Chapter 2

Animal Classification

Taxonomy (*Taxis*- arrangement, *normos*-law) - it is the branch of biology which deals- with identification, nomenclature and classification of different kinds of organism all over the world Binomial Nomenclature: It is the way of naming living thing on the basis of two Latin words genus (genetic name) and species (specific name) is called binomial nomenclature. eg. Man is common name. Its genetic name is Homo and specific name is Sapiens.

Important characteristic in classification of animals

A. Cellularity

(a) Unicellular - The organism is made up of only one cell as unicellular or a cellular eg. protozoa, (like amoeba).

(b) Multicellular - The organism is made up of many cells. eg. Man.

B. Body layer

a. Diploblastic - Those animals which are derived from two germ layers: outer-ectoderm and inner-endoderm. E.g. coelenterates, sponges (poriferas).

b. Triploblastic - Those animals which are derived from three germ layers: outer-ectoderm, middle-mesoderm and inner endoderm. g. All other animals except protozoans, poriferaus and coelenterates.

C. Body organization

a. Cellular grade organization- All individuals are made up of cells. Each cell performs all vital activities independently. Tissue is absent. eg. Porifers (sycon, Leucosolenia).

b. Cell aggregate body plan- The animals are basically a cluster of cells with limited division of labor. This body plan lacks any tissues or organs and they lack any nervous coordination between them. eg. sponges.

c. Blind Sac form- These animals have mouth but no anus. Ingestion and egestion through the same openings eg.coelenterata, flatworms.

d. Tube within tube body plan- It is the most complex body plan, tissue organization forms organ, organ and organ forms system.

Has two openings (mouth and anus) and the digestive tube is in the form of the tube running through the center of the body. eg. Higher invertebrates (Annelida, Arthropoda,Mollusca and Echinodermata) and Mammals.

D. Symmetry

a. **Assymemetry** - Body plan is in such a body plan the animal cannot be cut into two equal halves. eg. Amoeba.

b. **Radial or biradial symmetry** - These animals have such a body plan that when the animal is cut from any side passing through the centre body can be divided into two exactly equal and similar halves. eg. Coelenterata and Echinodermata.

c. **Bilaterally Symmetrical** - In all higher animals the body can be divided into two similar image of each other. Eg. Platyhelminthes to upto Chordata except Echinodermata.

Hierarchic system of classification K D C O F G

1. Kingdom
2. Phylum (Animal) / Division (Plant)
3. Class
4. Order
5. Family
6. Genus
7. Species.

- Interbreeding is possible only among the same species.

E. Body Surfaces

a. **Anterior end** - The part of the body which moves forward (and usually contains the mouth) is called the anterior end.

b. **Posterior end -** The end of the body which lies opposite to the anterior end.

c. **Dorsal surface -** The upper surface is the dorsal surface, which faces towards the sky in natural posture.

d. **Ventral surface -** The under faces towards the ground in natural pouse.

e. **Depressed body -** dorsoventrally pressed or flattered.

f. **Laterally compressed -** Flattened laterally.

F. Habitat

The place where an organism lives successfully is called habitat.

a. **Aquatic -** These organisms live only in water.

- **Freshwater** Species live in the water other than sea or ocean such as ponds, rivers, lakes etc.
- **Marine water** Species live in sea or ocean water. The organisms which live in the sea water are called Marines.

b. **Amphibious** - Those animals which can live both on the land and in water. For eg. Frog, toad.

c. **Terrestrial -** These animals can live on land. eg. man, lizard.

d. **Aerial Animal** which can live in air eg. Birds, Bats,Insects.

Aerial animals are also called volant or flying animal.

e. **Arboreal animal/Scansorial animal-** These are the animals which live on the tree and hold the branches of tree. eg. Monkey.

f. **Fossorial or digging Adaptation -** These animals mostly live underground in holes and burrows. eg. earthworm.

g. **Saltoterial -** Animal adapted for jumping. eg. Kangaroo

h. **Cursorial -** Animals which can run fast. eg. Deer.

i. **Phytophagus (Phyto-plant, Phagus-eating)** - These are the plant-eating animals. eg. cow, goat, Rabbit.

j. **Haematophagus/Sanguivorous -** Feeding on blood. Eg leech.

Coprophagous animals- Animal feeding on its own excreta. Eg. Rabbit

Solitary - Those animals which live alone or individually. Eg Man.

