nerve cord are present only in free-swimming larvae. Adults are sessile and enclosed in a covering tunic. Therefore they are also called tunicate e.g. *Molgula*.

(ii) Subphylum: Cephalochordata

Notochord and nerve cord extend along the entire length of the body and persists throughout life e.g. *Amphioxus*.

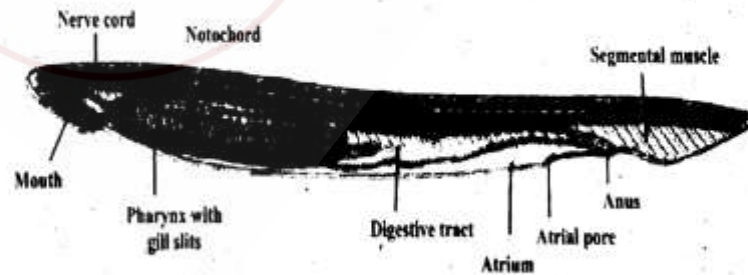


Fig: Amphioxus

SUBPHYLUM VERTEBRATA (Craniata / Higher chordates)

Introduction

This group includes animals, which have cranium enclosing brain and vertebral column.

Classification

It is customary to place vertebrates into two super classes:

- (1) Pisces (Fishes), which are strictly aquatic forms.
- (2) Tetrapods (Four footed), which are mostly land dwelling animals.

Vertebrates may be divided into amniotes, having foetal membranes (reptilian, aves and mammals) and anamniotes, without foetal membranes (amphibian, cyclostomata, chondrichthyes, osteichthyes and pisces).

SUPER CLASS PISCES

This super class includes three important classes:

1. Cyclostomata
2. Chondrichthyes
3. Osteichthyes

(1) CYCLOSTOMATA

Introduction

This class includes most primitive living vertebrates, which are also called as jawless fishes. This distinguishes them from rest of the vertebrates. Some of their characteristics are as follow:

Characteristics

- (i) Body is long, eel-like.
- (ii) Scales are absent.
- (ii) There are no paired appendages.
- (iv) There is cartilaginous skeleton.
- (v) There is ventral suctional mouth.
- (vi) Heart is with one auricle.
- (vii) There are six to fourteen pairs of gills.
- (viii) Digestive system lacks stomach.
- (ix) Sexes are separate in lampreys. Hagfishes are hermaphrodite.
- (x) Fertilization is external and long larval period is present in lamprey.

Examples

This group is presented by lampreys and hagfish.

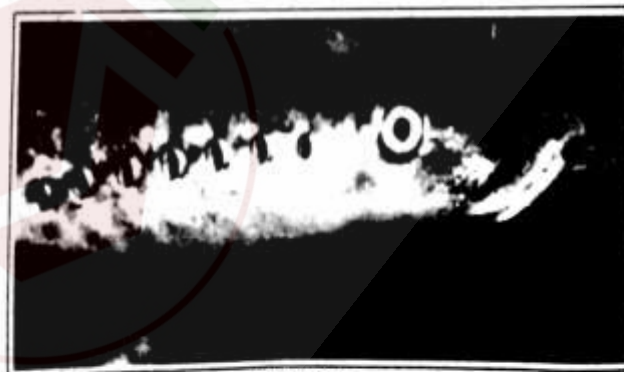


Fig. Lamprey

(2) CHONDRICHTHYES

Introduction

Fishes present in this group have cartilaginous endoskeleton, but have many resemblances to the bony fishes, the cartilaginous skeleton is considered a degenerated character rather than primitive character. Their main features are:

Characteristics

- (i) Body is fusiform.
- (ii) Mouth is ventral and olfactory sacs are not connected to mouth cavity.
- (iii) Placoid scales are present on body.
- (iii) Endoskeleton is entirely cartilaginous.
- (v) There is J-shaped stomach in digestive system.
- (vi) Circulatory system has many parts of aortic arches.
- (vii) Respiration is by means of 5-7 pairs of gills without the covering i.e. operculum.
- (viii) There is no swim bladder.
- (ix) Sexes are separate.
- (x) They may be oviparous or viviparous.

