Biyani Girl's College

Concept Based Notes

ANIMAL DIVERSITY

BSC Semester-I

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BIYANI GIRLS COLLEGE

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Preface

I am glad to present this book, especially designed to serve the needs of the students. The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self-explanatory and adopts the "Teach Yourself" style. It is based on question-answer pattern. The language of book is quite easy and understandable based on scientific approach.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Mr. Rajeev Biyani,Chairman & Dr. Sanjay Biyani, Director (Acad.) Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this endeavor. They played an active role in coordinating the various stages of this endeavor and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

Author

Syllabus

Animal Diversity

Section – A

LOWER INVERTEBRATES

Unit 1: Protista/Protozoa: General Characteristics and Classification up to classes; Locomotory Organelles and locomotion in Protozoa. 3 hrs

Unit 2: Porifera : General characteristics and Classification up to classes; Canal system in Porifera. 3 hrs

Unit 3: Coelenterata (Cnidaria): General characteristics and Classification up to classes; Polymorphism in Hydrozoa. 3 hrs

Unit 4: Helmithes: Platyhelminthes: General characteristics and Classification up to classes; Life cycle of *Taenia solium* and its parasitic adaptations.
Nemathelminthes : General characteristics and Classification up to classes; Life cycle of *Ascaris lumbricoides* and its parasitic adaptations. 6 hrs

Section – B

HIGHER INVERTEBRATES

Unit 1: Annelida : General characteristics and Classification up to classes; Formation of Coelom; Metamerism in Annelida. 3 hrs

Unit 2: Arthropoda: General characteristics and Classification up to classes; Larval forms in Arthropoda, Metamorphosis in Insects. 5 hrs

Unit 3: Mollusca: General characteristics and Classification up to classes; Torsion and detorsion in Gastropoda; Pearl Formation. 4hrs

Unit 4: Echinodermata: General characteristics and Classification up to classes; Water-vascular system in Asteroidea. 3 hrs

Section –C

LOWER VERTEBRATES

Unit 1: Protochordata: General characteristics and Classification of Protochordata up to orders; Retrogressive metamorphosis. 3 hrs

Unit 2: Agnatha: General characteristics and outline classification of cyclostomes up to classes; Ammocoete larva 3 hrs

Unit 3: Pisces: General characteristics and Classification up to order. Parental care in fishes and Migration in fishes. 5 hrs

Unit 4: Aquatic adaptation in fishes; Origin fins; Scales of fishes; Osmoregulation in Fishes. 4 hrs

Section –D

HIGHER VERTEBRATES

Unit 1: Amphibia: General characteristics and classification up to order; Neotany; Parental care in Amphibians. 3 hrs

Unit 2: Reptilia: General characteristics and classification up to order; Identification of Poisonous and non-poisonous snakes; Biting mechanism in Snakes. 4 hrs

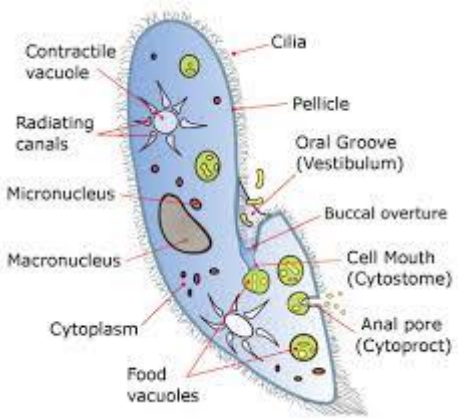
Unit 3: Aves: General characteristics and classification up to order; Types of feathers; Flight adaptations and Migration in birds. 4 hrs

Unit 4: Mammals: General characteristics and classification up to orders; Dentition in Mammals; Adaptive radiation in mammals. 4 hrs

SHORT QUESTIONS:

Question 1. Write general characters of phylum Protozoa?

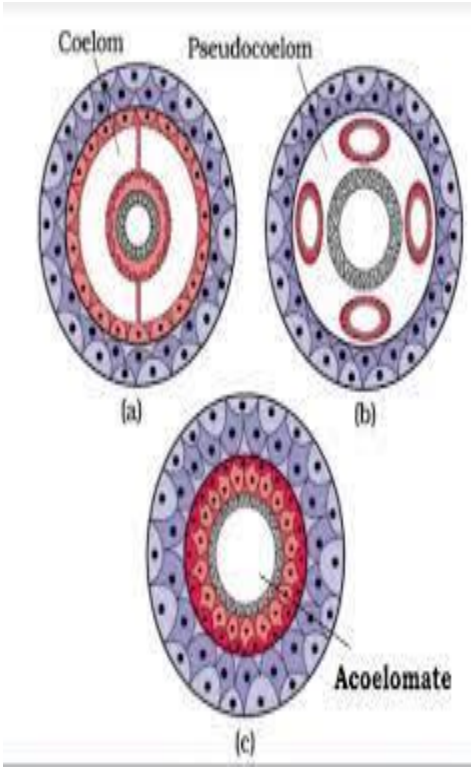
Answer
They are parasites or free-living.
They have flagella for locomotion.
Their body is covered by a cuticle or pellicle.
Freshwater forms have a contractile vacuole.
Reproduction is by binary fission (longitudinal division)
Examples : Trypanosoma, Trichomonas, Giardia, Leishmania, etc.



Question 2. Write a short on occurrence and types of coelom.

Answer

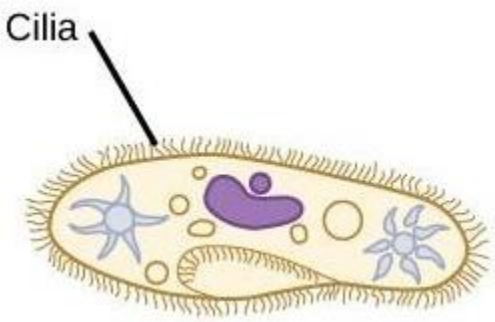
The coelom is one of the characteristic features of metazoans. The true coelom is a body cavity formed during embryo development from the three germinal layers. The body cavity meaning a fluid filled space that can accomodate organs. The coelom is lined by mesodermal epithelium cells. Presence or absence of coelom is one of the criteria for classifying animals.
1. Acoelomate : Coelom is absent. The blastocoel is completely occupied by mesoderm. E.g. Porifera, Coelenterata
2. Pseudocoelomate : True coelom is not present. The blastocoel is partly filled by mesodermal cells. The body cavity is lined by mesoderm only towards the body wall and mesoderm is not present towards the gut. E.g. Roundworms (Aschelminthes)
3. Eucoelomate:Animals that have a true coelom. The coelom is lined by mesoderm on both the sides, towards the body wall and towards the gut. The blastocoel present in the gastrula gets completely replaced by a true coelom. The body organs are suspended in the coelom by mesenteries. E.g. from the phylum Annelida to Chordata.



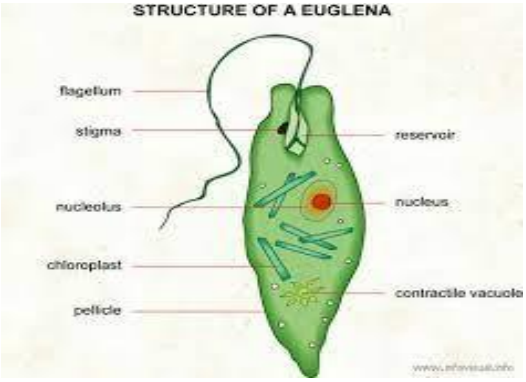
Question 3. Write a short note on-

(a)Ciliary locomotion (b)Flagellar locomotion

Ciliary movement is referred to as the rhythmic movement of cilia, which causes movement of the fluid or the cell. Cilia are found in eukaryotic cells. An example is in Paramoecium, ciliary movement helps in the movement of the cell which is locomotion as well as in the movement of the food inside the cell.



Flagella are microscopic hair-like structures involved in the locomotion of a cell. The word "flagellum" means "whip".
The flagella have a whip-like appearance that helps to propel a cell through the liquid. Some special flagella are used in few organisms as sensory organs that can sense changes in pH and temperature.
They are filamentous structures found in archaea, bacteria, and eukaryotes.



Archaeal flagella are nonhomologous.
Bacterial flagella are a coiled, thread-like structure, sharp bent, consisting of a rotary motor at its base and are composed of the protein flagellin. A shaft exists between a hook and a basal body passing through the protein rings in the cell membrane.
Eukaryotic flagella are complicated cellular projections that pummel backwards and forward and are found in protist cells, gametes of plants, and animals. It is made up of a protein called tubulin.

Question 4. Write main characteristics features of phylum porifera.

Answer: Among cells. Hence, their body is considered as a colony of different types of cells.

Body surface : Their body bears minute pores called 'ostia' through which water enters the spongocoel (body cavity). Water leaves the body through a large opening called 'osculum'. Beating of flagella creates water current.

Circulation: Water is circulated in the body through the 'canal system'. When the water enters the body of poriferans, cells absorb the food, exchange respiratory gases and release excretory products.

Digestive system: The body cavity of sponges (spongocoel) is lined by unique type of flagellated cells called choanocytes or collar cells for digestion. 7

. Endoskeleton: The body of sponges consists of calcareous / siliceous spicules and proteinaceous 'spongin fibres'.

Sponges have great power of regeneration. e.g. Scypha, Euspongia (Bath sponge), Euplectella (Venus' flower basket).

Phylum Porifera

- Sponges
- No symmetry
- No germ layers
- No coelom
- Digestion is cell dependent

Question 5. Write economic importance of sponge.

Answer: Sponges, or phylum Porifera, have several economic uses, including:

Biomedical research: Sponges have been used in biomedical research as a source of new drugs and compounds, such as anticancer and anti-inflammatory agents.

Aquaculture: Some species of sponges are farmed for their ability to filter water, making them useful in the aquaculture industry. They can be used to help keep aquaculture ponds clean, by removing excess nutrients from the water.

Cosmetics: Sponges have been used in cosmetics for their ability to exfoliate and cleanse the skin.

Industrial uses: Sponges have been used for cleaning and polishing surfaces, as well as for insulation and soundproofing.

Art and crafts: Some species of sponges are used for decorative and craft purposes.

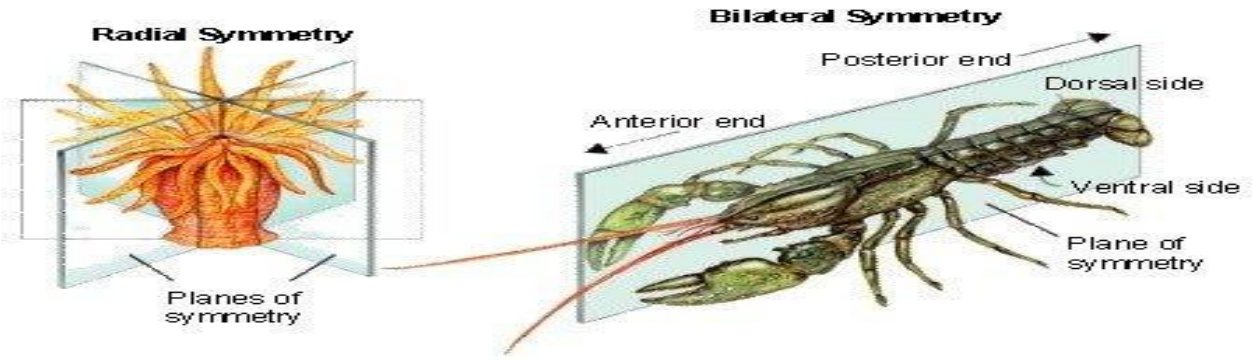
Food: Some species of sponges are edible and have been used as a food source in some cultures.

It is important to note that many species of sponges are also ecologically important, playing roles in their ecosystems such as filter feeders, habitats and ecosystem engineers. Some species of sponges are also considered as endangered, over-exploitation can lead to the depletion of these important species.

Question 6. Give difference between radiata and bilateria.

Radiata	Bilateria
Organisms that can be divided into multiple identical parts when cut along the central axis.	Organisms that can be divided into two identical halves along a single plane.

Exhibits radial symmetry.	Exhibits bilateral symmetry.
Comprises two germ layers: endoderm and ectoderm.	Comprises three germ layers: endoderm, mesoderm, and ectoderm.
Diploblastic level of organization.	Triploblastic level of organization.
Examples include hydras, corals, and sea urchins.	Encompasses all higher animals, except sponges, ctenophores, cnidarians, and placozoans.
Does not have a definitive left and right side.	Has a definitive left and right side.
Does not have a coelom.	Can be coelomates, pseudocoelomates, or acoelomates.



Q7. Write main characters of phylum platyhelminthes.

Their body is dorsoventrally flattened.

They exhibit bilateral symmetry.

Also, they are triploblastic, with three germ layers.

They do not have a body cavity and are acoelomate.

The body is soft and unsegmented.

They are mostly parasitic with a few free-living

They exhibit an organ system grade of organization.

The digestive system is incomplete or absent. In fact, there is a single opening which leads to a well-developed gastro-vascular cavity. Also, the anus is absent. And there is no true stomach structure. In a few species, the digestive system is completely absent.

Respiratory and circulatory systems are absent. In fact, the respiration generally occurs by simple diffusion through the body surface.

The flame cells help in excretion. The excretory system has protonephridia with the flame.

A primitive nervous system is present.

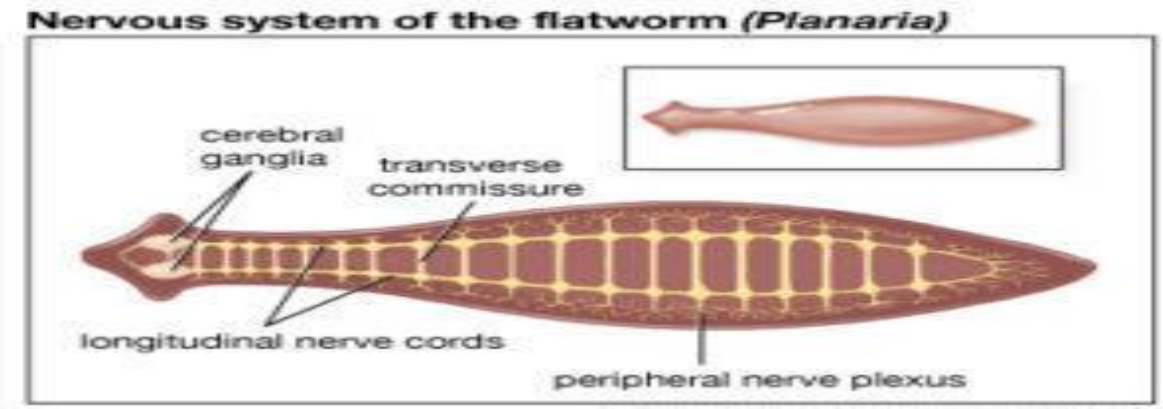
These animals are hermaphrodites i.e. both male and female organs are present in the same body

Sexual reproduction happens through gametic fusion.

Asexual reproduction also happens in a few species through regeneration and fission.

Fertilization is internal.

The life cycle of these organisms can be complex, especially if they are parasitic, as this may involve one or more host animals.



Q8. Give classification of Ascaris.

Domain: Eukaryota

Kingdom: Animalia

Phylum: Nematoda

Class: Chromadorea

Order: Ascaridida

Family: Ascarididae

Genus: Ascaris

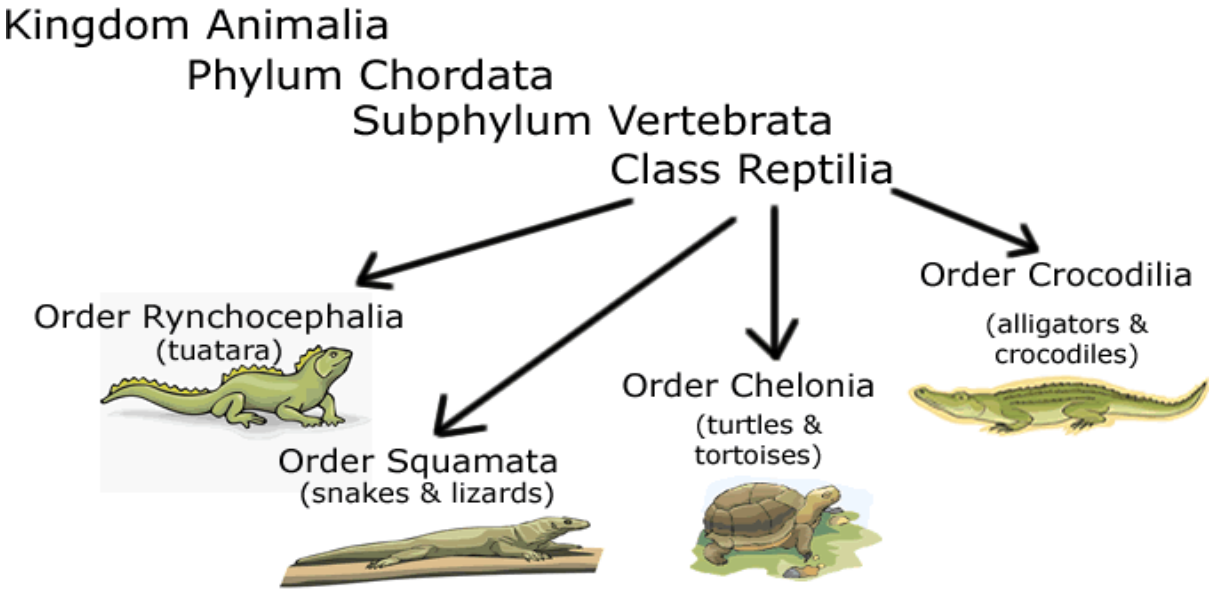
Species: lumbricoides

Q9.Classify Reptilia upto orders giving important characters and suitable example.