Colonial - Those animals which live in group. eg Bees, ants.

Sedentary - These are fixed animals which attach themselves to some substratum eg. Sycon, obelia.

Pelagic animals - Those animals which live on the surface of sea water.

Benthic - These are marine animals which live on the bottom of sea water.

Abyssal -. These animals are found in the deep mid-water of the sea where light penetration is low.

Lentic - Organisms (funna) inhibiting in standing water bodies. eg. lake, ponds, pools.

Lotic - The animals found in running water or rivers. eg. reptiles and fish.

G. Body temperature

- **Cold Blooded (poikilothermic) -** Those animals whose body temperature is variable according to environment. Eg. Reptiles, fish.
- **Warm blooded (Homeothermic) -** Those animals whose body temperature is not variable according to the environment. eg. Bird, Mammals.

H. Coelom or body cavity

- Coelom is the cavity between the body wall and gut (alimentary canal).
- Coelom is the true body cavity lined by mesoderm.

I. **Acoelomate** - Coelom is not found in body cavity eg. porifera, coelenterata.

II. **Pseudocoelomate** - It is the cavity
   - Which is filled with muscles.
   - It is the false coelomic cavity bounded on the outer side by ectodermal cells. Eg. Aschelminthes like Ascaris (Roundworm).

III. **True coelom**- it is the cavity between body wall and gut wall .
   - It is found in **Annelida and higher animals.**

Two types

Schizocoel - it is the coelom formed by splitting of mesodermal layers, e.g. Annelida, Arthopoda,Mollusks and higher chordates.

Enterocoel- it is the coelom formed by the fusion of archenteron, e.g. echinodermata

IV. **Haemocoelom** - it is the cavity filled with blood. Eg. Arthropods .

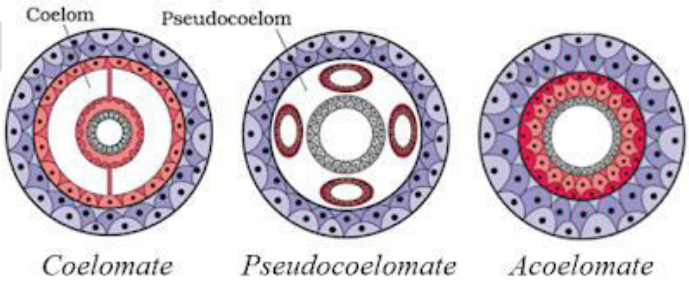


Figure: Different types of coelom in animals

Different types of coelom in animals

1. **Locomotion**

S.N	Locomotary Organ	Animals
1	Pseudopodia	Amoeba Entamoeba
2	Flagella	Euglena Trypanosoma
3	Cilia	Paramecium
4	Setae	Earthworm
5	Parapodia	Neris
6	Muscular Foot	Mollusca
7	Tube Feet	Starfish (Echinodermata)
8	Fins	Fishes
9	Limbs	Vertebrates (Amohibia to mammalia group)

J. Reproduction

(a) Asexual reproduction - It is a type of reproduction in which sexes are not involved. It takes place by binary fission, multiple fission, budding and gemmule formation etc.

- **Binary fission** - It is a method of a sexual reproduction in which a single parent divided to form two daughter individuals. eg. Paramecium divided by transverse Binary fission
- **Multiple fission** - Single parents divide multiple times to form many daughter individuals.
- Eg. Plasmodium (Malarial parasite) divides by this division.
- **Regeneration** - It is a process in which an animal is cut into many parts and each part is able to grow and develop fully. eg. Hydra.

(b) Sexual reproduction - It is a type of reproduction in which male and female gametes fuse to form **zygote.**

Monoecious or Hermaphrodite or Bisexual = An individual of a species having both male and female reproductive organs. Eg. Pheretima, Taenia.

Unisexual or Dioecious - When male reproductive organs are found in separate individual, the situation is called Dioecious. eg.Man.

Oviparous - Animals which lay eggs. eg. Fishes, amphibians, reptiles, birds.

Viviparous - Animals which give birth to young ones. eg. Man

Ovo-vivparous- Animals which give birth to very immature births. eg. Kangaroo.

Protandry - It is the term used for the organism in which male reproductive organ (testis) matures earlier than the ovary. eg.Earthworm.

Protogyny - It is the term used for the organism in which female reproductive organs (ovary) mature earlier than testis. eg. Human beings.