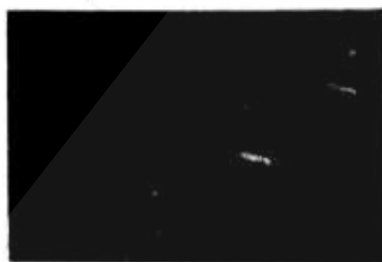


Fig. Shark

Examples

Most common examples are sharks, skates and rays.

- ★ With the exception of whales the sharks are the largest living vertebrate reaching nearly 30-50 feet in length. They are of economic importance. Most are highly destructive to fish, lobsters and crabs. In some parts of the world, they are used as food by man. Commercially shark liver oil is extracted and used in medicine as a source of vitamin A and D. Shark skin leather is used for making articles.

Q. Give two commercial importance of sharks. (DGK-G2)(FBD-G1)-16
(DGK-G1)(DGK-G2)-16,
(RWP-G1)-17

The skates and rays are bottom dwelling fishes. In these the anterior pairs of fins (pectoral fins) are much enlarged and are used for swimming like wings. Two members of this group are of special interest (i) the sting rays and (ii) electric ray.

- ★ In the sting rays, tail is long and whip like and has sharp spines, which can inflict very dangerous wounds.
- ★ The electric rays have certain dorsal muscles modified into powerful electric organs, which can give severe shocks and stun their prey.

(3) OSTEICHTHYES

Introduction

Fishes present in this group have bony skeleton, so also called as bony fishes.

Characteristics

- (i) They have more or less bony skeleton, which has replaced the cartilaginous skeleton.
- (ii) Notochord may persist in parts.
- (iii) Skin has embedded dermal scales, which may be ganoid, cycloid or ctenoid. Placoid scales are absent.
- (iv) Both types of fins i.e. single median and paired are present. These fins also have fin rays of cartilage or bone.
- (v) Mouth is terminal. Jaws are either with or without teeth.
- (vi) Respiration is by gills, which are supported by gill arches and covered by operculum.
- (vii) A swim bladder is usually present with or without connection with the pharynx. This helps in buoyancy.
- (viii) There is two chambered heart with one atrium and one ventricle. Blood has nucleated red cells.
- (ix) Brain is present with 10 pairs of cranial nerves.
- (x) Sexes are separate, gonads are paired and fertilization is usually external.

ADAPTATIONS TO AQUATIC LIFE

The major adaptations in fish for the aquatic mode of life are as follows:

(1) Stream-lined body

Their body is boat shaped. This type of body offers little resistance to water while swimming.

(2) Swim bladder

This is found in most bony fishes except a few. It may or may not be connected to pharynx. It is mainly a hydrostatic organ and can change the gravity of fish by filling itself with gas. The fish can thus float high or sink lower in water. The gases that fill the swim bladder are oxygen, carbon dioxide and nitrogen and may be secreted by the glands present in swim bladder. Fishes in which bladder is connected to pharynx, the bladder may be filled by gulping of air.

(3) Fins

Fins are another important adaptation to aquatic life. There are two types of fins.

- **Paired fins** (pectoral and pelvic)
- **Unpaired fins** (dorsal, caudal (tail) and anal).

Fins help in swimming as they keep balance of fish in water.

(4) Circulatory System

There is two chambered heart with afferent and efferent branchial system.

(5) Respiratory System

In most fishes, respiratory organs are the gills, adapted to receive oxygen dissolved in water and remove carbon dioxide in water as gills have network of blood capillaries.

(6) Excretory Organs

Kidneys of fish are also modified for excretion in the aquatic environment.

Comparison of Water and Land Habitats

Fish are adapted to strict aquatic life. The group of ancient fish known as **dipnoi** showed modification of aquatic breathing system to meet the conditions of terrestrial life by developing lungs. But this case is only an incident in the transition to land. There are a number of differences between water and land habitats.

1. Oxygen is more in air than in water.
2. Dissolved substances e.g., different kinds of salts are present in water.
3. Temperature changes are more drastic in terrestrial environment
4. A great variety of cover and shelter is provided by land habitat than aquatic habitat.
5. As a medium water provides greater support to the body than air.