Ans. Do you know that the Reptiles dominated our planet for a long time? Animals of Class Reptilia, first appeared in late Paleozoic and they became numerous by Mesozoic. This is known as “The Age of Reptiles".These are the first Vertebrates completely adapted for life on land, though a few have become secondarily aquatic. We will study the characters and position of Reptilia by studying the classification of the living reptiles in the first part on Reptiles. Reptiles are distinguished by the characters .

1) Most reptiles lay eggs (oviparous), though some can give birth to live young.
2) Their eggs are laid on land in loose soil or sand.
3) Their eggs have a leathery shell to protect them from drying out.
4) Reptiles are covered with tough, dry skin and protective scales or plates.
5) Reptiles are cold-blooded. This means that their body temperature is regulated by the air temperature. If the air is not warm enough, they seek out direct sunlight. They spend the winter months (in colder climates) in a kind of hibernation called torpor, buried in mud or leaf litter. In very hot climates, they may also hibernate when it's too hot. This is called estivation.
5) Unlike mammals, reptile teeth are usually the same shape and size throughout their mouth.
6) Unlike mammals, reptiles can take care of themselves very soon after hatching. Some species of reptiles, like the American alligator will watch over newly hatched young for a time.
7) Some reptiles have a venomous bite.
8) The study of reptiles is called herpetology.
9) Reptiles are broken down into 4 groups (Orders) living today.

- Crocodilia (crocodiles, caimans, alligators, gharials)
- Testudines (turtles, terrapins, sliders, tortoises)
- Squamata is broken down into 2 suborders: Lacertila or Sauria (lizards) and Serpentes (snakes)
- Sphenodontia (tuataras)



LONG QUESTIONS-

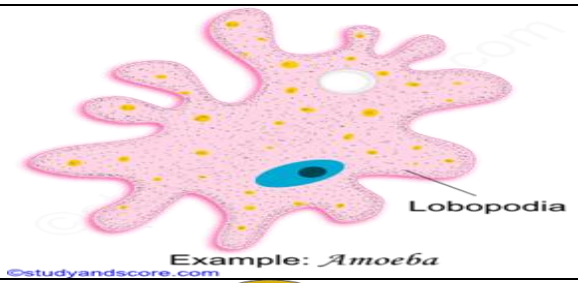
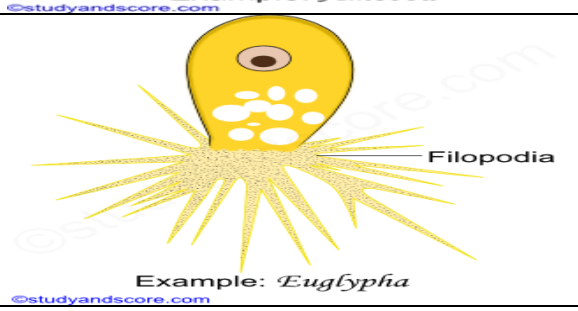
Question 1. Describe in details various locomotory organelles and locomation in Protozoa.

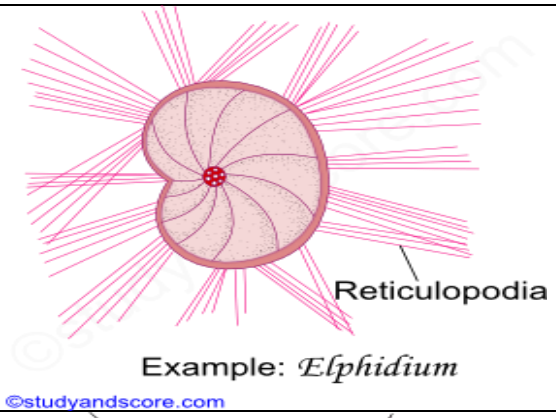
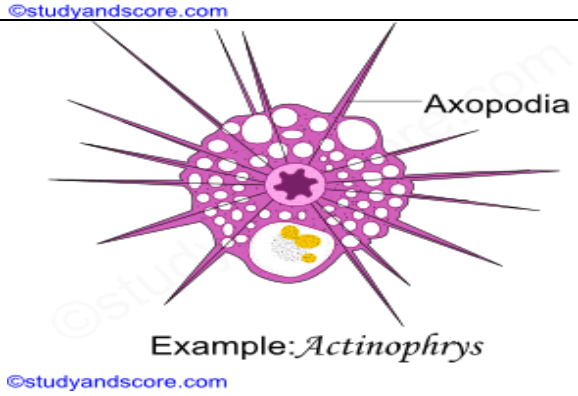
Ans. Depending on number of pseudopodia formed on the surface:

Polypodia- Several pseudopodia formed on the surface of the body.Eg: Amoeba proteus

Monopodia- Only single pseudopodia is formed on the surface of the body.Eg: Entamoebahistolytica

Depending on the structure of the pseudopodia:

Lobopodia: These are lobe like and blunt structures with broad and rounded ends. These structures composed of endoplasm and ectoplasm. Lobopodia move by pressure flow mechanism. Eg: Amoeba proteus, Entamoebahistolytica	
Filopodia: These are slender filamentous pseudopodia tapering from base to tip. Sometimes these may be branched out but they are not fused to form a network. They are composed of only ectoplasm. Eg: Euglypha, Lecithium	

Reticulopodia: They are also known as rhizopodia or myxopodia. They are filamentous, profusely interconnected and branched. They form a network. The primary function of these pseudopodia in ingestion of food and the secondary function is locomotion. They exhibit two way flow of the cytoplasm. They are commonly found in foraminifers. Eg: Elphidium, Globigerina	
Axopodia: These are fine needle like, straight pseudopodia radiating from the surface of the body. Each Axopodia contain a central axial rod which is covered by granular and adhesive cytoplasm. The main function of these axopodia is food collection. Axopodia also exhibit two-way flow of cytoplasm. Axopodia are mainly found in Heliozoans and radiolarians. Eg: Actinosphaerium, Actinophrys, Collozoum	

LOCOMOTION IN PROTOZOA

Moving ones body is an essential need of any organism. Some organism are sessile while other moves at very high speed.Some organisms moves very slowly such as amoeba or euglena where as other can move fastest example leopard. There is a vast diversity of organism on the basis of their locomotion. In class protozoa classification is done on the basis of its locomotory organ only. Imagine if there is such a much difference in one phylum how much difference must be present in whole animal kingdom.

Some of the time locomotion is misunderstood with the term movement, locomotion is define as movement of whole body of an organism from one place to another hence it can said that locomotion is a kind of movement in which whole body moves where as in movement it is not necessary that whole body move only a single part can also move example peristaltic movement of intestine.

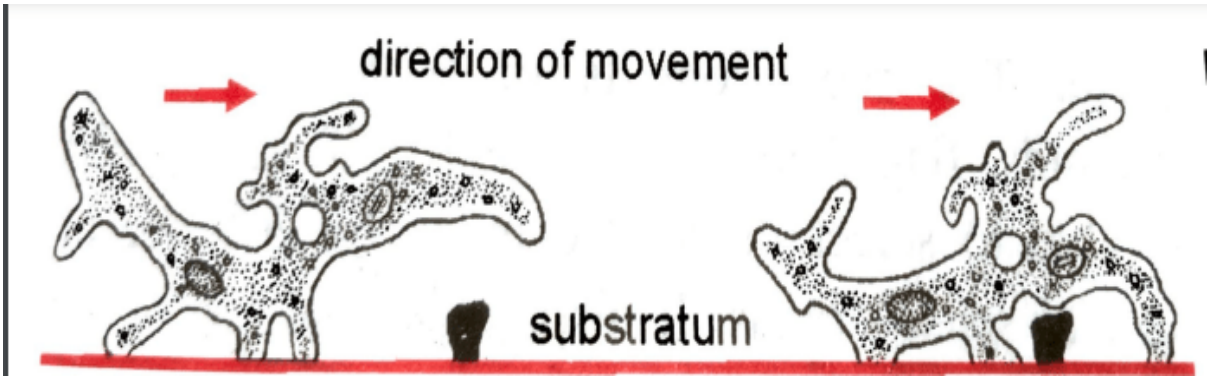


FIGURE DEPICTING:- MOVEMENT OF AMOEBA

AMOEBOID MOVEMENT

Amoebiod movement is shown by Amoeba by the formation of pseudopodia which is finger like projection. These are broad with a round tip and are called lobopodia. They are formed by the flow of cytoplasm in forward direction.

Theories of amoeboid movement

How the pseudopodia is formed is still not very clear various theories are put forward to explain same but there no sufficient evidence to proof any hypothesis correct.

[a] Contractile hydraulic theory

It was proposed by Schultze in 1875. It states that ectoplasm also known as plasmagel undergoes contraction at the posterior end and causes protoplasmic current to flow forward, pushing the more fluid like endoplasm also known as plasmasol forward. This results in the formation of pseudopodium and pushing the body forward.

[b] Surface tension theory

It was proposed by Berthold in 1886. It states that there is difference in the surface tension between the physical characteristics of the body and substratum which results in amoeboid movement. In this theory amoeboid movement is compared with movement of fluid globule mercury droplet. A pseudopodium is formed by the outflow of protoplasm also known as fountain streaming from external and internal factors.

This theory assume the liquid form of the body surface but in majority of amoeboid form it is rigid and gelatinous.

[c]Rolling movement theory

This theory was given by Jennings in 1904. He did his studies on Amoeba verrucosa. He compare amoeboid movement with rolling movement of fluid filled sac on substratum.

He observed that a carbon particle on amoebas upper surface first passes forward and then turn downward on anterior tip, remains on lower surface for a time as body rolls forward and then passes upwards at the posterior end to repeat this cycle.

His finding may be correct for Amoeba verrucosa which is devoid of pseudopodia but it cannot applied to A. Proteus which is devoid of pseudopodia.

[d] Walking movement theory

This theory was proposed by Dellinger in year 1906. He did his studies on A. Proteus and conclude that there is presence of contractile substances which are mainly responsible for amoeboid movement.

According to this theory the extended pseudopodia attached to substratum and pull itself back by contraction and moves its body forward.

[e] Sol gel theory

This theory was given by Hyman in 1917 and later supported by Pantin and Mast. It states that amoeboid movement is due change in consistency of cytoplasm. It is most widely excepted theory till date.

It is also known as change in viscosity theory. It involves 4 process for amoeboid movement

Plasamalemma is a outermost thin, elastic cell membrane become adhere to substratum.

There is a local partial liquefication of the plasmagel at the interior end. That causes the central plasmasol under tension to flow forward against this weaken area to produce a bulge, the beginning of pseudopodium. It rapidly changes into plasmagel around periphery. Thus forming a gelatinized tube within which the plasmagel continue to flow forward.

Inner plasmagel interiorly undergo solation which allow to maintain constant flow of plasmasol from behind in the direction of movement.

Contraction of elastic plasmagel tube at which is located on outer side moves from in front backward while main bulk of body moves forward . The plasmagel thus exert squeezing motion from the side and near the amoeba forcing the plasmasol ahead. At tip of pseudopodium the endoplasm is changed to ectoplasm.

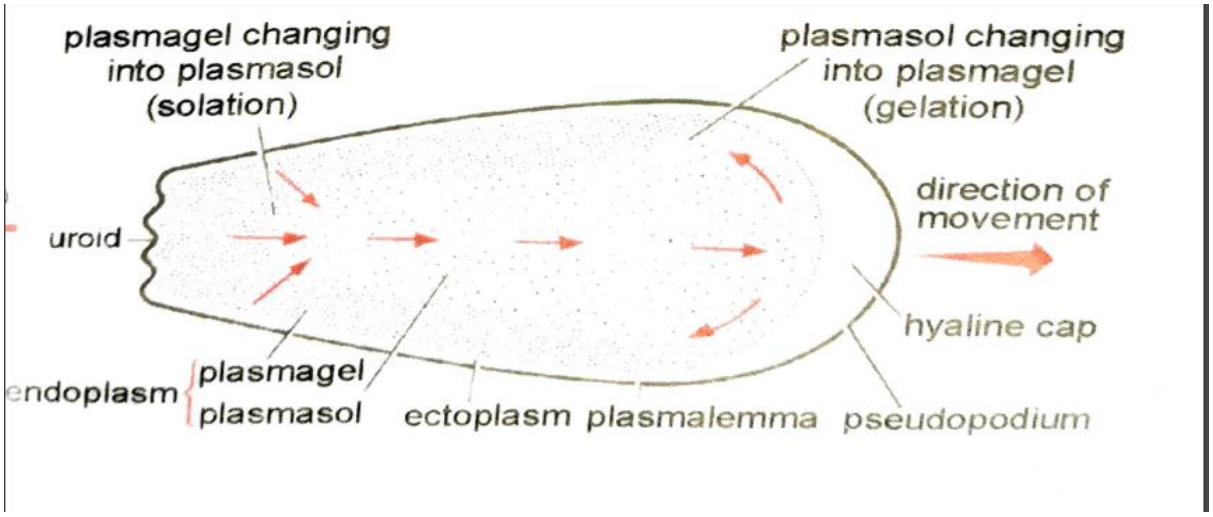


FIGURE DEPICTING :- AMOEBA MOVENT ACCORDING SOL AND GEL THEORY

[f] Folding and unfolding theory

This theory was proposed by Goldacre and Lorch folding and unfolding of protein chain leads to contraction and relaxation of protein molecule. They suggested that sol state of protoplasm is due to folding of protein whereas gel state is to unfolding of protein. Folding leads to contraction of end and amoeba progress on the other hand unfolding leads to liquefied sol state which is forced by central endoplasm and pushed forward. Considerable amount of ATP is invested in the form of energy for folding and unfolding of protein.

[g] Front and fountain zone contraction theory

It was proposed by Allen in 1961. He compared amoeboid movement with muscle movement where contraction takes place. Where protein contraction leads to endoplasm contraction anterior end so that amoeba moves forward. The endoplasm is constantly converted to ectoplasm anteriorly and ectoplasm to endoplasm posteriorly.

[h] Reversible gel-sol transformation theory.

Given by Yagi and Marsland this theory is most accepted theory explanation of amoeboid movement. This theory suggest that solation at anterior end occur into which endoplasm flows under pressure generated by contraction of the cortical plasmagel at the posterior end. This results in propulsion of amoeba.

FLAGELLAR MOVEMENT

Single long locomotory flagella is enough for euglena movement. During swimming the flagella is directed obliquely backward toward the side bearing stigma. It undergo spiral undulations with waves that are transmitted from the base to the tip cuasing beating or sideway lashing. It beats on an average of 12 beats per second.This beating of flagellum drives the water backward and allow whole body to move forward. Each beat not only allow the body to move forward but also to one side. Hence when the body repeats one type of movement over and over the organism revolve in circle or gyrates.

As it directed to the backward direction to the long axis of the body the organism also rotate on its axis. It has been now calculated that euglena rotate at 1 turn per second speed.