K. Excretion

It is the process of removal of unwanted substances from the body. The excretory organs in various organisms are:

S.N.	Organ	Example
1.	Contractile Vacuole	Protozoans
2.	Flame Cells	Helminthes
3.	Nephridia	Annelida
4.	Malpighian Tubules	Arthropods
5.	Kidney	Vertebrates

L. Circulation

Two types

a. **Open circulation** - It is the type of circulation in which blood remains in large open sinuses. Blood vessels are absent. eg. Arthropods.

b. **Close circulation** - It is the type of circulation in which blood flows through closed blood vessels. eg. Annelids and vertebrates.

M. Respiration

Respiratory organs of various organisms are

S.N.	Organ	Animal
1	Outer surface / general body	Paramecium, Amoeba
2	Gills	Aquatic Animals eg: fishes
3	Trachea	Terrestrial animals eg: insects
4	Book lungs	Arthropods eg scorpion
5	Lungs	Frogs, lizards, man

Metamorphosis

The larva of an animal undergoes certain changes to become an adult. This process is called metamorphosis.

- **Direct development** - It is the type of development in which an egg changes into adult form without a larval stage.
- **Indirect development** - It is the type of development in which an egg changes into larva and then into adults.

Animal Kingdom

Animal kingdom is further subdivided into

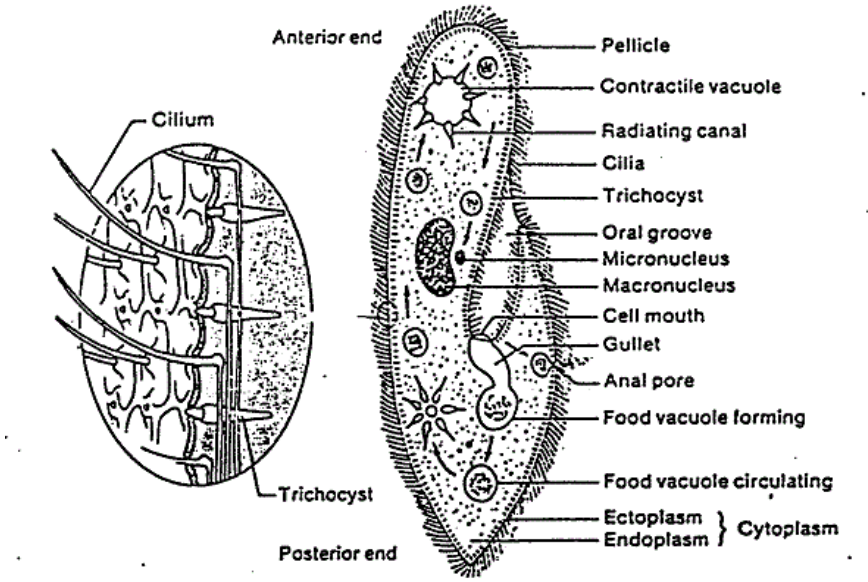
(a) Invertebrates

(b) Vertebrates

Invertebrates

- Invertebrates do not have backbones or vertebral columns and they are less developed animals.
- They may be diploblastic or triploblastic.

  They are subdivided into a phyla. these are protozoa porifera coelenterate , platyhelminthes, Nemahelminthes,(Aschelminthes) Annelida ,mollusca , arthopoda and



echinodermata .

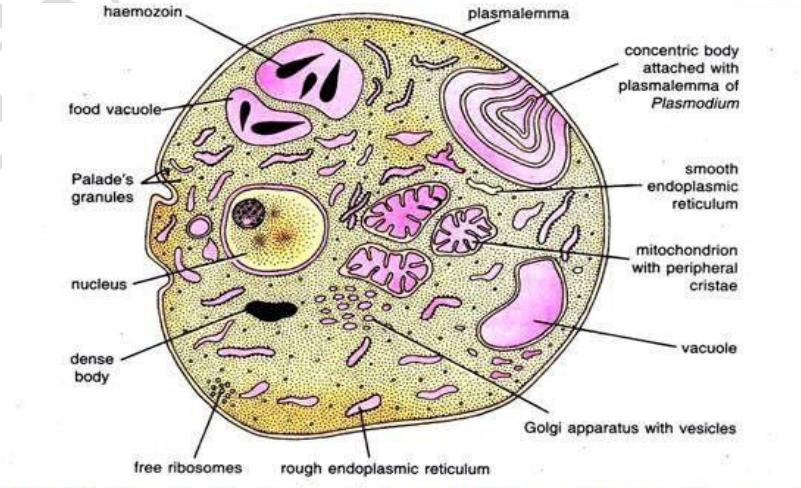


Fig: Structure of paramecium.