Q. Write the role of swim bladder in bony fishes. (BWP-G1)-14

(RWP-G1)-15

Q. Explain the adaptations of aquatic mode of life in fish.

(RWP-2013: BWP-14: LHR-03, 15: GUJ05, 07, 14)

Adaptation to Land Habitat

In transition from aquatic to land environment, animals had to undergo modifications or adaptations to cope with the above conditions on land this includes.

1. Development of skin for protection against dry conditions of land.
2. The eggs of land animals are protected by shells from drying and mechanical injury. Size of egg is also large to provide space for storage of food
3. They developed lungs in place of gills, which could take oxygen from the air.
4. In connection with development of lungs, there are corresponding changes in the circulatory system to take oxygen from the air.
5. For locomotion, paddle-like fins are replaced by jointed appendages modified for walking, running, climbing and flying.
6. Sensory organs have become more advance and specialized.

Q.13: Give general characters of class Amphibia and Reptilia with example.

Ans. SUPER CLASS TETRAPODA

Animals present in this group have two pairs of jointed limbs.

They are divided into four classes i.e.

- | | |
|-------------------|-------------------|
| 1. Class Amphibia | 2. Class Reptilia |
| 3. Class Aves | 4. Class Mammalia |

CLASS AMPHIBIA

Introduction

They spent dual life i.e both in water and on land, so called amphibians.

Characteristic Features:

The characteristic features of amphibians are;

1. **Skin** is smooth and moist with many glands. In some glands are poisonous, pigment cells (chromatophores) are present in skin. Scales are absent.
2. **Skeleton** is mostly bony. Body form varies greatly in the different amphibians, tailed or without tail
3. **Limbs** are usually four but some are legless e.g. caecilians. Webbed feet are often present.
4. **Respiration** is by gills in larval stages and by lungs and skin in the adult.
5. **Heart** is three chambered with respect to atria and ventricle. Sinus venosus and truncus arteriosus are also present. Double circulation takes place through the heart.
6. **Sexes** are separate, fertilization is external and larval stages are present.
7. **Amphibians** are not amniotes.
8. **Larva** changes into adult by metamorphosis.
9. They are **cold blooded** (poikilothermic) animals and hibernate in winter

Examples

Transition from Aquatic to Land Habitat

Amphibians are on the border line between aquatic and true terrestrial animals. Fossil evidence from the Devonian period of earth history suggests that a large population of fish belonging to the group lobe-finned (dipnoi) came to live in shallow fresh water. Some of these crawled from one pool to another and therefore spent more time on land. This gave rise to the group that we recognized as amphibians, which are the first vertebrate to come on land.

Although amphibians have acquired certain characters enabling them to live on land but at the same time they have retained some aquatic characters as the result of their dependence on aquatic habitat. This double life is expressed in their name.

Structurally they are between fish on one hand and reptiles on the other hand.

In the transitions from water to land amphibians have developed certain changes.

- They have developed limb in place of fins.
- Lungs have replaced gills.
- Some changes occurred in skin.
- Circulatory system has been modified for lung circulation but it retained link with gills and digestive system in correspondence with aquatic life.

Because of their dependence on water for their life history, they are not a very successful group of vertebrates and are confined to areas only where they can find water or moist conditions.

CLASS REPTILIA

Introduction

Reptiles are adapted for complete existence on land in contrast to amphibians that are still tied more or less to water or moist habitats. This indicates that reptiles have certain adaptations not found in amphibians.

Q. Give general characteristics of class reptiles.

(RWP-2013: BWP-14: LHR-03, 05, 06, 15: GUJ05, 07, 14: SGD-05)

Characteristic Feature

Some of the advancements shown by reptiles are their characteristic feature are as follow:

1. They have **dry scaly skin**, which is adapted to life on land.
2. **Heart** is four chambered with incompletely partitioned ventricle. In crocodiles ventricles are completely partitioned into two. These changes ensure more oxygen supply through blood circulation to all parts of the body.
3. Most reptiles have better developed **limbs**, well adapted for efficient locomotion.
4. Reptiles have developed some sort of copulatory **organ** necessary for internal fertilization.
5. In amniotic eggs of reptiles, **shell** is leathery, which can resist dryness and injury. They have large yolk eggs.
6. They have **protective embryonic membranes** called amnion, allantois and chorion.
7. Reptiles like amphibians are also cold blooded (poikilothermic) and hibernate in winter.