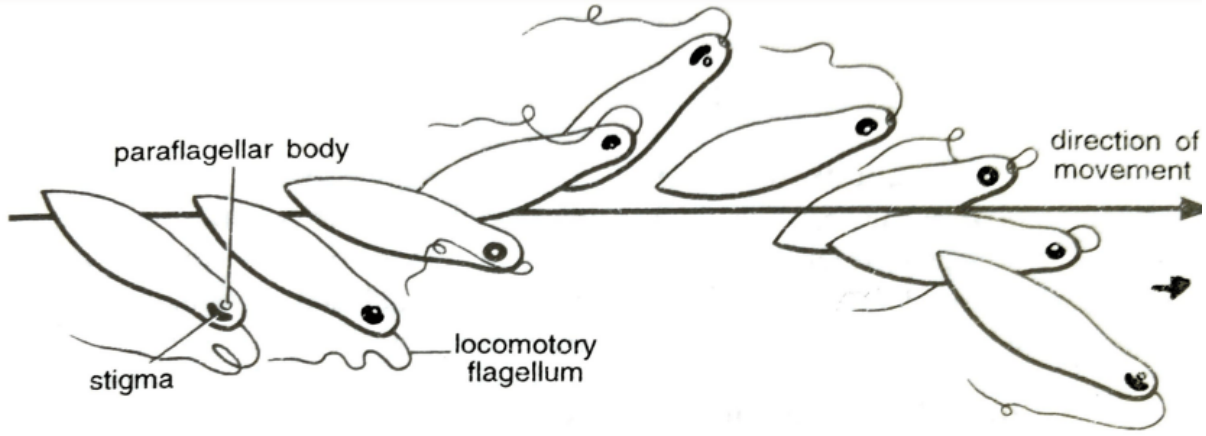
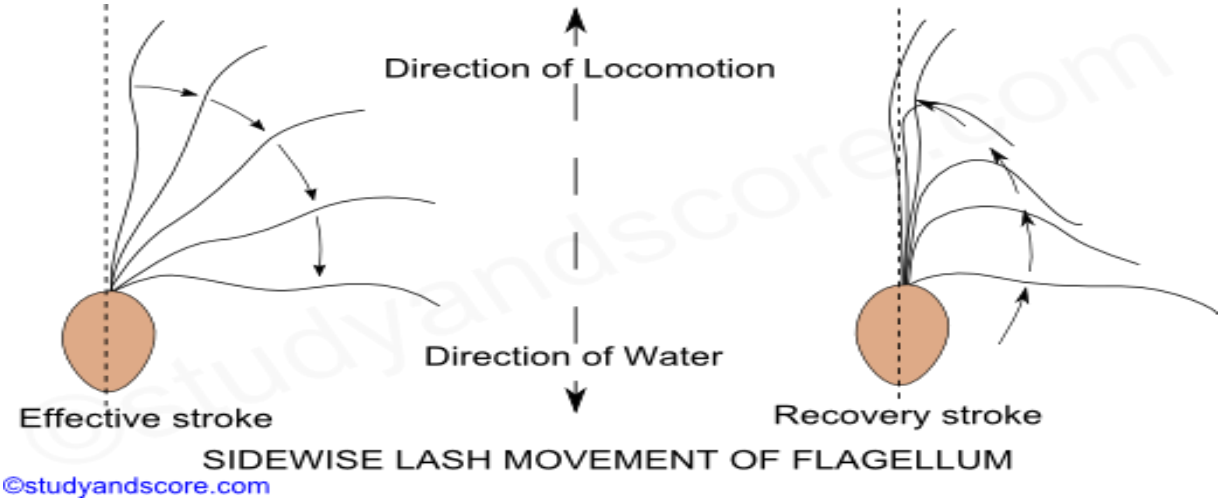


FIGURE DEPICITNG:- FLAGELLAR MOVEMENT



CILLIARY MOVEMENT

Paramecium has streamlined body which enable it swim about in water with a minimum amount of friction.

[a] Cilliary beats

During movement, a cilium oscillates like a pendulum. Each oscillation comprises fast and effective stroke and a slow recovery stroke. During effective stroke cilia becomes slight curve and rigid and strikes the water like a oar, so that body is propelled in opposite direction of stroke.

At the cilia of body do not move simultaneously and independently but progressively in a characteristic wave like manner called metachronal rhythm. The cilia in longitudinal row beat in characteristic wave beginning at the anterior end.Cilia in longitudinal row beats one behind other where as in transverse row move synchronously.

[b] Mode of swimming

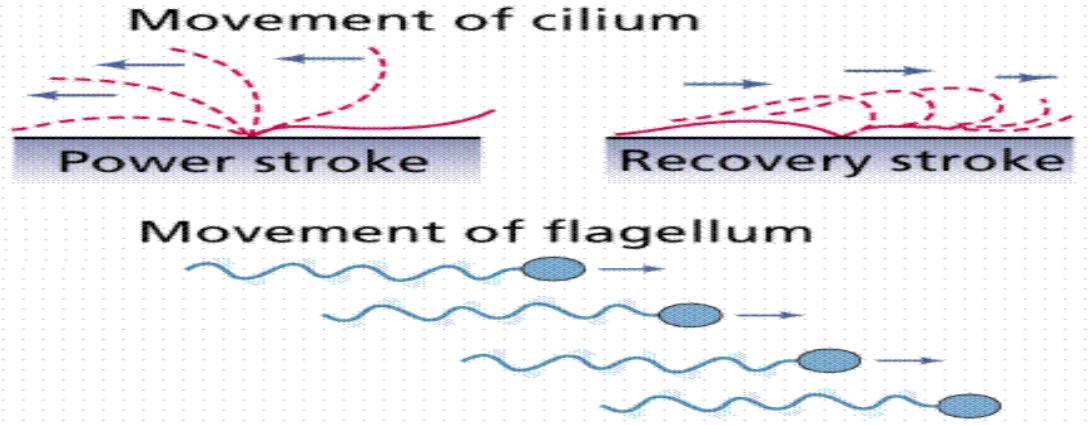
They rotate spirally along the left handed helix.

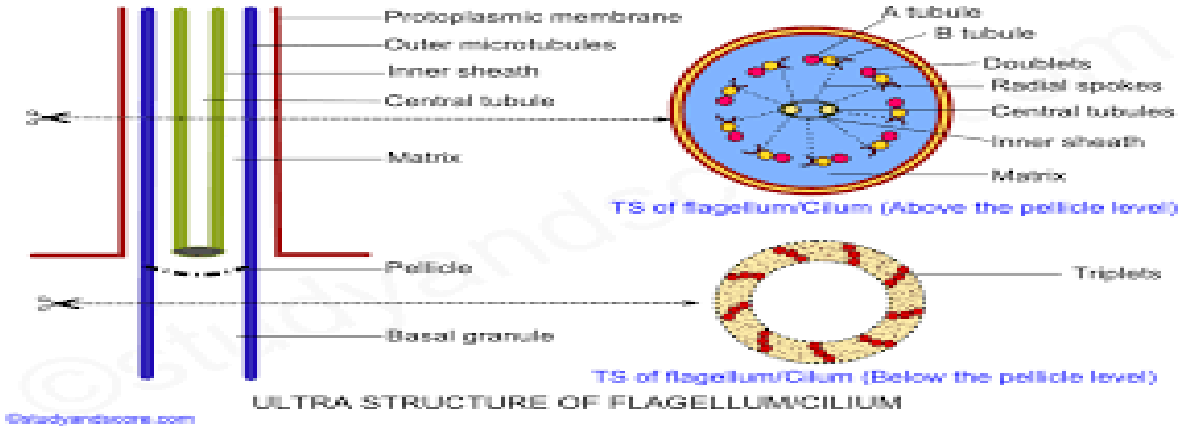
The body do not move directly backward but somehow how tilt to the right

Secondly the cilia of oral groove strike obliquely and more vigorously so as to turn anterior end continuously away from the oral side and move in circle. The combine action causes the movement of animal along the fairly straight path rotating about its axis in an anti clockwise direction.

In backward movement paramecium follow the straight path. This is due to the fact that the effective stroke is carried out anteriorly.

DEPICTING:-CILLIARY MOVEMENT [A] EFFECTIVE STROKE [B] RECOVERY STROKE





CONCLUSION

There are large number of protozoans which moved with the help of or more whipped like structure called flagella. The movement can also takes place with help of cilia or with the help of pseudopodia in case of amoeba. Most unicellular organisms are included in this catergory. The flagellates are either plant like typically having chloroplast or animal like with no chloroplast.

Protozoa that moves with the help of cilia are refer as ciliates and are included in subphylum cilliophora .Beside the character of these locomotor organ all ciliates posses two nuclei macro and micro nuclei.

Amoeba is most popular free living protozoa it is regarded as a lowest form of animal as it body consist of mere spaces of protoplasm. It serves as an interesting and suitable material for laboratory as it is easy to obtain and very slow in locomotion. Amoeba perform locomotion with the help of pseudopodia various theory are given to describe its motion.

Question 2. Explain the type and function of canal system in sponges.

CANAL SYSTEM IN PHYLUM PORIFERA (SPONGES):

All the cavities of the body traversed by the currents of water, which nourish the sponge from the time it enters by the pores until it passes out by the osculum, are collectively termed canal system. In the Olynthus canal system is seen in its simplest type. In other forms it may attain a high degree of complexity, but its general evolution can never the less be reduced to simple process of growth on the part of primitive Olynthus resulting infolding of the walls and accompanied by a restriction of the collared (choanocyte) cells to certain regions. In the gradual and continuous process of differentiation three distinct types of organization can be distinguished .There are usually three types of canal system met within sponges, viz., asconoid type, syconoid type and leuconoid type.

Asconoid Type:-

Asconoid type of canal system is the simplest of all the types.

In this there is a radially symmetrical vase-like body consisting of a thin wall enclosing a large central cavity the spongocoel opening at the summit by the narrowed osculum .

The wall is composed of an outer and inner epithelium with a mesenchyme between.

The outer or dermal epithelium here termed epidermis consists of a single layer of flat cells.

The inner epithelium, lining the spongocoelis composed of choanocytes.

The mesenchyme contains skeletal spicules and several types of amoebocytes , all embedded in a gelatinous matrix.

The wall of the asconoid sponge is perforated by numerous microscopic apertures termed incurrent pores or ostia which extend from the external surface to the spongocoel .

Each pore is intracellular i.e. it is a canal through a tubular cell called a porocyte .

The water current impelled by the flagella of the choanocytes passes through the incurrent pores into the spongocoel and through the osculum furnishing in its passage food and oxygen and carrying away metabolic wastes.

The water current in the asconoid sponges follow the following route:-

Water from exterior in current pores spongocoel osculum water out.

Asconoid type of canal system is found only in few sponges, e.g., Olynthus, Leucosolenia .

CANAL SYSTEM IN PHYLUM PORIFERA (SPONGES)

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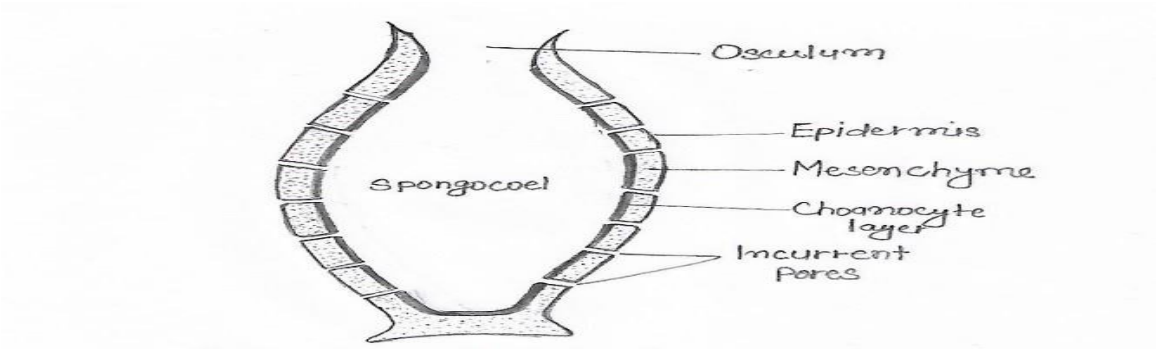


Fig: Asconoid type of canal system

Syconoid Type:-

Syconoid type of canal system is the first stage above the asconoid type.

It is formed by the out pushing of the wall of an asconoid sponge at regular inter valsin to finger like projections, called radial canals.

At first these radial canals are free projections and the outside water surrounds the whole length, for the rear enodefinitein current channels.

But in most syconoid sponges, the walls of radial canals fuse in such a manner as to leave between them tubular spaces, the incurrent canals which open to the exterior between the blind outer ends of the radial canals by apertures termed dermal ostia or dermal pores.

Since these incurrent canals represent the original outer surface of the asconoid sponge they are necessarily lined by epidermis.

Radial canals being the out pushing of the original spongocoel are necessarily lined by choanocytes and are therefore ,better called flagellated canals.

The interior of the syconoid sponge is hollow and forms a large spongocoel which is lined by the flat epithelium derived from epidermis.

The openings of the radial canals in to the spongocoel are termed internal ostia.

The spongocoel opens to the exterior by the single terminal osculum.

The wall between the incurrent and the radial canals is pierced by numerous minute pores called prosopyles.

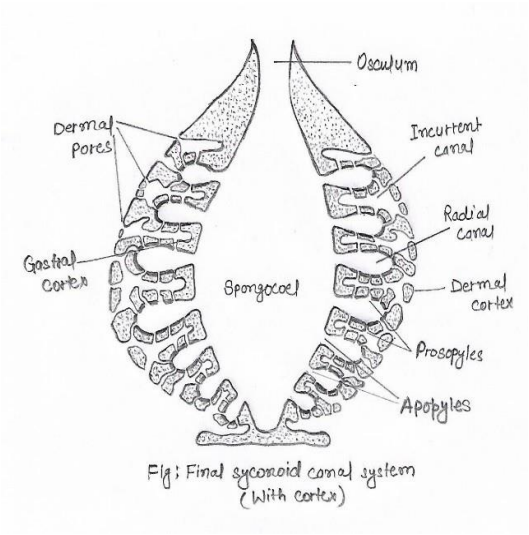
The water current in syconoid sponges take the following route:-

Dermal pores in current canals → prosopyles → radial canals → internal ostia (apopyle) → spongocoel → osculum → out.

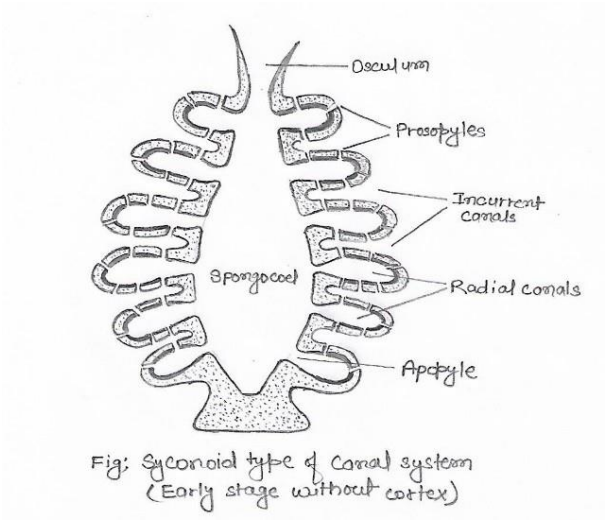
The syconoid structures occurs in two main stages.

The first type illustrated in a few of the heterocoelous calcareous sponges, especially members of the genus Sycon.

In the second stage, the epidermis and mesenchyme spread over the outer surface forming a thin or thick cortex often containing special cortical spicules.



Fig; Final syconoid canal system (With cortex)



Fig; Syconoid type of canal system (Early stage without cortex)

Leuconoid Type:-

As a result of further process of outfolding of the choanocyte layer and thickening of bodywall the leuconoid type of canal system develops.

The choanocyte layer of radial canal of the syconoid stage evaginates into many small chambers, and these may repeat the process, so that clusters of small rounded or oval flagellated chambers replace the elongated chambers of the syconoid stage.

The choanocytes are limited to these chambers.

Mesenchyme fills in the space around the flagellated chambers.

The spongocoel usually obliterated and the whole sponge becomes irregular in structure and indefinite in form.

The interior of the sponge becomes permeated by many incurrent and excurrent canals joint form larger excurrent canals and spaces which lead to the oscula .

The surface is covered with epidermal epithelium and pierced by many dermal pores (ostia) and oscula.

The dermal pores lead into incurrent canals that branch irregularly through the mesenchyme .

The incurrent canals lead into the small rounded flagellated chambers by openings till termed prosopyles .

The flagellated chambers open by apertures called apopyles into excurrent channels , and these unite to form larger and larger tubes, of which the largest lead to the oscula .

The course of water current is:-

Dermal ostia → incurrent canals → prosodus (if present) → prosopyles → flagellated chambers → apopyles → aphodus (if present) → excurrent canals → larger channels → oscula → out .

The leuconoid type of canal system exhibits numerous variations but presents three stages of evolution ,viz eurypylous ,aphodal and diplodal .

Eurypylous type:-

In the eurypylous leuconoid type of canal system, the flagellated chambers are wide and thimble-shaped, each opening directly into the excurrent canal by a wide aperture called apopyle and receive the water supply direct from incurrent canal through the prosopyle.

The current of water takes the following route:-

Dermal pores or ostia as dermal spaces in current canals prosopyles flagellated chambers apopyles excurrent canals spongocoel oscula out.

This type of canal system is found in Leucilla.

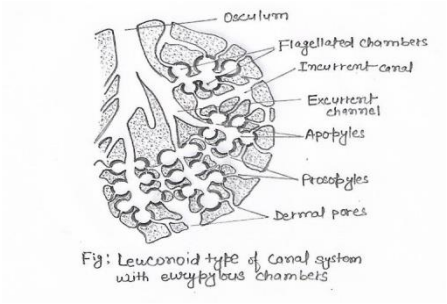


Fig: Leuconoid type of canal system with eurypylous chambers

Aphodal Type:-

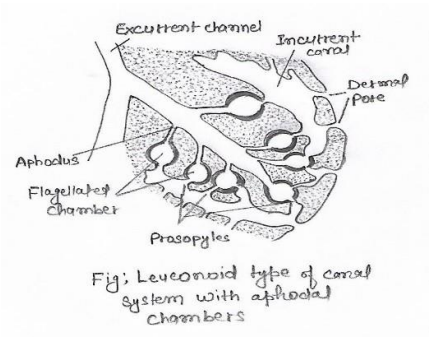
In the aphodal leuconoid type of canal system, the flagellated chambers are small and rounded.