Fig: Trophozoite of plasmodium

It is the phylum of first primitive unicellular, animals and they where first observed by **Dutch naturalist Anton Van Leewenhoek"**

- They are simple primitive and microscopic animals.
- They are unicellular or acellular animals. a single celled body performs all life activities. places or parasites.
- They may be free living found in fresh and salty water and damp
- They may have pseudopodia, flagella or cilia as locomotory organelles.
- Locomotory organs such as pseudopodia (amoeba), cilia (paramecium) and flagella (Euglena). But plasmodium does not have any locomotory organs.
- Their nutrition is holozoic, holophytic or saprozoic but digestion is always intracellular.

Examples: Amoeba, Entamoeba, Euglena, Trypanosoma, Giardia, Plasmodium, Paramecium.

Entamoeba histolytica causes dysentery.

- Paramecium is often called Slipper animalcule because of its slipper-like structure.
- Trypanosoma causes sleeping sickness.
- Giardiasis is caused by Giardia.
- Kala-azar is caused by leishmania donovani but it is transferred by Sandfly.
- Malaria is caused by the bite of infected female anopheles mosquitoes.
- Plasmodium causes malaria diseases so it is called malarial parasite.
- Quinine, a drug used against malarial parasites, is obtained from the bark of cinchona.
- Different types of taxes in Amoeba:- Thermotaxis (response to temperature), Phototaxis (response. to light), Thigmotaxis (response to touch), Rheotaxis (response to water current), **Galvanotaxis** (response to electric current), Geotaxis (gravity).

Phylum: Porifera

- Term porifera was coined by Robert Grant. Study of poriferans is called parazoology.
- They are pore bearing animals and are generally called sponges.
- They are first Metazoa which slow cellular grade of organization that lack tissues and organs.

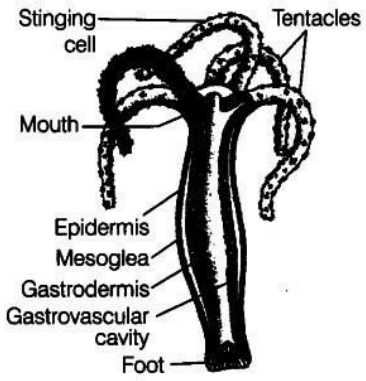
- They are fixed aquatic and diploblastic animals. Mostly asymmetrical and few are radially symmetrical
- Body wall is perforated by numerous small pores called. Ostia through which water current enters the body. One or more large exits are present called osculum.
- Multicellular organisms with cellular grade.
- Nutrition is holozoic with intracellular digestion.
- Respiration and excretion occurs through the general body surface. Asexual reproduction occurs by budding and gemmules formation but sexual reproduction is absent.
- Nervous system and sex organ are absent. • Water canal system is well developed,
- Body shape may be vase-like cylindrical, tubular or cushion like. eg. Sycon, Euptectells, Euspongia, Spongilla.

Poriferans are pore bearing animals.

- Spongilla-freshwater sponge
- Euspongia Batching sponge Euplectella (venus flower basket) is often used as a costly marriage gift in Japan, which means "till death we do not apart").
- Hyalonema (Glass rope sponge)
- Sycon (Urn sponge or crown sponge)
- They are multicellular animals with tissue grade of body organization.
- They are diploblastic animals i.e. the body wall consists of an outer layer ectoderm (epidermis) and inner layer endoderm (gastrodermis). These layers are separated by a non cellular gelatinous layer, the mesoglea.
- They are a coelomate i.e. without true coelom.
- They are sedentary or free swimming: solitary or colonial.
- They show polymorphism i.e. they show two types of individuals in their life i.e. the polyps and the medusae polyps are sessile concerned with feeding protection and asexual reproduction and the medusae are free swimming and concerned with sexual reproduction.
- Mouth is surrounded by tentacles arranged in one or more whorls. They help in food capture, ingestion and defense.
- Individuals are radially or radially symmetrical with a central coelenteron or gastrovascular cavity. Communicating with the exterior by the mouth.