The above characteristics are for terrestrial habitat in which reptile motly lives. However, it is an established fact that reptiles have evolved from amphibians by undergoing the above changes and have become fully terrestrial.

Reptiles in Time

Reptiles flourished throughout **Mesozoic period** (225-65 million years ago). Climate, which was favorable for them, became less favourable in tertiary period. So, most of them became extinct. The existing reptiles belong to four, out of dozen or more main lines that have existed in the past.

Examples

The modern reptiles for the most part live in temperate and tropical zone, indeed they flourished in the latter.

The present day reptiles are firstly, lizards and snakes. Secondly, the tuatara (*sphenodon*), of New Zealand, which have survived upto today with little change. Thirdly, the crocodiles which are an offshoot from the stock from which modern birds were evolved. Reptiles of today have been derived from dinosaurs of Jurassic (195- 135million year) and cretaceous period (136-65 million years).

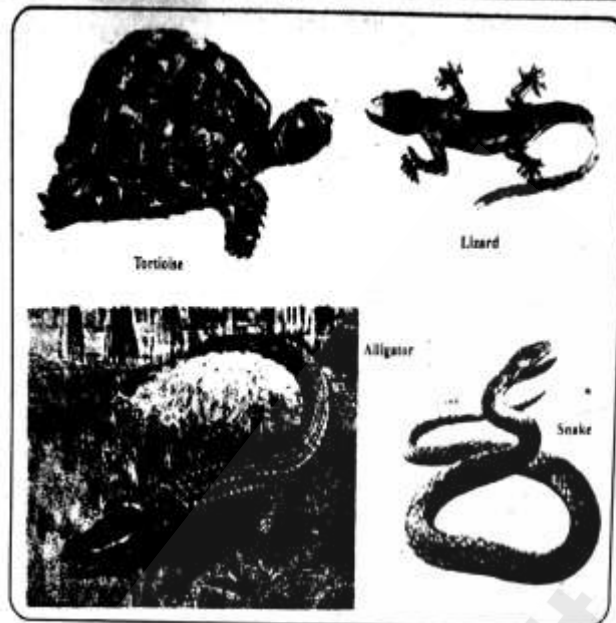


Fig. Various kinds of reptiles

Q.14: Give the adaptations for aerial mode of life in birds. What is their origin?

Ans. CLASS AVES- BIRDS

Introduction

Birds are one of the most interesting and most widely known group of animals. Birds share with mammals the highest development in the animal kingdom.

Evolution of Birds

It is believed that both birds and mammals have evolved from reptiles along different lines the earliest known bird fossil is that of **archaeopteryx**, two species of which have been found from the rocks of **Jurassic period** of earth's history .

According its fossils, it is found that

- It was about the size of a crow.
- Skull was similar to present day birds.
- Jaws extended into a beak and there was a long tail
- It had bony teeth in jaw socket unlike modern birds, which do not have teeth.
- Each wing had three claws.

With the exception of feathers, these birds showed resemblance with the dinosaurs (giant reptiles of the past). Many fossils of birds from later eras of earth history have also been found that had teeth.

The above evidence suggests that birds evolved from reptilian ancestors. The archaeopteryx and other had characteristics of both reptiles and birds and therefore form a connecting link between the two distinct groups.

Characteristic Features

1. Body is stream lined and spindle shaped with four divisions i.e. head, neck, trunk and tail.
2. Limbs are adapted for flying. The forelimbs are modified into wings and hind limbs for perching and in some birds for running as in ostrich.

Q. Give different characters of birds.
(LHR-GI-2003, 12: GUJ-05)

Q. Give reptilian character of archaeopteryx. (AJK-G1)-16

Q. What is the importance of Jurassic period? (SGD-G2)-16



Fig. Archaeopteryx

3. There is epidermal exoskeleton of feathers. Legs bear scales.
4. The skeleton is light due to air spaces, which is an adaptation for flight.
5. The skull has large sockets, jaws extend into horny beak. Teeth are absent.
6. The organ of voice is called **syrinx**, it is situated at the lower end of trachea near the origin of the two bronchi.
7. As birds do not have teeth, they have developed a thick muscular structure called Gizzard, which is used for crushing food.
8. The circulatory system has 4-chambered heart and there is only right aorta which curves to the right side and then bends backwards.
9. The lungs have extensions known as air-sacs, which extend into the bones also.
10. Excretory system does not have a bladder, urine is semisolid.
11. Sexes are separate. Fertilization is internal and eggs are of large size with much yolk. Only one ovary and oviduct is functional. In eagle both ovaries and oviducts are functional.
12. They are warm-blooded (homeothermic).
13. Some birds have secondarily lost the power of flight and are called **running birds** e.g. Ostrich, Kiwi etc.