The opening of each flagellated chamber into the excurrent canal is drawn out into an arrow tube, usually not of great length ,termed aphodus .

The relation of the flagellated chambers to the incurrent canals remainas before.The route of water current is as follows:-

Dermal pores or ostia subdermal spaces incurrent canals prosopyles flagellated chamber aphodus excurrent canals spongocoel oscula out.

This type of canal system is found in Geodia and Stelleta .



Fig; Leuconoid type of canal system with aphodal chambers

Diplodal :-

In some cases there is also a narrow current tube,the prosodus between the incurrent canal and the flagellated chambers such a condition is called diplodal .

This type of canal system is found in Oscarella, Spongilla etc.

The current of water takes the following route:-

Dermal pores or ostia subdermal spaces incurrent canals prosodus flagellated chambers aphodus excurrent canals spongocoel oscula out.

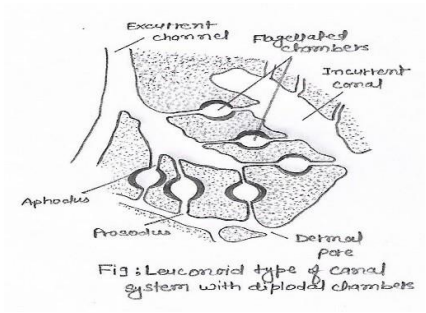


Fig : Leuconoid type of canal system with diploded chambers

Rhagon Type:-

This type of canal system is found in demospongia which in turn arises by direct rearrangement of the inner cell mass.

The rhagon type of sponge has a broad base and it is conical in shape with a single osculum at the summit.

The basal wall is termed the hypophare which is devoid of flagellated chambers.
The upper wall bearing a row of small, oval flagellated chambers called spongophare .

Spongocoel is bordered by oval flagellated chambers opening into it by wide apopyles .

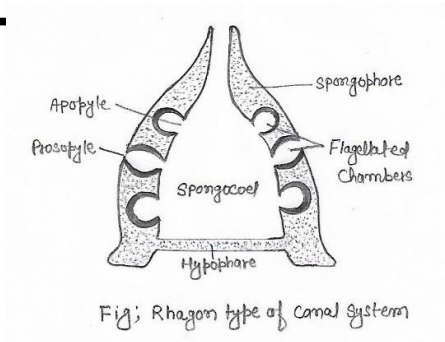
Dermal pores or ostia open into subdermal spaces which extend below the entire surfaceof the body.

Branching incurrent canals lead from the subdermal spaces into small flagellated chambers which have been formed by breaking down of radial canal, the flagellated chambers are lined by choanocytes lead into spongocoel .

The spongocoel opens by a single osculum .

The course of water current of water is :-

Ostia subdermal space incurrent canals prosopyle flagellated chambers apopyles excurrent canals spongocoel osculum out.



Fig; Rhagon type of canal system

FUNCTIONS OF CANAL SYSTEM

The canal system helps the sponges in nutrition, respiration, excretion and reproduction.

The current of water which flows through the canal system brings the food and oxygen and takes away the carbon dioxide, nitrogenous wastes and faeces.

It carries the sperms from one sponge to another for fertilization of the ova.

Canal system increases the surface are of sponges and increase the volume that is why the ratio of surface area and volume remain fixed.

Question 3.Describe in details the classification of phylum Porifera .

CHARACTERS AND CLASSIFICATION OF PHYLUM PORIFERA

The Porifera may be defined as "asymmetrical or radially symmetrical multicellular organisms with cellular grade of organization without well-defined tissues and organs: exclusively aquatic; mostly marine, sedentary, solitary of colonial animals with body perforated by pores, canals and chambers through which water flows ; with one or more internal cavities lined with choanocytes and with characteristic skeleton made of calcareous spicules, siliceous spicules of horny fibers of sponging."

General Characters:-

Porifera are all aquatic,mostly marine except one family spongillidae which lives in fresh water.

They are sessile and sedentary and grow like plants.

Body shape is vase or cylinder-like asymmetrical or radially symmetrical.

The body surface is perforated by numerous pores, the ostia through which the water enters the body and one or more large openings, the oscula by which the water passes out.

Multicellular body consisting of outer ectoderm and inner endoderm with an intermediate layer of mesenchyme, therefore diploblastic animal .

The interior space of the body is either hollow or permeated by numerous canals lined with choanocytes. The interior space of sponge body is called spongocoel.

Characteristic skeleton consisting of either fine flexible sponging fibers, siliceous spicules or calcareous spicules .

Mouth absent, digestion intracellular .

Excretory and respiratory organs absent .

The nervous and sensory cells are probably not differentiated.

The sponges are monoecious; reproduction both by asexual and sexual methods.

Asexual reproduction occurs by buds and gemmules .

The sponges possess high power of regeneration.

Sexual reproduction occurs by ova and sperms.

Fertilization is internal but cross fertilization occurs as a rule.

Cleavage holoblastic, development in direct through a free-swimming ciliated larva called amphiblastula or parenchymula.

The organization of sponges has been grouped into three main types, viz; ascon type,sycon type and leuconoid type due to simplicity in some forms and complexity in others.

Classification:-

The classification of Porifera is based chiefly on types of skeleton found in them.

CLASS I: CALCARIA OR CALCISPONGIAE

They have skeleton of separate calcareous spicules which are monaxon or tetraxon; tertaxon spicules lose one ray to become triradiate.

They are solitary or colonial; body shape vase-like or cylindrical.

They may show asconoid, syconoid or leuconoid structure.

They are dull coloured sponges less than 15 cm in size.

They occur in shallow waters in all oceans.

Order1: Homocoela

Asconoid sponges with radially symmetrical, cylindrical body.

Body wall is thin and not folded, spongocoel is lined by choanocytes .

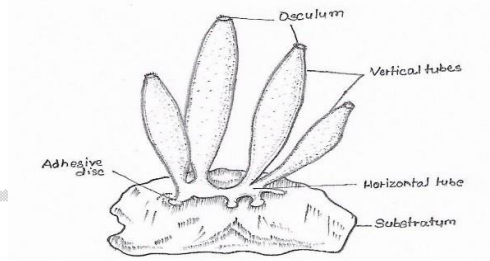


Fig: Leucosolenia colony

Example: Leucosolenia, Clathrina.

Order2: Heterocoela

Syconoid or leuconoid sponges having vase-shaped body.

The body wall is thick and folded, choanocytes line only radial canals.

Spongocoel is lined by flattened endoderm cell.

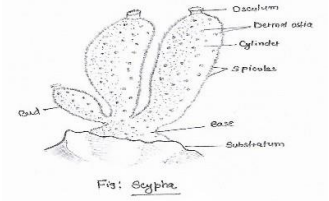


Fig: Scypha

Example: Sycon or Scypha, Grantia.

CLASS II : HEXATINELIDA OR HYALOSPONGIAE

(G; hyalos = glassy + spongos = sponge)

They are called glass sponges.

Skeleton is of siliceous spicules which are triaxon with 6 rays. In some the spicules are fused to form a lattice ike skeleton.

There is no epidermal epithelium.

Choanocytes line finger-shaped chambers.

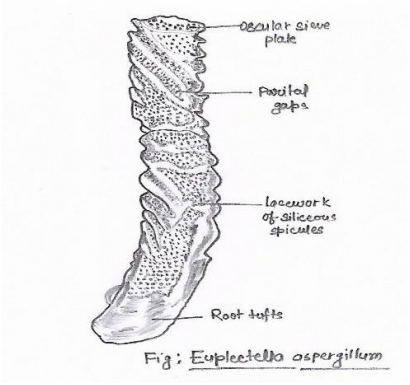
They are cylindrical or funnel shaped and are found in deep tropical seas , they grow up to one meter.

Order1: Hexasterophora

Spicules are hexasters,i.e.star-like in shape.

Radial canals or flagellated chamber saresimple.

They are not attached by root tufts but commonly attach estoahard surface.



Fig; Euplectella aspergillum

Example: Euplectella, Farnera.

Order2: Amphidiscophora

Spicules are amphidiscs. Nohexasters.

They are attached to the substratum by root tufts.

Example: Hyalonema, Pheronema.

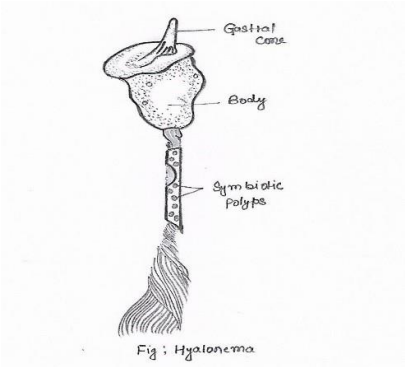


Fig ; Hyalonema

CLASS III: DEMOSPONGIAE

(Gr;demos=frame+spongos=sponge)

Contains the largest number of sponge species. Large-sized, solitary or colonial.

The skeleton may be of sponging fibers or of sponging fibers with siliceous spicules or there may be no skeleton.

Spicules are never six-rayed, they are monaxon or tetraxon are differentiated into large megascaleres and small microscleres.

Body shape is irregular and the canal system is of leucon type.

Generally marine,few freshwater forms.

Subclass I: Terractinellida

Sponges are mostly solid and simple rounded cushion like flattened in shape usually with out branches.

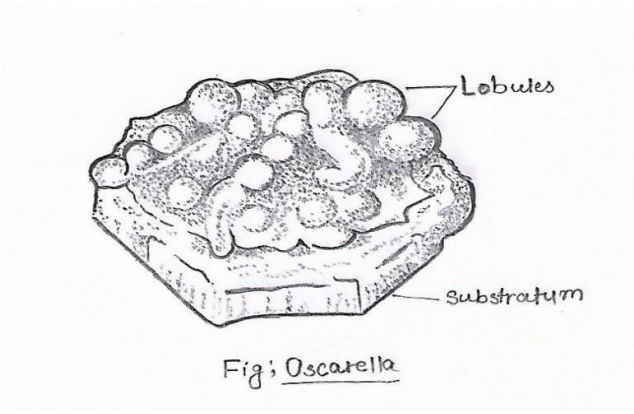
Skeleton comprise mainly of tetraxon siliceous spicules but absent in order myxospongida.

Canal system is leuconoid type. Shallow water form.

Order1: Myxospongida

Simple structure.

Skeleton absent.



Fig; Oscarella

Example: Oscarella, Halisarca.

Order2: Carnosa

Simple structure.

Spicules are not differentiated into megascleres and microscleres.

Asters may be present.

Example: Plakina.

Order3: Choristida

Spicules are differentiated into megascleres and microscleres.

Example: Geodia, Thenea.

Subclass II: Monaxonida

Monaxonids occur in variety of shapes from rounded mass to branching type or elongated or stalked with funnel or fanshaped.

Skeleton consists of monaxon spicules with or without spongin.

Spicules are distinguished into megascleres and microscleres.

They are found in abundance throughout the world.

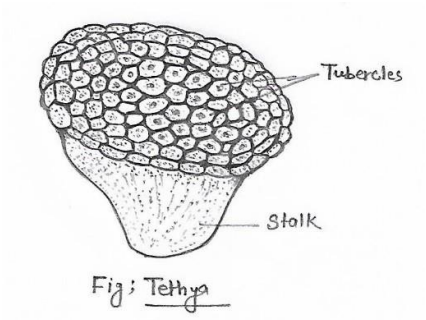
Shallow and deep water forms.

Order1: Hadromerida

Monaxon megascleres in the form of tylostyles.

Microscleres when present in the form of asters.

Sponging fibers are absent.



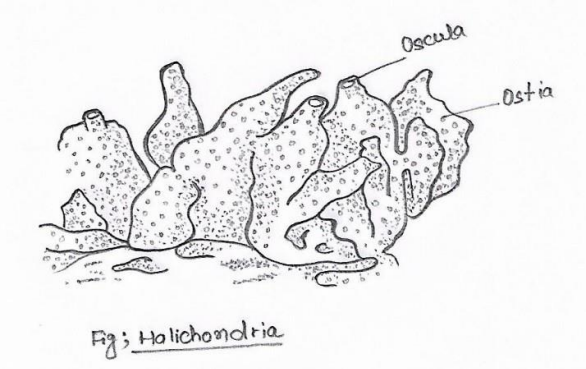
Fig; Tethya

Example: Cliona, Tethya.

Order2: Halichondrida

Monaxon megascleres are often of two types viz; monoactins and diactins.

Microscleres are absent. Sponging fibers present but scanty.



Fig; Halichondria

Example: Halichondria.

Order3: Poecilosclerida

Monaxon megascleres are of two types, one type in the ectoderm and another type in the choanocyte layer.

Microscleres are typically chelas, sigmas and toxas.

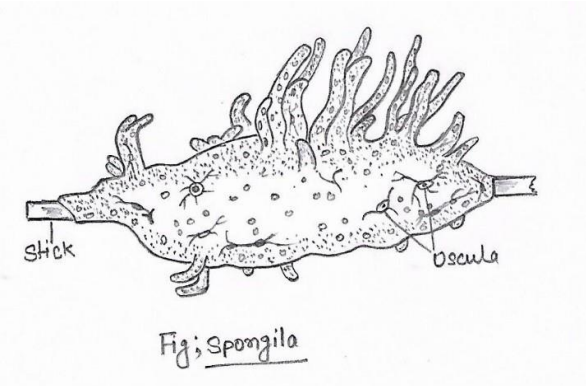
Example: Cladorhiza.

Order 4: Haplosclerida

Monaxone megascleres are of only one type, viz; diactinal.

Microscleres are absent.

Spongin fibers are generally present. Example: Chalina,Pachychalina,Spongilla.



Fig; Spongila

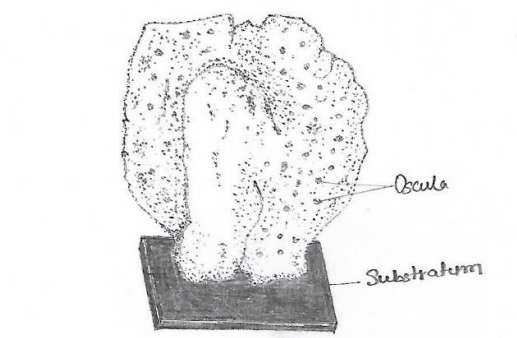
Subclass III: Keratosa

Body is rounded and massive with a number of conspicuous oscula.

Skeleton composed of network of sponging fibers only.

Siliceous spicules are absent.

They are also known as horny sponges found in shallow and warm waters of tropical and sub-tropical region.



Fig; Euspongia

Example: Euspongia, Hippospongia.

Q 4. Write in detail the life history and development of Taenia.

Taeniasolium; Pork tape wormK

Taenia solium commonly known as the pork tapeworm or the armed tapeworm.

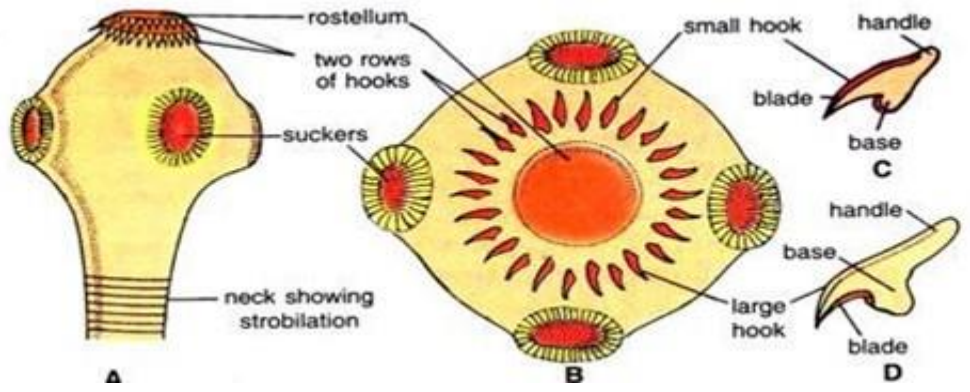
It is a flat-ribbon like tape worms that causes intestinal taeniasis.

Adult worms are rarely pathogenic but the encysted larval stage (cysticercus cellulosae) of the worm caused a serious disease in human called Cysticercosis.

Habitat:

The adult worm inhabits the small intestine (upper jejunum) of human.

Morphology:



Adult worm:

Adult Taenia solium is a flattened ribbon like tapeworm that is white in color.

The adult worm measures about 2-3 meters in length.