- Reproduction is both asexual and sexual. Asexual means by budding and sexual by means of sperms and ova.
- Coclom respiratory excretory and circulatory system are absent. Digestion is intracellular as well as extracellular.
- They show alternation of generation Asexual sessile polyp generation alterate with free swimming medusa generation eg. Hydra, obelia, Aurelia, coral, jellyfish, sea anemone (metridium).

Coelenterata are coral bearing groups.



Hydra

- They are flatworms, their body is dorsoventrally flattened and bilaterally symmetrical.
- Triploblastic. Acoelomate (coelom is absent) Organ grade of body organization.

- They lack skeletal, circulatory and respiratory systems. They may or may not have an alimentary canal. If present the alimentary canal is incomplete because it lacks anus.
- They are hermaphrodite and possess one or more sets of male and female reproductive organs, eg, liver fluke, planaria, Taenia.

Sheep liver fluke - Fasciola hepatica

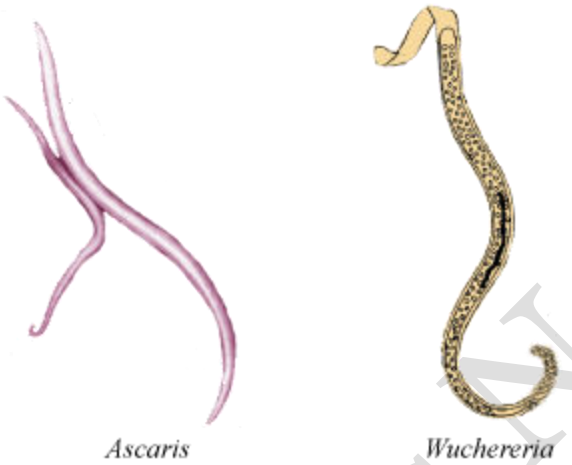
Human liver fluke-Clonorchis sinensis.

Blood fluke - Schistosoma haematobium

Lung fluke-Paragonimus westermani

- **Taenia solium -** Pork tapeworm
- **Taenia saginata** - Beef tapeworm

- **Echinococcus granulosus -** Dog tapeworm
- **Diphyllobothrium -** Fish tapeworm
- **Hymanolapsis nana** - Dwarf tapeworm .
- **Cysticercosis** is the disease caused by **pork tapeworm.**



Ascaris *Wuchereria*

Phylum: Aschelminthes/ Nemathelminthes

- **Askos**-mean cavity and **Helminths** meaning worms.
- They are often called Roundworms.
- Presence of false coelom i.e. Pseudocoelomate.
- They are mostly aquatic and may be free living or parasitic.
- Body is unsegmented, bilaterally cylindrical, symmetrical, flat.
- They are triploblastic and their body is covered with cuticles.
- No district head but a complete alimentary canal is present.
- No circulatory and respiratory system.
- They are Dioecious ie male and female sexes develop on separate individuals.
- Fertilization is internal.
- Excretory system is well developed Le. Renette cell/ H-shaped (incomplete ladder like) cells.

  eg. Ascaris, Wuchereria bancrofti.

Wuchereria bancrofti (Microfilarial worm) causes filariasis.

- Ascaris lumbricoides (Roundworm) causes Ascariasis.
- Ancyclostoma duodanale (hookworm) causes Ancylostomiasis.
- Hookworm infestation is the most common cause of iron deficiency anemia in Nepal.
- Enterobius vermicularis (pinworm)
- Trichuris trichiura (whipworm), Rotifera (wheel animalcule). Loa Loa (eye worm)
- Term Annelida was coined by lamarck.
- Mostly aquatic, some are terrestrial.
- Triploblastic, bilaterally symmetrical and metamerically segmented.
- They are truly coelomate animals.
- Circulatory system consists of a closed type.
- Excretory system consists of Nephridia.
- Locomotory organ is mostly setae.
- They are hermaphrodite or dioecious,
- They have a well-developed alimentary canal with both mouth and anus.
- Respiration takes place through the general body surface Nervous system consists of cerebral ganglia and double ventral nerve cord. eg. Earthworm (pheretima posthuma), Neris (sandworm) leech, Hirudinea (cattle feech), sea mouse (Aphrodite)