Q. What is syrinx?

(RWP-G1)-(SGD-G1)-16

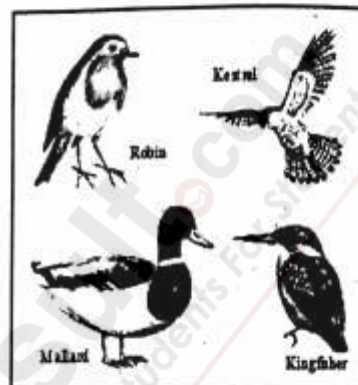


Fig. Birds

Examples

Most common examples are pigeon, robin, sparrows etc.

Q.15: What are the general characteristics of mammals? How do the three subclasses prototheria, metatheria and eutheria differ from one another?

Ans. CLASS MAMMALIA-MAMMALS

Introduction

The term mammal was given by Linnaeus to that group of animals, which are nourished by milk from the breast of mother. The group is considered to be the highest in the animal kingdom.

Evolution of Mammals

Their advancement over other groups is pronounced. Most important advancement is the evolution and development of their brain (nervous system) over the other vertebrates. It is universally accepted by biologist that mammals have evolved from reptilian ancestor, the **cotylosaurs**. This has been determined on the basis of the fossil record, which is easily available due to preservation of hard bones, unlike birds which have soft bones and mostly have not been preserved as fossils.

The ancestors of mammals lived simultaneously along with reptiles in Jurassic times and have been called mammal-like reptiles.

Some were only the size of mice and lived on trees. One of these early reptiles was **varanope** that was found as fossil in Texas.

Probably at least five groups of such mammal like reptiles developed mammalian characters and were 50% mammals. Mammals became dominant in the **Cenozoic period**.

Fundamental Features of Mammals

There are two important fundamental features found in each and every mammal.

1. They have **hair** on their body.
2. They **feed** their young one with milk.

Q. Write in detail the General Characters of Mammals.

(MTN-2010GI, 11GII: GUJ-03, 14)

(BWP-G1)-15

Q. Give general characteristics of class amphibian, birds and mammals. (LHR-2010)

Q. Give features of sub class metatheria and eutheria.

(RWP, LHR-2015: BWP-14:

GUJ-14: MTN-13)

GENERAL FEATURES OF MAMMALS

These are as follows:

1. They are very **successful group** living in all kind of habitat i.e. land, freshwater, sea water and air for which their bodies are modified.
2. They have body covering of **hair** instead of scales.
3. There is **muscular diaphragm** that separates the thoracic and abdominal cavities. This structure is not found in any previous group.
4. The **lower jaw** in mammals is composed of only one large bone and articulates directly with skull.
5. **External ear or pinna** is present. There is a chain of three bones in ear i.e. **Incus, Malleus and Stapes**.
6. Some mammals have deciduous and permanent teeth e.g. in man teeth are in **two sets**, one in early life (milk teeth) and other in later life (permanent teeth).
7. They have 4-chambered heart and there is left aortic arch (in birds it is right).
8. They are **warm-blooded (Homeothermic)** animals.
9. The **red blood cells are non-nucleated**.
10. They have developed voice apparatus, the **larynx and epiglottis**.
11. Most give **birth** to young ones (viviparous).
12. They feed their young ones on milk produced by **mammary glands** of mother.