The body of parasite can be divided into 3 parts:- Head (Scolex), neck and body (strobila)

i. Scolex (Head):

It measures 1 mm in diameter, about the size of a pin head.

It is globular in shape and has 4 circular suckers.

The head is provided with a rostellum armed with a double row of alternating large and small hooklets (130-180mm long).

The presence of hooklets gave its name armed tape worm.

ii. Neck:

The neck is short measuring 5-10 mm in length.

iii. Body (Strobila):

The body or Strobila consists of segments or proglottids.

The total number of proglottids are about 800-900.

The proglottids may be immature, mature or gravid.

The gravid segment measures 12 X 6 mm in diameter and looks grayish-black and transparent when fully developed.

The worm is hermaphrodite and each segment containing both male and female reproductive organs.

The common genital pore is marginal, thick-lipped and is situated near the middle of each segment alternating between the right and left side.

Testes consists of 150-200 follicles.

An ovary is two in number which has a third (accessory lobe).

The ovary is situated in the posterior side of the segment.

The gravid consists of a median longitudinal stem of uterus having 7-13 branches on each side of the segment.

Uterus is completely filled with eggs and each gravid consist nearly 30,000-50,000 eggs.

The vaginal opening is not guarded by a muscular sphincter.

The gravid segment are expelled passively, in chains of 5 to 6 at a time and not singly.

2. Eggs:

Eggs are similar to those of Taenia saginata.

Each egg is round, brown in color, measures 40-50 µm in diameter

Each egg consists of two shells.

The outer shell is thin, transparent and represents the remnant of yolk mass.

The inner shell, also known as embryophore is brown, thick walled and radially striated. It encloses the embryo.

The embryo measures 14-20 µm in diameter with hooklets.

Eggs do not float in saturated solution of common salt (NaCl).

Eggs are infective to pigs as well as to humans.

3. Cysticercus cellulosae larvae

Larvae is cysticercus cellulosae and is the Infective form of parasite.

It is also known as Taenia cyst.

The larval form develops in the muscle of pigs as well as various organs of the human.

A mature cyst is an opalescent ellipsoidal body and measures 8-10 mm width by 15mm in length. It has a fluid filled milky white bladder like structure.

The long axis of cyst lies parallel with the muscle fiber. The cyst is separated from the host tissue by a thin collagenous capsule. There is a dense milk white spot at the side, where the scolex with its hooks and suckers remain invaginated.

The cavity of cyst is fill with a clear fluid rich in albumin and salts.

The larvae can live for about 8 months in muscles of pig and can only develop into adults when ingested by man.

Life cycle of Taenia solium:

The life cycle is completed in two hosts.

Definitive host: Human

Intermediate Hosts: Pig, occasionally human.

Humans acquire infection by ingestion of inadequately or improperly cooked pork infected with cysticerci.

Inside the alimentary canal of man the scolex on coming incontact with bile exvaginates and anchor to the gut wall with its hooks and suckers.

The larvae develops into an adult worm by gradual strobilisation.

The worm grows to sexual maturity in 2-3 months and start producing eggs which are then passes in the faeces along with the gravid segments.

The pig gets infection by ingestion of eggs or gravid proglottids passed in human faeces.

In the intestine of pig, the oncospheres hatch out of eggs.

They attach to the intestinal mucosa by hooks, penetrate the gut-wall and gain entrance into the portal vessels or mesenteric lymphatic, finally reaching the systematic circulation.

Usually they travel via the portal vein and successively reach the liver, right side of heart, lungs, left side of heart, brain or other tissue with high blood flow.

The naked onchospheres are filtered out from the circulating blood into the muscular tissue where they ultimately settle down and undergo further development.

They lose their hooklets, enlarge, and develops into a fluid-filled cyst within a period of 9-10 weeks.

They remain viable for up to 8 weeks in muscle of pig during which they remain infective for human.

The new host gets infection by ingestion of the infected meat of pig and the cycle is repeated.

Occasionally humans get infection by eating food or drinking water contaminated with eggs.

On ingestion, the onchospheres are released from the eggs in the intestine. These larva invade the intestinal mucosa and are then carried by the circulation to different tissue where they develops into cysts.

In human most cysts are produced in the CNS, skeletal muscles, eye and subcutaneous tissue giving rise to a condition called cysticercosis.

Mode of transmission:

Ingestion of uncooked pork infected with tape worm

Ingestion of food and water contaminated by the eggs present in the infective faeces of a Taenia carrier.

Endogenous auto infection: Anus-hand-mouth transfer of eggs by contaminated hands of person with poor personal hygiene.

Autoinfection: Reverse peristalsis in which eggs produced by T. solium are thrown back to the duodenum, where they hatch and cause tissue infection

Pathogenesis of Taenia solium:

Both adult worm and cyst are pathogenic.
The adult worms are less pathogenic. They occasionally cause mild irritation or inflammation of the intestinal mucosa by their armed scolex.

The cyst, (Cysticercus cellulosae) are more pathogenic. They cause a serious disease cysticercosis in human, mostly cyst are produced in the skin, skeletal muscles, eye and CNS.

The cyst can remain viable for few years.

In the brain the cyst survives by overcoming the host defenses. It secretes the prostaglandins and other substances that inhibit activation of the complement and production of cytokines.This result in minimal host inflammation around the live cysticercus. The live cyst is surrounded by a local minimal cellular reaction that consists of few eosinophiles and macrophages.

The dead cyst is surrounded by a dense infiltration that consists entire spectrum of inflammatory cells, including leucocytes and multinucleated giant macrophages, inflammatory cells and less frequently foreign body giant cells. Outside this area a zone of fibrosis and chronic inflammatory infiltration are present.

Clinical diseases caused by Taenia solium infection

1. Intestinal Taeniasis:

Mostly the infection is asymptomatic.

In symptomatic cases, the clinical symptoms are nonspecific and mild and includes- nausea, abdominal discomfort, hunger pain, loss of weight, chronic indigestion etc.

Less frequently nausea, vomiting, headache and diarrhea are present in few cases.

2. Cysticercosis:

Cysticercosis is the infection with the larval stage of the parasite.

Human beings acquire infection through faccal oral contamination with T. solium eggs from tapeworm carriers or by auto infection.

Clinical manifestation depend on the affected organ; neurocysticercosis and ophthalmic cysticercosis are associated with substantial morbidity.

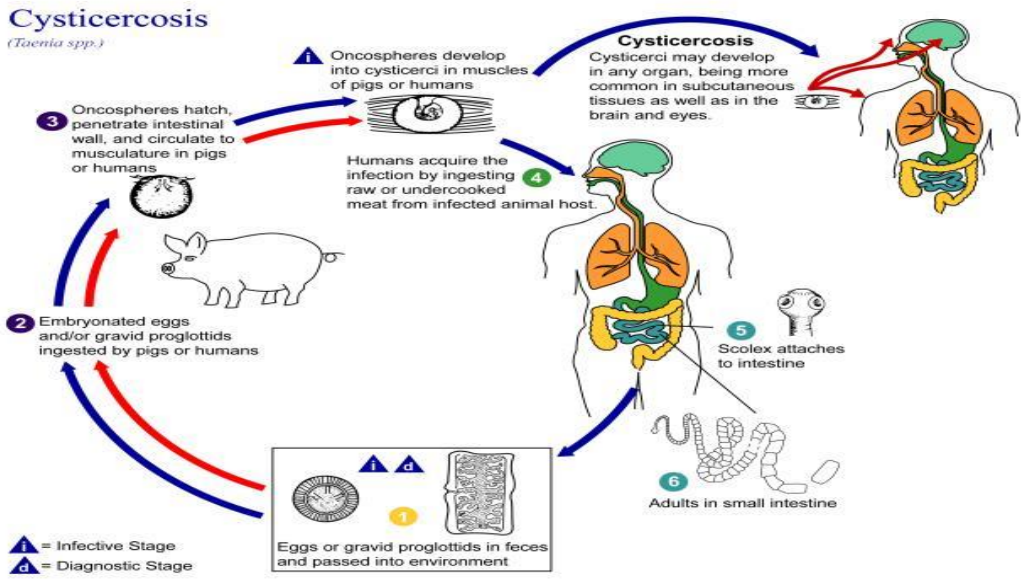
Prevention and control of taeniasis:

Avoidance of eating raw or insufficiently cooked pork

Inspection of pork for cysticerci.

Proper sanitation facilities.

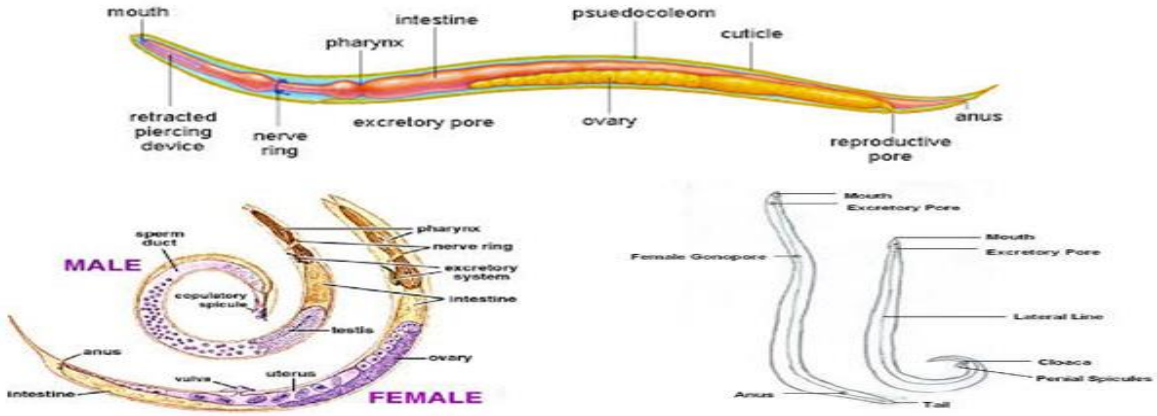
Treatment of infected persons.



Q.5. General Characteristics and classification of phylum Nemathehelminthes.

Ans. General Characteristics of Phylum Nemathelminthes:

Nemathelminthes or Aschelminthes:
They are commonly called thread worm or round worm.It is a phylum of unsegmented, triploblastic, pseudocoelomic, cylindrical or thread-like worms which are covered by a body wall having cuticle and epidermis. Hyman regarded Aschelminthes as a distinct phylum and the various groups included in it as classes. However, other zoologists consider Aschelminthes as a superphylum and its various groups as phyla (Rotifera, Gastrotricha, Kinorhynca, Nematomorph, Nematoda). Phylum Nematoda is its large group.



General characters

Mostly parasitic. Few of them are free-living.

They are cylindrical, elongated, slender worm like and tapers at both end.

Triploblastic.

Bilaterally symmetrical.

Organ system level of organization.

Body is unsegmented.

Body cavity is filled with muscle. They are pseudocoelomate i.e. body cavity is not lined by mesodermal layer.

Internal cephalization is present but externally there is little differentiation between the anterior and posterior regions.
Distinct head is lacking. However, mouth is present in anterior region.

Body is covered with tough and resistant cuticle.
It is cast off periodically or which moults only during the period of growth.
It protects the body against the action of digestive juice.

Digestive system is complete and straight with both mouth and anus.
Mouth is terminal and surrounded by lips bearing sense organ.

Respiratory and circulatory organs are absent.
Respiration occurs through general body surface. Respiration is aerobic in free-living forms and anaerobic in parasitic form.

Excretory system consists of intracellular canal or lateral excretory ducts. And also protnephridia having renette cells.

Nervous system is not much developed.
Nervous system consists of circumpharyngeal nerve ring and longitudinal nerve cords.

Sense organs are poorly developed in the form of papillae, which are well defined as amphids (in mouth) and phasmid (in anus).

These are unisexual i.e. sexes are separate with sexual dimorphism.

Fertilization is internal, may be cross or self.

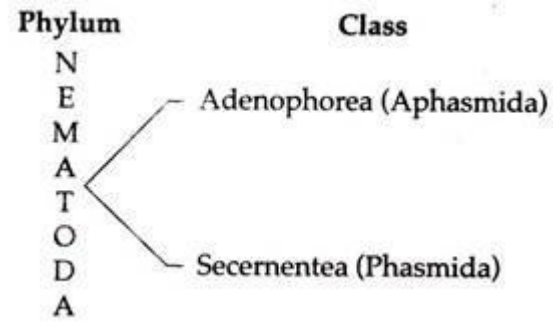
Development may be direct or indirect.
NOTE: Larval forms are Rhabditiform, Filariform and Micrifilaria.

Various lateral lines and pores are present on the surface of body.

S.N.	Zoological name	Common name	Disease
1	Ascaris lumbricoides	Roundworm	Ascariasis.
2	Wuchereriabancrofti	Filarialworm	Elephantiasis
3	Enterobius vermicularis	Pin/thread worm	Churna
4	Loa loa	Eyeworm	conjunctivitis
5	Ancyclostomaduodenale	Hookworm	Ancyclostomiasis
6	Trichuristrichuria	Whipworm	

Classification

Phylum Nematod is classified into two classes on the basis of sensory organ.



Aphasmida (Adenophora)	Phasmida (Secernetea)
Caudal sensory organs (Phasmid) are absent.	Phasmids are present.
Anterior sensory organs (Amphids) are of various types.	Amphids are pore like.

Usually free living.	Usually parasitic.
Excretory system absent or rudimentary.	Excretory system well developed with renette cells.
Tail is non-glandular.	Tail is glandular.
Examples: Trichinella, Dorylaimus	Examples: Ascaris lumbricoides, Enterobius vermicularis

Things to Remember

This is the first unisexual phylum.

The tail is often curved in male.

Amphids- are olfacto receptors

Phasmids- are chemo receptors and glandulo sensory.

Resistant cuticle on the body surface is adaptation for its parasitic life.

Cuticle secreted by underlying epidermis is composed of scleroprotein.

No segmentation. In some, the cuticle is striated and thus giving the appearance of segmentation and called pseudo-segmentation.

The pharynx is triradiate.

Males are usually smaller than females.

During development volume of cell increases (no increment in number of cells).

Ascaris lumbricoides

Monogenetic life cycle, found in small intestine (jejunum) of man.

Cause Ascariasis.

Male Ascaris are monarchic or monodelphic (presence of single testis).

Female are diorchic or didelphic (presence of pair of ovaries).

In Ascaris, fertilization occurs in uterus.

Moulting in life cycle occurs four times:

1st moulting- in soil

2nd and 3rd moulting- in lungs

4th moulting- in intestine.
2nd stage larva enters the lungs and 4th stage larva comes out of the lungs.

Excretory organ is H-shaped.

Mode of transmission- contaminated food and water.

Infective stage- embryonated eggs with rhabditiform larva.

Q.6.Write an assay on –

(a) Poisonous and non poisonous snakes

Ans. Both poisonous and venomous animals are toxic.

The venomous animals are those which can deliver or inject the toxin/venom directly into the body of another animals while poisonous animals are those which are toxic only if they are eaten or touched. It means the poisonous animal do not produce venom.

Example: A cobra snake is venomous because it produce venom and can inject this by biting while a lizard is poisonous which means it is toxic if another animals or humans eat it.

In case of snake, poisonous word is used in place of venomous which is not correct.

In another word we can understand as if an animal bites you and you die then the animal is venomous and if you bite the animal and you die then it is poisonous.

Toxins are the chemicals which are harmful to the body. Poison or venom are toxins which are differentiate on the basis of their delivery method. If the toxin is injected then it is called venom and if it eaten or absorb by skin then it is poison.

It means a venomous snake does not necessarily be poisonous. Garter snake (Thamnophis) is non venomous which means it is harmless in terms of its bite but poisonous as eating it is toxic (its body surface has toxins).

Around 3000 species of the snake are present across the globe. Only 20 percent (~600 species) is venomous and only 7 percent (~200 species) snakes are able to kill a human.

In Indian context more than 270 snake species are present out of which around 60 species are venomous. India reported approximate 50000 death every year by snake bites. Snakes are cold blooded animals which means they cannot regulate the body temperature internally. Their body temperature changes according the environment. Most of the snakes are covered by scales.

First observe the tail.

• Tail is flat, laterally compressed – Sea snake – Venomous.