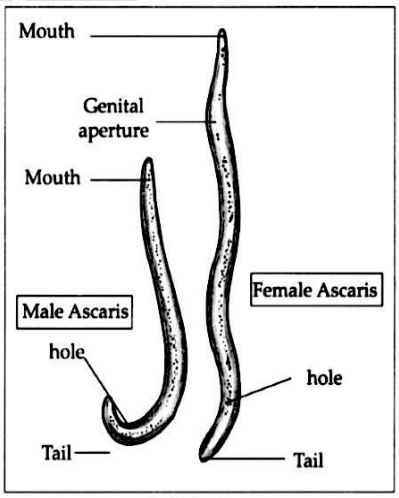


Fig.6.15. Ascaris

Classification:
Kingdom : Animalia
Sub kingdom : Non-chordata
Phylum : Aschelminthes

(Greek Arthos-jointed, podos-foot)

- Arthropoda includes animals with jointed legs/jointed appendages
- It is the largest phylum of the animal kingdom.
- They are triploblastic and bilaterally symmetrical and metamerically segmented.
- Their body is covered with a thick chitinous cuticle forming an exoskeleton.
- They have jointed appendages which are modified to different structures to perform different functions.
- The chitinous exoskeleton shed out at an interval which is called molting or ecdysis.
- Body is often divided into the head, thorax and abdomen. Head and thorax fuse in some forms which is called cephalothorax.
- Coelom is extensively replaced by haemocoel.
- Digestive system is complete and the circulatory system is open type.
- Respiratory organs may be general body surface, gills, Book lungs and Trachea.
- They are provided with compound eyes.
- Excretion through Malpighian tubules. Phylum arthropoda is further divided into 4 classes on the basis of jointed appendages.

Class 1: Crustacea

- Mostly marine, few are fresh water forms.
- Body is covered by an exoskeleton of chitinous cuticles.
- Body is divided into cephalothorax and abdomen.
- The head bears five pairs of appendages (two pairs of antennae. one pair of mandibles and two pairs of maxillae) and a pair of compound eyes.
- Respiration takes place by general body surface and gills. Eg. prown, crab, lobster.

Fig: Cancer

Class 2: Myriapoda

- These are terrestrial Arthopods.
- Body is worm like divided into head and numerous segments, each bearing one or two pairs of legs.
- Sexes are separate, respiratory organs are Trachea.
- Head consists of a pair of Antennae. eg. Scolopendra (centipede) julus (Millipede) etc.

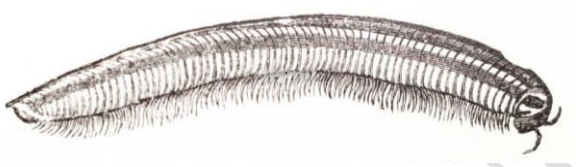


Fig: Julus

Class 3: Insects

- These are terrestrial but some are aquatic also.
- Body is divided into the head thorax and abdomen.
- The thorax has two pairs of wings and three pairs of walking legs.
- Excretion through Malpighian tubules. Eg. Mosquitoes, silkworms, cockroaches, Honey bees etc.

Fig: Musca

Class 4: Archhida

- They are mostly terrestrial while some are aquatic.
- They have no antennae and mandibles.
- Body is divided into cephalothorax and abdomen.
- Excretory organs are Malpighian tubules or coxal glands or both e.g. spider, scorpion, king crab, tick and Mites.

Fig: Aranea (Spider)

Phylum: Mollusca

- They are mostly aquatic, living in the sea and in fresh water.
- They are triploblastic, coelomate and bilaterally symmetrical.
- Body consists of head, foot mantle and visceral mass.
- Their body is covered by a calcareous shell which protects soft internal organs. The shell is secreted by a layer of epidermal tissue called the Mantle.
- Circulatory system is closed.
- Head is distinct, provided with eyes, tentacles and other sense organs.
- Haemocyanin, a copper containing pigment, is present as respiratory pigment. Excretion through metanephridia.
- The male and female molluscs are separate and the fertilization is either external or internal. eg. Octopus. unio, slug, oyster, snail (pila).

Fig: Snail

Mollusca are perl secreting groups.

- Octopus (Devil fish), sepia (cuttlefish).

Phylum: Echinodermata (Echinos-spine, derma-skin).

- Triploblastic radially symmetrical and coelomate animals.
- They have a water vascular system which includes tube-feet or for locomotion. They also bear Madreporite. Body is unsegmented. They are mostly star like globular, discoid or elongated
- Fertilization is external.
- They are spiny skinned animals with calcareous endoskeleton of plates and spines. Excretory organ is absent eg. star fish, sea urchin, Brittle star sea cucumber, sea lily.