Example

Seal, Mouse, Bat, Squirrel, Dog, Deer

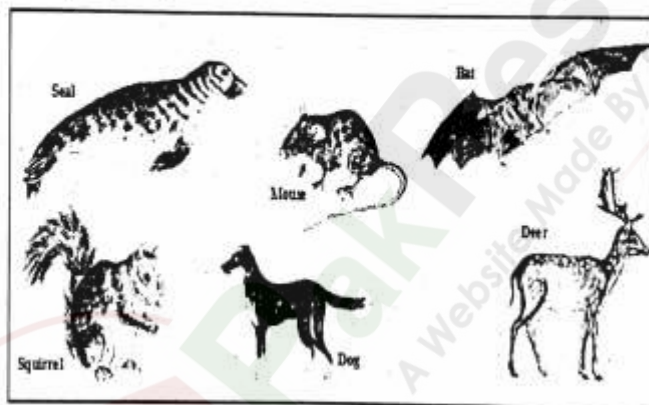


Fig. Mammals

CLASSIFICATION OF MAMMALS

Mammals are classified into three sub-classes.

- (1) Prototheria (2) Metatheria (3) Eutheria

(1) PROTOTHERIA

Introduction

Prototherians are also called **egg-laying mammals**.

Characteristics

They have characteristics of both reptiles and mammals and therefore form a connecting link between the two. They also provide evidence about evolution/origin of mammals from reptilian stock.

Reptilian Features

- (i) They lay **eggs**.
- (ii) They have **cloaca** and cloacal opening instead of separate opening for digestive system and urinogenital opening.

Q. Name some egg-laying Mammals. (DGK-G1)-16

Q. What are the prototheria? (SGD-G1)-15

Mammalian Features

- (i) Hairs are present on body in form of thick fur.
- (ii) Females feed their young ones with milk after hatching.

Examples

- **Duck-bill platypus** is found in aquatic habitat. It has a bill similar to that of duck and has webbed toes. It has thick fur on its body.
 - **Spiny ant-eater (Echidna)** which has structures for ant eating habit.
- Both examples are found in Australia.

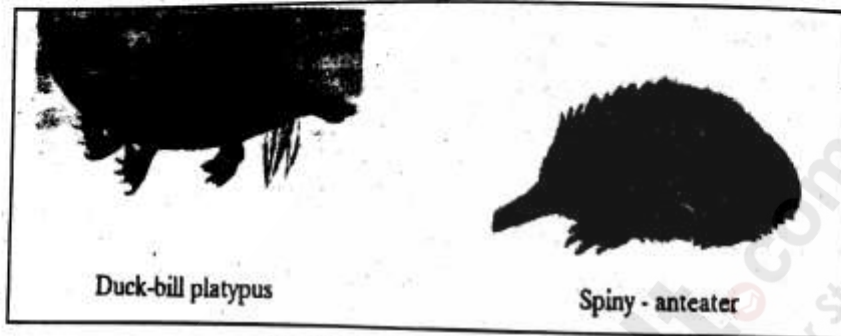


Fig. Various kinds of Echinoderms

(2) METATHERIA

Introduction

Metatherians are also called pouched mammals or marsupials.

Characteristics

- (i) These are most primitive mammals
- (ii) They have an abdominal pouch called marsupium where they rear young ones.
- (iii) Immature young ones are born and are carried by mother in marsupium till they develop to their maximum. During this period they are fed on the milk produced by the milk glands of mother, the nipples of which are in the marsupium.

Examples

Opossum, Kangaroo and Tasmanian wolf of Australia and America are common examples.



Fig. Kangaroo, a marsupial

Q. What is marsupium?

(FBD-G1)-14, (RWP-G1)-17

Q. Write down features of subclass Metatheria.

(MTN-G1)-14

(GUJ-G1)-16

(3) EUTHERIA

Introduction

Eutherians are also called **placental** or **typical mammals**.

Characteristics:

- (i) Young ones are fully developed in the body of mother (due to large size).
- (ii) During development, **placenta** is formed between foetus and mother through which fetus is nourished. Placenta also has endocrine function i.e. produces certain hormones.
- (iii) They have **maximum mammalian characters**. But in some hairs have been modified in scales (pangolin) and spines (porcupine).

Examples:

Examples are man, whale, elephant, horse, rat, mice, bat, dolphin etc.

Q. Give two character of eutheria.

(MTN-G1)-15 (MTN-G1)-16

Q. Define placenta and its function.

(RWP-G1)-15, (BGD-G2)-16



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