• Tail is short and blunt – Sand Boa – Non venomous

• Tail is round and cylindrical – Venomous/Non venomous

Nature of the ventral scales:

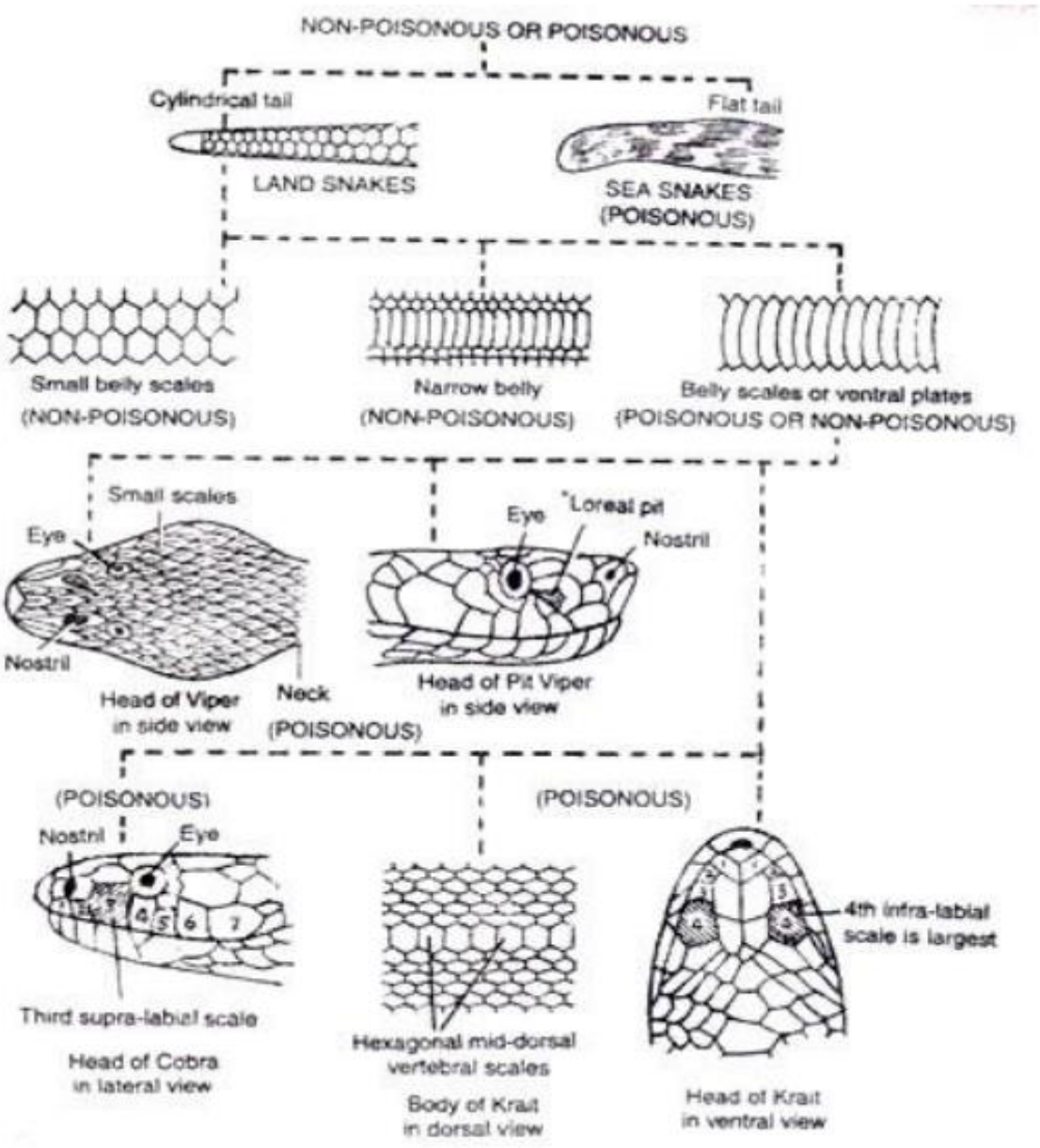
If the tail is cylindrical snake can be venomous or non venomous,

Observe the ventral scales:

• Small scales on the ventral side (belly region) – Non venomous- Garter snake.

• Ventral scales are large but do not cover the belly region completely, small scales at the end of broad ventral scales- Non venomous – Python.

• Ventral scales are broad and cover the entire width of the belly region – Venomous/ Non venomous.



Q.7 Write the economic importance of Annelida.

Ans. The economic importance of Annelida are :-

They help loosen up the soil and aerate it as they burrow deep.

This aids in the proper aeration of the roots of the plants, making them grow deeper and grow well.

They are used present in vermiculture to produce quality manure.

They are used as baits for fish catching.

They interchange the topsoil with the layer just below, increasing soil fertility.

The excreta of earthworms is rich in the nitrogenous matter and is required for plant growth

Q.8 What Is Coelomic Cavity?

Ans. In most animals, Coelom is the main body cavity located in the body to envelop and contain the internal organs, digestive tract etc. It is a hollow, fluid-filled cavity serving as a skeleton.

Q.9 Explain types of nephridia in Earthworm.

Ans: There are three types of nephridia present in earthworms:

Septalnephridia - They are present on both sides of the intersegmental septa of segment 15 to the last segment. They open into the intestine.

Integumentary nephridia - They are attached to the lining of the body wall of segment 3 to the last segment and open into the pharynx.

Pharyngeal nephridia - Three pairs of pharyngeal nephridia are present as extremely minute structures in the 4th, 5th and 6th segments.

Q.10 What is Torsion?

A. Torsion or twisting is a significant process that happens during gastropod larval development. This process rotates the visceropalliumcounterclockwise through 180° from its original position, bringing the mantle cavity and pallial complex in front of the body in adults. Here, let’s learn more about the process of torsion in Mollusca.

Q.11 Give an account of larval forms found in Echinodermata.

Ans. In echinoderms eggs and sperms are released in water and fertilization takes place in water forming zygote. Echinoderms are deuterostomes and hence cleavage is radial, holoblastic and indeterminate. The larvae hatch in water and feed and grow through successive larval stages to become adults. The larvae of echinoderms are bilaterally symmetrical but lose symmetry during metamorphosis. Different classes of echinoderms show structurally different larval stages and their comparisons can reveal their evolutionary ancestry.

1) Bipinnaria larva –

Early bipinnaria appears like hypothetical dipleurula. It has oval body without arms and ciliary bands for locomotion.

It has well developed alimentary canal for feeding and grows to become bipinnaria.

Bipinnaria larva possesses 5 pairs of ciliated arms which do not have any skeletal support inside.

These arms are used for swimming in water while feeding on planktons.

Pre-oral and post-oral ciliary bands are also present.

This larva resembles Auricularia larva of Holothuroidea in general appearance.

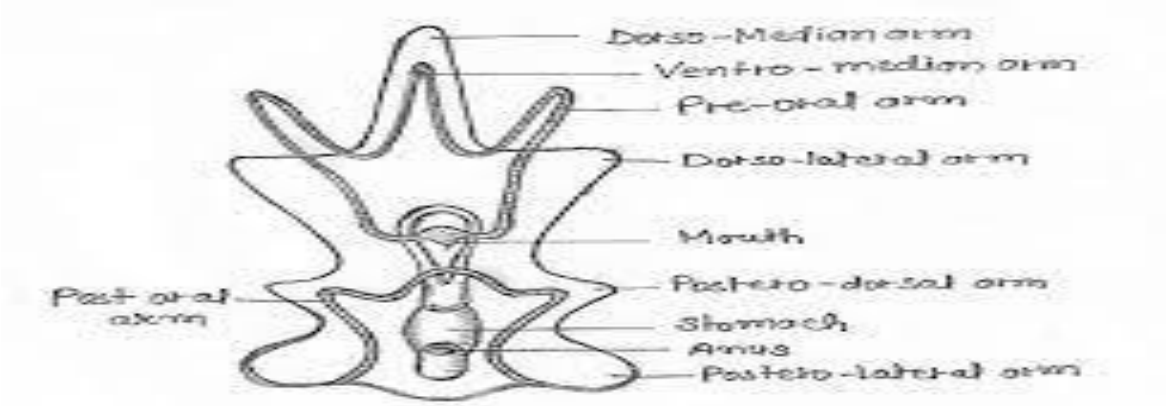


Fig: Bipinnaria Larva

2) Brachiolaria larva –

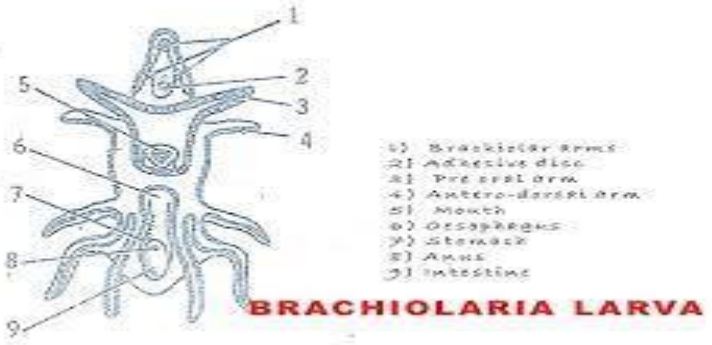
Brachiolaria larva is formed after 6-7 weeks of life and growth of bipinnaria.

This larva is sedentary and remains attached to a hard substratum for which it possesses three brachiolarian arms having adhesive discs at the tip.

Ciliated arms get reduced and become thin and functionless, while mouth, anus and gut are well developed.

It has axocoel, hydocoel and somatocoel that later on give rise to water vascular system.

Development of starfish takes place inside the sedentary brachiolaria which ruptures and releases tiny starfish into water.



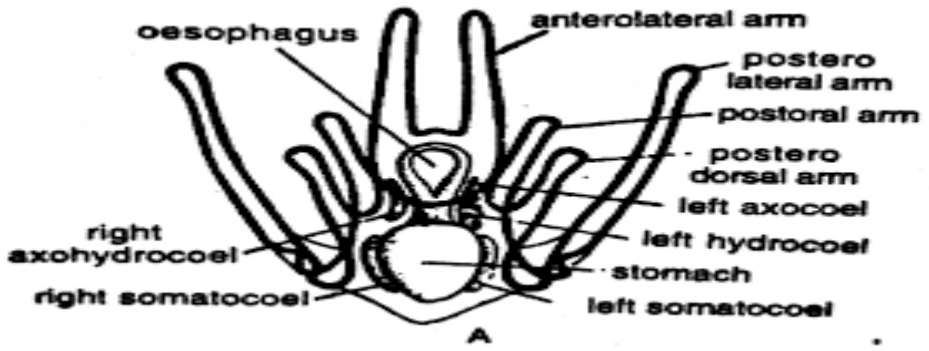
3) Ophiopleuteus larva –

Ophiopluteus is the only larva of Ophiuroidea that resembles echinopluteus larva of Echinoidea in general features.

Anterolateral, post-oral and posterodorsal arms are present but pre-oral arm is absent. Instead, it has very long posterolateral arms.

All arms are supported by calcareous skeletal rods.

This larva metamorphoses to become adult.



4) Echinopleuteus larva –

There is a single larval stage in echinoidea called Echinopluteus which is bilaterally symmetrical.

The larva has oval body and long paired ciliated arms that are supported by calcareous skeletal rods.

Pre-oral arm is present but posterolateral arm is absent.

The other three arms are anterolateral, post-oral and posterodorsal arms.

Mouth, anus and gut are well developed.

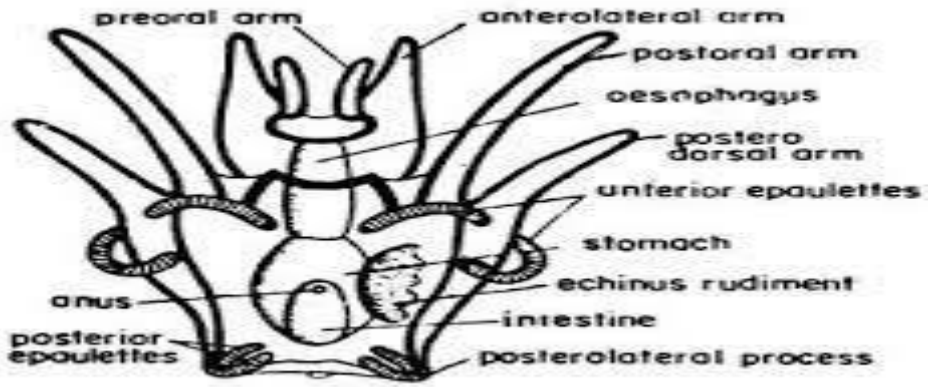
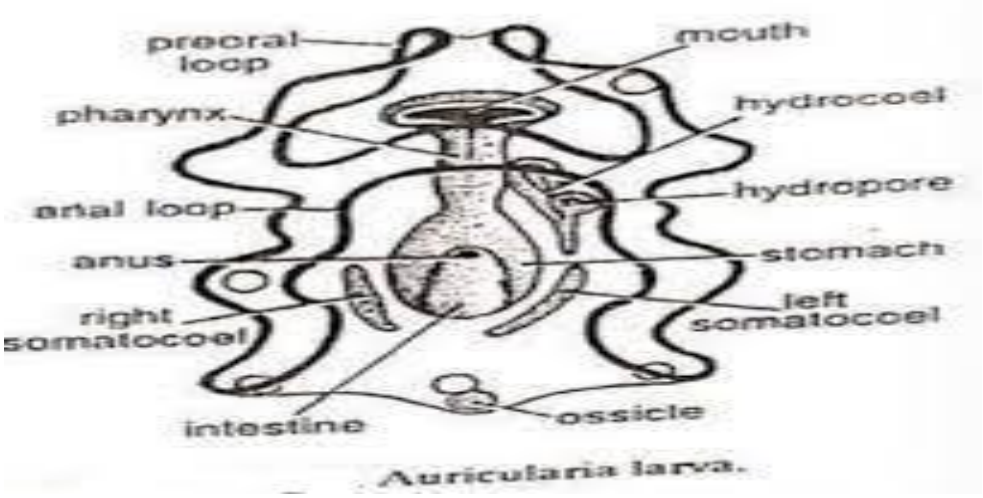


Fig. 27.11. Echinopluteus larva

5) Auricularia larva –

Auricularia larva has striking resemblance with bipinnaria of Asteroidea as it also possesses 4 or 5 pairs of ciliated arms for swimming and has a welldeveloped mouth, gut and anus.



Auricularia larva.

6) Doliolaria larva –

Doliolaria larva is the next stage after auricularia.

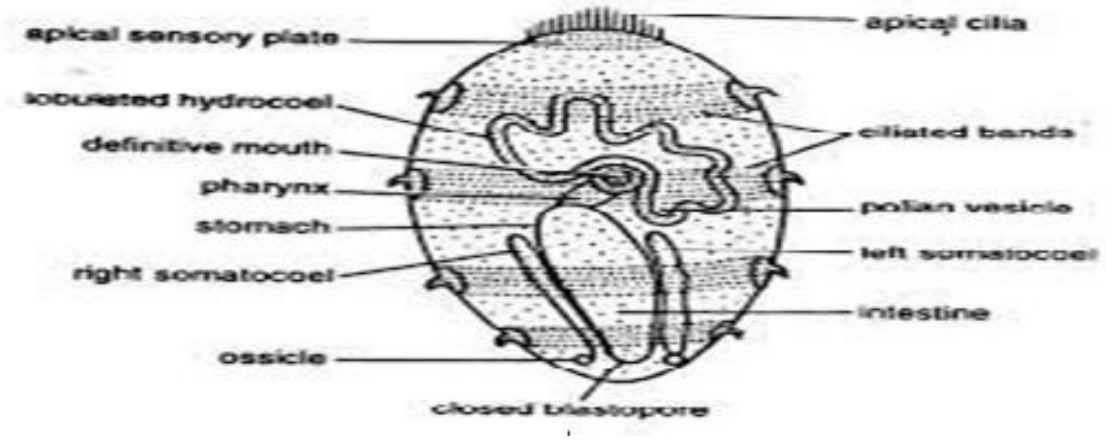
It has barrel like body with 5 ciliated bands surrounding it.

Mouth or vestibule in on the ventral side for feeding.

There is neural sensory plate on the anterior side for feeding.

There is neural sensory plate on the anterior side and an apical tuft of cilia for balancing while swimming.

Doliolaria transforms into adult but in some holothurians doliolaria stage may be absent.



Q.12 Discuss the water vascular system and its importance in Echinodermata.

Ans. Introduction: - The water vascular system is a modified part of coelom & consists of a system of sea water filled canals having certain corpuscles. It plays most vital role in the locomotion of the animals & comprises madreporite stone canal, ring canal, radial canal, Tiedman's body, lateral canals & tube feet.

(1) Madriporite :- The madreporite is a rounded calcareous plate occurring on the aboral surface of the central disc in inter-radial position. Its surface bears a number of radiating, narrow, straight or wavy grooves or furrows. Each furrow contains many minute pores at its bottom. Each pore leads into a very short, fine, tubular pore-canal. Which passes inward in the substance of the madreporite. There may be about 200 pores and pore-canal. The pore-canals unite to form the collecting canals. Which open into an ampulla beneath the madreporite.

(2) Stone Canal:-The ampulla opens into a "S" shaped stone canal. The stone canal extends downwards (orally) and opens into a ring canal, around the mouth. The walls of stone canal are supported by a series of calcareous ringd. The lumen of stone canal is lined by very tall flagellated cells. in embryonic stages and young Asterias, the stone canal remains a simple tube but in adult Asterias, lumen of stone canal possesses a prominent ridge with two spirally rolled lamellae.

(3) Ring Canal :- The Ring canal or water ring is located to the inner side of the peristomial ring of ossicles and directly above (aboral) to the hyponeural ring sinus. It is wide and pentagonal or five sided.

(4) Tiedmann's Bodies :- The ring canal gives out inter radially nine small, yellowish, irregular or rounded glandular bodies called racemose or Tiedmann's bodies from its inner margins. The Tiedmann's body rest upon the peristomial ring of ossicles. The actual function of tiedmann's bodies is still unknown, however they are supposed to be lymphatic glands to manufacture the amoebocytes of the water vascular system.

(5) PollianVesicles :- The ring canal gives off on its outer side in the inter radial position one, two or four little, pear shaped, thin walled contractile bladder or reservoirs with long necks called pollian vesicles. They are supposed to regulate pressure inside ambulacral system and to manufacture amoeboid cells of ambulacral system.

(6) Radial Canal :- From its outer surface the ring canal gives off a radial water canal into each arm that runs throughout the length of the arm and terminates as the lumen of terminal tentacle. In the arm the radial water canal runs immediately to the oral side of the ambulacral muscles.

(7) Lateral Canal :- In each arm, the radial canal gives out two series of short, narrow, transverse branches called lateral or podial canals. Each lateral canal is attached to the base of a tube foot and its provided with a valve to prevent backward flow of fluid into the radial canal.

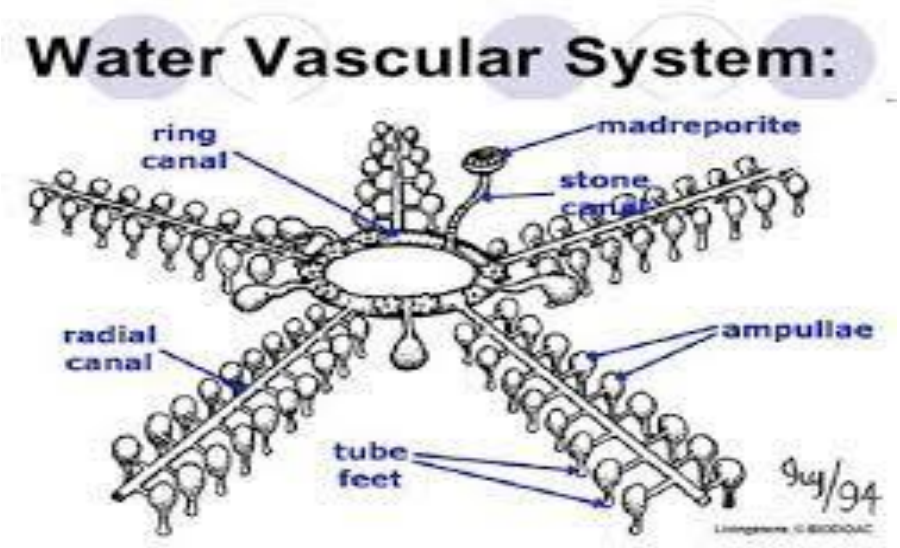
(8) Tube feet :- As already mentioned, there are four rows of tube feet in each ambulacral groove. A tube foot is a hollow. elastic, thin walled, closed cylinder or sac-like structure having an upper sac like ampulla, a middle tubular podium & a lower disc like sucker. The ampulla lies within the arm, projecting into the coelom above the ambulacral pore which is a gap between the adjacent ambulacralossicles for the passage of the podium. The tube feet are chief locomotory and respiratory organ of Asterias.

Function of Water Vascular System :- The water vascular system has three main functions. They are as follows- Fig : Function of water vascular system of Star fish

(1) Locomotion :- The water vascular system is used mainly for locomotion. The inner wall of the water vascular canals are provided with cilia. The beating of the cilia causes the seawater to enter through the madreporite. Finally, the seawater reaches the tube feet and their ampullae. The ampullaecontract ; the valves at the junction of the lateral canals and tube feet, prevent the flow of water into radial canals. The water is forced into the podia. The podia are elongated and protected out through the ambulacral groove. Then the suckers are applied to the substratum. The tube feet now contract & push the body forward. The water from the tube feet is pushed into the ampulla. Hence, the tube feet shorten. The suckers are released. Then the ampulla contracts & the whole process is repeated.

(2) Food Capture :- The tube feet are used to capture the prey. The suckers are used to open the shells of molluscas.

(3) Attachment :- The Starfish can be attached to the rocks by the tube feet.



Q.13 Explain metamerism in Annelida.

Ans. Metameric segmentation or metamerism is an architectural body plan in some animals in which the similar body segments and organ systems are serially repeated one after another. The similar body segments are called metameres or somites.
The animals which exhibit such features called metamerically segmented. Structurally each meta-mere or somite is constructed on the basis of some fundamental plan and usually possesses a part of almost all the body systems.
In all respects the segments forming an individual are identical in structure and the organs they contain or in other words, the individual is formed by rhythmic repetition of segments which are similar both externally and internally. This repetition is often disturbed by simplification, by coalescence of segments or by .differentiation between the segments.

Occurrence of Metamerism: Metamerism is first seen in annelids in animal kingdom. Each segment usually contains
appendages, muscles, nerves, blood vessels, excretory organs and a pair of coelomic sacs which are repeated in almost all segments. It is also seen in kinorhynchs, arthropods and most chordates.

1. Metamerism first observed in Annelida in the animal kingdom.
2. The most successful animals of animal kingdom like arthropoda and chordate will also show metameric segmentation.
3. In annelids the metameric segmentation is both external and internal. The body is divided into a number of segments which contain all body organs repeatedly but the alimentary canal is long and straight tube extending through all the segments.
4. In arthropods the segmentation is external.
5. In chordates the segmentation is internal.

Characteristic Features of Metamerism:
1. Metamerism is always confined to the intermediate (trunk) segments except the anterior acron (head) and a poste riorpygidium or telson.
2. Each metamere represents a mirror image of the other.
3. Segmental structures are interdepend ent on each other.
4. They are integrated into a single functional unit.
5. All the segments of body work in co ordination.

Types of Metamerism: The metamerism in different groups is divided into the following types:1.
True Metamerism:
The true metamerism is one in which the segmentation of the body develops by the segmentation of the mesoderm. It occurs in annelids, arthropods and in most chordates. The body of annelids consists of a number of segments and the number remains constant in a particular species except in certain cases of asexual reproduction. New segments are not added to the body after maturation.
That means after the embryonic stage all the segments become the same age. Moreover, the segmental structures are inter dependent and integrated so that the individuality of the body is preserved. New segments arise at the posterior end in front of the pygidium. Hence, newer segments occur at the posterior end and older segments remain just behind the head.

2. HomonomousMetamerism:
If the segments or somites of the animal are all alike, the' segmentation is called homonomous metamerism. It is seen in annelids. Each metamere contains segmental blood -vessels, nerves,

nephridia and coelomoducts. This is a primitive type of segmentation and is not found in any exist ing animal because a few anterior segments are specialised to form the head which is called cephalization.
A well-defined and well-organised head is lacking in annelids. However, formation of a 'head' issuggested in polychaetes by anteriorly placed structures and their association with parapodial cirri.
In some polychaetes transformation of one or two post-oral segmental parapodia into protostomial cirri has occurred. This transformation is accompanied by a shift of these post-oralsegments and their ganglia anterior to mouth (pre-oral), resulting some sort of a brain formation. Cephalization in true sense is absent in annelids.

3. Heteronomous Metamerism:
In arthropods and chordates the segments of the body are dissimilar in different body regions and restricted only to certain organs. This type of metamerism is called heteronomous metamerism.

4. External Metamerism:
In arthropods, the metamerism is external. Internally the segments are not marked by partitions.

5. Internal Metamerism:
In vertebrates there is internal metamer ism, seen in the embrayos and confined to the muscular, skeletal (vertebrae and ribs) and nervous system.

6. External and internal Metamerism:
In Annelids, the metamerism is clearly visible both externally and internally. Externally it ismarked by the constriction on the skin of the body and internally it is marked by the partitions(septa).

7. Complete Metamerism:
When the segmentation is seen practically in all systems, the metamerism is called completemetamerism. It is seen in annelids.

8. Incomplete Metamerism:
When the segmentation is not seen in all the organs, the metamerism is called incompletemetamerism. It is seen in arthropods and chordates.

9. Pseudo-metamerism or Strobilization:

In contrast to true metamerism, pseudo-metamerism or strobilization is seen in tapeworms(Platyhelminthes) where segmentation of the body takes place by the segmentation of theectoderm. The body consists of a number of segments or proglottids which varies in different individuals of the same species. New segments are added to the body throughout life. Theproglottids or segments differ in the degree of development. The segments or proglottids arefunctionally independent or self-con tained units and new segments are always formed and thereis no cooperation between the segments. The new segments are formed at the anterior end, justbehind the scolex.

Origin of Metamerism:
There are several conflicting views re garding the origin of metamerism

1. **Pseudo-metamerism Theory:** This theory postulates that the metamerism evolved sec ondarily as a result of repetition of bodyparts whose ancestor was acoelomate and un-segmented, and contained the various systems ororgans which had serially spread out along the entire length of the body (pseudo-segmentation).
   This is supported by the fact that Turbellarians contained testes, yolk glands, transverse connectives of two nerve cords which are serially repeated along the length of the body, andthese organs were separated by the development of septa producing metamerism. The metamericsegmentation was linked with the evolution of coelom.
   Distinguish between pseudo-metamerism and metamerism:
   Pseudo-metamerism:
   1. Segmentation of the body is related to the segmentation of the ectoderm.
   2. New segments are formed at the anterior part of the body (behind the scolex).
   3. Segments work as an independent unit.
   4. No co-ordination among the segments e.g., tapeworms (Platyhelminthes).
   Metamerism:
   1. Segmentation of the body is related to the segmentation of the mesoderm.
   2. New segments are formed at the posterior end of the body (in front of the anal segment).
   3. Segments work as different units.
   4. Segments work in co-ordination with all other segments e.g., Annelida, Arthropoda, Chordata.

2. Cyclomerism Theory: This theory was proposed by Sedgwick in 1884 and sup ported by Remane in 1950 and 1963.
This theory is the corollary of the enterocoelous theory of coelom origin and is associated withthe origin of metameric segmentation.
It is assumed that the origin of coelom took place from the gastric pouches of some ancestralanthozoan coelenterates. The gastric pouches are separated from the main gastric cavity andarranged in linear fashion. These pouches are transformed into gastric cavity and arranged inlinear fashion. These pouches are transformed into coelomic pouches in the protocoelomates.First four gastric pouches are developed in ancestral medusoid coelenterates. Further division oftwo pouches resulted into three pairs of coelomic cavities, viz., protocoel, mesocoel andmetacoel in the protocoelomates. Loss of protocoel (anterior pouch) and mesocoel (lateral two pouches) leads to the formation of un-segmented coelomates, such as molluscs andsipunculans.Later subdivision of metacoel (posterior pouch) produces segmented annelids.

3. Corn or Fission Theory: According to this theory, the metameric segmentation resulted due to incomplete separationfollow ing the repeated transverse divisions of a non-segmented ancestor or by asexual reproduction producing a chain of sub-individuals or zooids. These zooids are united end to end. Suchevents occur in scyphozoan strobilae and in platyhelminthes.
Remarks:
The chief objection of this theory is the sequence of zooid formation in platyhelminthes and scyphozoans is never serial with terminal fission. An other objection is that the reproduction byfission is usually confined to sessile animals where the ancestors were prob ably free-swimming.

4. Locomotion theory: R. B. Clark (1964) proposed the locomotion theory to explain the origin of metamerism.According to this theory, metamerism evolved in annelids as an adaptation to the peristaltic locomotion and for burrowing, and in chordates metamerism is associated with the strong undulatory, serpentine swimming. In annelids, peristaltic locomotion involves shortening andlengthening of body by circular and longitudinal muscles which act against each other. Ascoelom is filled with coelomic fluid which acts as hydro static skeleton to facilitate thelocomotion, but peristaltic movement is not possible until it is compartmented by the development of septa.

With the development of compartmented coelom the fluid pressure main confined to a particularregion of the body and it does not affect the whole body. The septa and metameric segmentationto gether allow the part of the body to contract and other parts in the longitudinal axis relax. Thisenables a strong peristaltic wave to propagate down the body. For burrowing the animals need ahard skeleton but they lack such structure and the coelomic fluid, and inter-segmental septa act as hydraulic skeleton.In chordates the metamerism evolved independently for locomotion. Metamerism allowed the
tail muscles to be arranged segmentally for the undulatory movement ofthe body.

Significance of Metamerism:
1. It helps in locomotion, not only in burrowing but in all other types of locomotion.
2. Metamerism offers division of labour

Q.14 Explain the character and classification of Protochorda?

Ans. The organisms belonging to the Protochordata are generally known as the lower chordates. They don't form a "proper" taxonomic group and are only classified as such for convenience purposes.

However, they do form a major group of Chordata. They are also known as Acraniata because they lack a true skull. They are divided into two subphyla- Urochordata, Cephalochordata.

Characteristics of Protochordata

They are generally found in marine water.

Their body is bilaterally symmetrical, triploblastic, and coelomated.

At a certain stage of their lives, their body develops a long, rod-like structure for support called the notochord.

They exhibit organ system level of organization.

E.g., Herdmania, Amphioxus.

Classifications of Protochordata

Urochordata or Tunicata

They are found in the marine environment.

They are sessile and filter-feeders.

They are also known as tunicates because their body is surrounded by a leathery sheath composed of tunicin (cellulose).

The notochord appears in the larval stage in the tail of the larva and disappears in the adult. This is known as retrogressive metamorphosis.

The neural tube in the larva is replaced by a dorsal ganglion in the adults.

Respiration occurs through gills.

They have an open circulatory system.

The excretory organs are absent.

They reproduce asexually by budding.

E.g., Herdmania, Selpa

Cephalochordata

They are marine and filter-feeders.

The notochords remain throughout life and extend up to the head region.

The nerve cord and the tail also remain throughout life.

Solenocytes are the excretory organs.

They respire through gills which open in the atrium.

The body wall comprises myotomes.

E.g., Amphioxus

Q.15 Describe the Retrogressive metamorphosis?

Ans. It is a biological process by which an animal physically develops after birth through cell growth and differentiation. The transformation of a maggot into an adult fly and of a tadpole into an adult frog are examples of metamorphosis.
'Retrogressive metamorphosis' means degenerative changes wherein an active larva transforms into a sedentary adult. For example, in Urochordata, the larva bears all advanced characters of Chordata but after metamorphosis, the adult loses its chordate characters. Thus, here the larva exhibits advanced characters and during metamorphosis, retrogression of characters occurs, such type of metamorphosis is called retrogressive metamorphosis. Let us consider an example of Herdmania, a Urochordate.
Changes during Metamorphosis in Herdmania (Urochordata) are:
-The notochord, nerve cord muscles, and tail will be reduced. All these structures help the larva to swim freely in the water. But they are not useful to adults.
-The alimentary canal becomes complicated. The pharynx enlarges in size. The number of gill slits will increase by divisions.
-The stomach, gonads, and intestine will grow.
-The nervous system is reduced.
-The atrial cavity enlarges into a sac-like structure.
-The eyespot and statocyst will completely disappear.

Note: Progressive metamorphosis is when an organism increases in complexity and develops more advanced characteristics over the course of time. Retrogressive metamorphosis is the opposite in which the larval stage has complex organs but disappears or reduced in the adult stage.

Q16. Describe the Character and Classification of Agnath?

Ans. GENERAL CHARACTERS:

1. Agnathaare earliest known vertebrates and are character-ized by the absence of jaws.

2. Teeth, paired appendages and exoskeleton are absent.

3. Skull has a membranous roof.itt

4. Single median nasal opening.

5. Vertebral column consists of a persistent notochord with a fibrous neural tube.

6.Presence of large number gill-slits, from 7-14 pairs.

7. Absence of conus in the heart. lying.

8. A persistent hypophysial sac.

9. One or two semicircular ducts in the ear.

10. Long kidneys and long archinephric ducts.

11. Genital ducts absent.

12. Pineal apparatus fairly well-developed.

13. Larval stage is microphagus and has an endostyle like protochordates.

Subphylum Agnatha is divided into two classes:

1. Ostracodermi

2. Cyclostomata.

Class 1.Ostracodermi

1. Fossil jawless Agnatha of fresh water.

2. They had fish-like bodies with heavy head armour.

3. They had heavy bony dermal plates in the skin.

4. Some of the forms had one pair of fins behind the head.

5. They had single nostril on the top of the head.

6. There was a slit-like mouth at the extreme front end of the head. It was used for scooping decaying matter from the floor of the lake.

7. The paired eyes were situated on the top of the head. Median pineal eye was also present.

8. The gill-slits were round and all have similar gill-pouches.

9. The endoskeleton was moderately ossified.

10. Two semi-circular canals were mostly present in the ear. Example: Cephalaspis.

Class 2.Cyclostomata

1. Body is long, rounded and eel-like.

2. Skin is soft, smooth and without exoskeleton.

3. Mouth is suctorial devoid of functional jaws.

4. Nostril is single and median.

5. Paired fins or lateral appendages are absent.

6. Skeleton is cartilaginous.

7. Notochord is persistent.

8. Heart is two chambered and aortic arches are many.

9. Single gonad without duct.

10. Development is direct or indirect.

Order 1.Petromyzontia

1. Dorsal fin well developed and branchial basket complete.

2. The naso-hypophysial sac terminates posteriorly in a blind sac, i.e., it does communicate with the mouth.

3. Mouth suctorial with rasping tongue.

4. Seven pairs of gill-slits.

5. The gills open into a respiratory tube below the oesophagus.

6. Development is indirect.

Example: Petromyzon.

Order 2.Myxinoidea

1. Dorsal fin absent.

2. Branchial basket is reduced.

3. The naso-hypophysial sac opens posteriorly in the mouth.

4. Mouth is terminal and surrounded by 6 small tentacles, 5. Gill-alits 6-14 pairs.

6. Development is direct.

Examples:

1. Myxine. 2. Bdellostoma.

Q.17 Explain the migration in Fishes?

Ans. Migration in fishes: In ecology, it is an animal behaviour of mass movement of animals from one place to another. The purposes for migration varies accordingly with the types of animals. Migratory behaviour of fish is a regular phenomenon. Their journey is purposed mainly for feeding and reproduction.

Types fish migration on the basis of needs:

1. Alimentary or Feeding migration: migration for search of feeding ground. It occur when food resources get exhausted.

2. Gametic or spwaning migration: it occur during breeding season in search for the suitable spawning ground.

3.Climatic or seasonal migration:migration in search for suitable climatic condition.

4. Osmo-regulatory migration: migration for water and electrolytes balance from sea to fresh water and vice-versa.

5. Juvenile migration: it is larval migration from spawning ground to the feeding habitats of their parent.

Movement of fishes during the migration:

1. Drifting movement: It is a passive movement of fish along with water currents

2. Dispersal movement: It is a random locomotory movement of fish from a uniform habitat to diverse direction

3. Swimming movement: It is an orientated movement of fish either toward or away from the source of stimulus

4. Denatant and Contranatant movement: It is an active swimming movement. Denatant movement is swimming with the water current while contrantant movement is swimming against water current Types of fish migration The migration of some fishes is a regular journey and is truly an innate animal behaviour.

Fish migration are classified into following types:

1. Diadromous migration: It is the migration of fish between sea and fresh water. As we know, most of the fishes are restricted to either fresh water or sea water. Changes in habitat may causes osmotic imbalance in those fishes. However some fishes regularly migrate between sea and fresh water and have perfect osmotic balance, they are the true migratory fish. This migration is of two types.

(i) Anadromous migration: It is the migration of marine fishes from sea to fresh water for spawning. Fishes spend most of their life living and feeding in sea. They only migrate during breeding season to the river for spawning ground.

Eg.Salmon, Hisla, Lamprey etc. Salmon migrate for breeding during winter from sea to river. While migrating, some physiological changes occurs: stops feeding during journey changes colour from silver to dull reddish brown gonads mature They select suitable spawning ground and make a saucer-like nest in which female lays eggs and male releases smelt over them. Juvenile larva hatched out from the egg known as Alevins. Alveins then transform into parr and metamorphosed into adult when return to the sea.

(ii) Catadronous migration:

It is the migration of fresh water fishes from river to sea during breeding season for spawning. Eg. Eel (Anguilla spp).

Both European eel (Anguilla anguilla or Anguilla vulgaris) and the American eel (Anguilla rostrata) migrate from the continental rivers to Sargasso Sea off Bermuda in south Atlantic for spawning, crossing Atlantic Ocean.

Before and during migration some physiological changes occur in their bodies:

Deposit large amount of fat in their bodies which serves as reserve food during the journey

Colour changes from yellow to metallic silvery grey.

Digestive tract shrinks and stops feeding

Eyes get enlarged and vision sharpens. Other sensory organs also become sensitive.

Skin serves respiratory organ.

Gonads get matured and enlarged.

The lay eggs in suitable spawning ground and are fertilized by males. After spawning they die. The larva hatch out and develop into young ell and finally return to river.

2. Potamodromous migration: It is fresh water migration of fresh from one habitat to another for feeding or spawning. Eg. Carps, catfish

3. Oceanodromous migration: It is the migration of fish within sea in search of suitable feeding and spawning ground. eg. Clupea, Thummus, Tuna

4. Latitudinal migration: it is the migration of fish from north to south and vice-versa. It is a climatic migration. Eg. Sward fish migrate north in spring and south in autumn.

5. Vertical migration: it is a daily migration of fish from deep to the surface and vice-versa for food, protection and spawning. Eg. Sward fish usually move vertically downward to greater depth for food.

6. Shoreward migration: it is the migration of fish from water to land. However it is a temporary migration. Eg. Eel migrate from one pond to another pond via moist meadow grass.

Significance of fish migration:

To find suitable feeding and spawning ground

For protection from predators

Survive from extreme climatic conditions

Increases genetic diversity

It is an adaptational characters for survival and existences.

Q.18 Explain the Parental Care in Amphibians?

Ans. In amphibians there are many devices for the protection of the eggs during the early stages of development and the youngs. In this way nature has practised economy in the number of eggs, which varies in direct proportion to the chances of destruction. Parental care is the care of the eggs or the youngs until they become able to protect themselves from the predators.

These devices fail under two heads:

(1) Protection by the parents by means of nests, nurseries, or shelters and

(2) Direct caring or nursing by parents.

The different modes of protection are given below in the three important orders of class Amphibia.

1. Protection by Means of Nests, Nurseries and Shelters:

A number of different species of frogs and toads construct nests or shelters of leaves or other materials in which the eggs are deposited and the youngs are developed.

A. In Enclosures in the Water (Mud Nests):

A large tree frog (Hylafaber) known in Brazil as the "Ferreiro". It protects its progeny by building a basin-shaped nest or nursery in shallow water on the border of the pond. The female scoops mud to a depth of 7.5 or 10 cm and with the mud, thus, removed a circular wall is built around the nest, which emerges above the surface of the water.

The inside wall is smoothened by the flattened webbed hands and the bottom is also levelled by belly and hands. The eggs and early larvae are, thus, protected from predators (insects and fishes, etc.) until they are able to defend themselves. Heavy rains later on destroy the wall and larvae go to the water.

B. In Holes Near Water (Foam Nests):

A still better mode of protecting the offspring during the early stages of development has been adopted by a Japanese tree frog Rhacophonisschlegelii. The male and female in embrace bury themselves in the damp earth on the edge of ditch or flooded rice field, and make a hole or chamber, a few centimetres above water level. The walls of this chamber are polished and during this process the gallery by which they enter into that chamber gets obliterated and then oviposition begins.

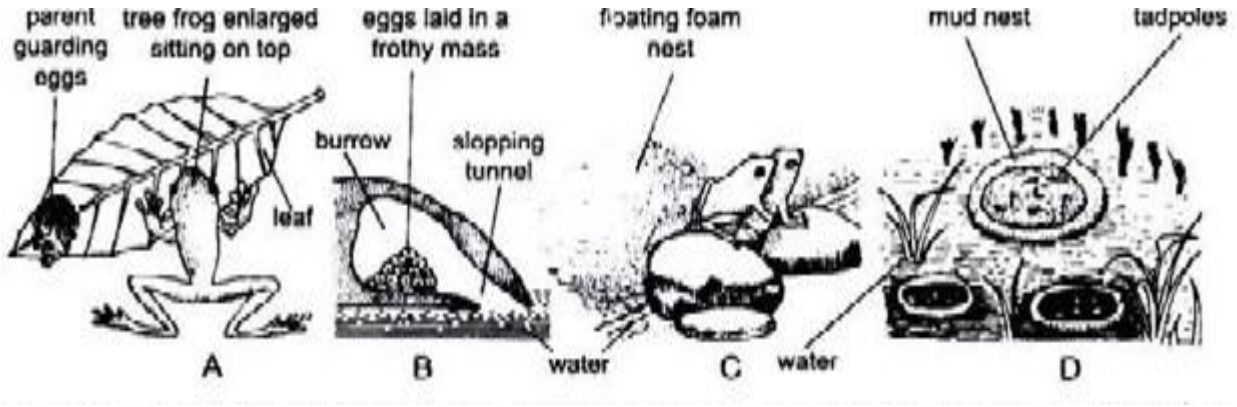
The female first produces a secretion from cloaca which is beaten into a froth. The eggs are deposited into the froth. Now the inactive male impregnates them, and then both of them separate and make an exit gallery towards the ditch. It is obliquely downwards towards the water, later on this is used by the larvae who come to the water to complete the development.

The bubbles collapse, the froth liquefies and this liquid acts as an efficient vehicle for transporting the larvae down the tunnel into the water. Similarly female of South American tree frog, Leptodactylusmystacinus stirs up a frothy mass of mucus which is filled up in holes near water and then eggs are laid in it. The tadpoles from these nests easily enter water. Some anuran females discharge huge mucus and beat it into a foam with their hindlegs and then eggs are laid. Later on hatching tadpoles drop into water from the foam.

C. In Nests on Trees (Tree Nests):

Some tree frogs like Phyllomedusa in South America, Rhacophorusmalabaricus in India, and Chiromantis in tropical Africa glues the eggs to foliage hanging over water, and after hatching, the tadpoles drop straight into the water. Hylaresinfictrix (tree frog) lines a shallow cavity of the tree by bees wax brought from the hives of stingless bees. Eggs are laid there when it is filled with rain water. Tadpoles develop here safely.

Autodax (Urodela) lay 10-20 eggs in a dry hole in ground or in a hole on a tree, up to 10 metres above the ground. Both parents remain in the hole to protect the eggs and larvae and also provide them moisture. Youngs remain within the hole for a considerable period with their parents.



D. In Transparent Gelatinuous Bags:

The eggs of Phtynixalusbiroi are large which are enclosed in sausage-shaped transparent common membranous bag secreted by the female and is left in the mountain streams. The whole development takes place within the eggs and little frogs go out in perfect condition. No gills have been observed and the large tail serves as a breathing organ of young ones. Salamandrellakeyserlingi (urodele) deposits its small eggs in a gelatinous bag which is attached to an aquatic plant below the water level.

E. On Trees or in Moss away from Water:

Several species of tropical American genus Hylodes lay their large eggs in damp places under stones or moss or plant leaves. The metamorphosis is hurried up within the egg. Due to plenty of yolk in the egg the entire development takes place within the egg and young frogs hop out as an air breather with a vestige of tail.

2. Direct Nursing by the Parent:

A. Tadpoles Transported from One Place to Another:

Small South American frogs Phyllobates and Dendrobates and tropical African frogs Arthroleptis and Pelobates lay their eggs on ground. The hatched tadpoles adhere by their sucker-like lips and flattened abdomen to the back of one of their parents and, thus, they are carried from one place to the other and

in this way they can even go from one pool to the other and this is particularly when one pond is to dry up.

B. Eggs Protected by Male:

The eggs (17 in number) of Mantophrynerobusta are strung together by an elastic gelatinous envelope forming a clump over which the male sits for development. It may be outside water .The larvae have no gills, well developed legs, large tail which is vascular and respiratory.

C. Eggs Carried by the Parents:

In Obstetric toad (Alytesobstetricans) of Europe, the male winds the strings of eggs-formed by adhesion of their gelatinuous investment-round his body and hindlegs. Here they are retained until the tadpoles are ready to be hatched.

Female Rhacophorusreticulatus (Sri Lankan tree frog) carries the eggs glued to her belly.

In Desmognathusfusca (urodele) the eggs are laid in the form of rosary-like strings. The string is bound round the body and the female nourishes them at a comparatively dry spot.

D. Eggs in Back Pouches:

(i) Exposed:

In a Brazilian tree-frog, Hylagoeldii, the female carries the eggs on the back within an incipient brood pouch in which the eggs remain exposed. How they reached there is not known but probably male does it. In Nototrema also the eggs are placed over the back in a single large brood pouch covered by the skin and opened posteriorly in front of cloacal aperture.

(ii) In Cell-Like Pouches:

In Pipaamericana (Surinam toad) the eggs are carried on the back of the mother. In breeding season the back skin of female becomes thick, vascular, soft and gelatinous. The male places and spaces the eggs. Each egg sinks into a small pouch, over which develops an operculum, which comes from a remnant of the egg envelope, reinforced by integumental secretions.

Thus, the young develop moist and safe in maternal tissue. Between the invaginated pits arises a rich vascularisation. In each larva there develops a broad and vascular tail. It is suspected that metabolic exchanges take place between maternal and embryonic tissues in the manner of a primitive placenta. The larva does not develop gills, and has been reported to be born as a tadpole about eighty days after egg-deposition.

E. In the Mouth or Gular Pouch:

(i) By the Male:

In Rhinodermadarwini, small South American frog, the eggs (few and large) are transferred by the male to the relatively immense vocal sacs that extend over its ventral surface. There the eggs develop. In Arthroleptis, male frog keeps the larvae in his mouth.

(ii) By the Female:

The female of a West African tree-frog, Hylambatesbreviceps, carries the eggs in her mouth. Female Rheobatrachussilus (Australian frog) keeps her eggs in her stomach. The tadpoles are expelled through mouth after metamorphosis.

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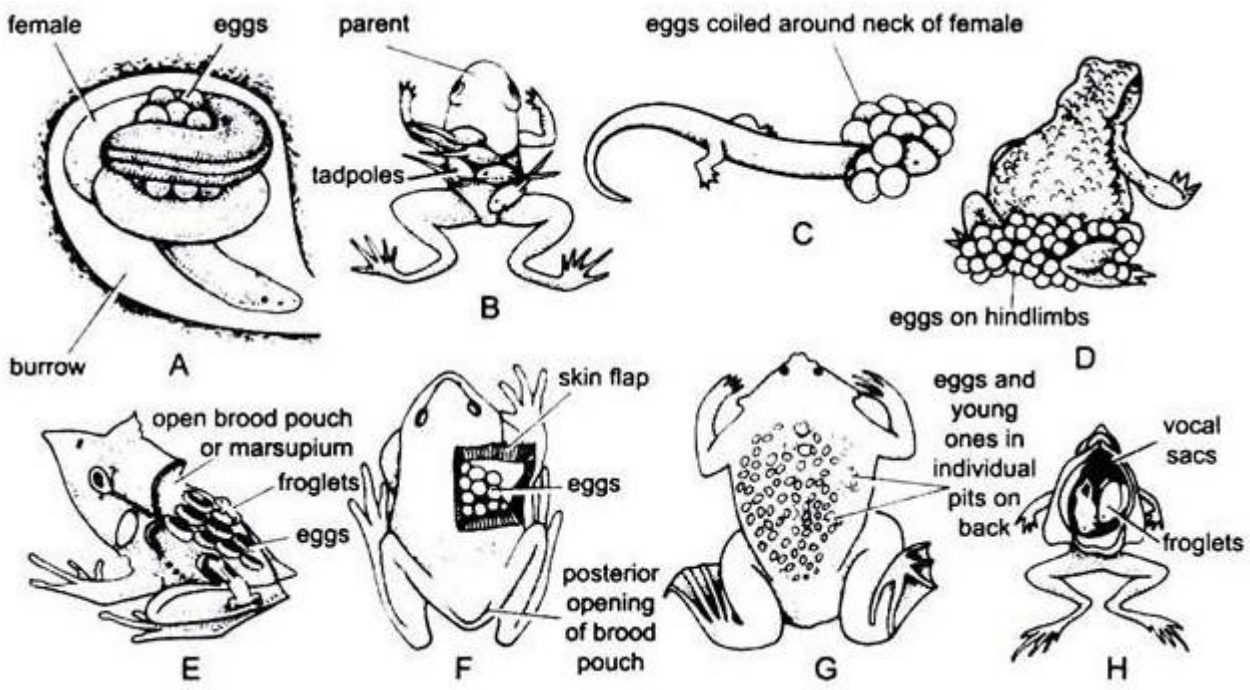

F. Coiling Around Eggs:

In Plethodon (urodele) the eggs are laid in small packages of about five beneath the stones or in the hollow of rotten log, and the mother coils round them. In Megalobatrachusmaximus (urodele) the male coils round the eggs.

Female Amphiuma (urodele) also coils round the eggs laid in burrows in damp soil.

CoeciliansIchthyophis and Hypogeophis are oviparous, lay eggs in burrows in damp soil and coil round them until they hatch.

G. Viviparous or Viviparity:

Two small East African toads, Pseudophryne vivipara and Nectophrynetornieri, are known to be viviparous, but no observations have yet been made on them beyond the fact that larvae are found in the uteri. Caecilians like Typhlonectes, Geotrypetes, Schistometopum, Chthonerpeton, Gymnopis are ovoviviparous.