

ECHINODERMATA

\* Echinodermata are group of marine spiny skinned.

\* penta-radially symmetrical. Water vascular system is present.

\* coelomate animal. Well developed endoskeleton form calcareous ossicles and spines.

Echinodermata

Sub-Phylum

sub-Phylum

pelmatazoa

Eutherozoa

- 1. Asteroidea
- 2. Ophiuroidea
- 3. Echinoidea
- 4. Holothuroidea
- 5. Ophiocystioida.

- 1. Crinoidea
- 2. Heterostelea
- 3. Cystidea
- 4. Blastoida
- 5. Edrioasteroidea

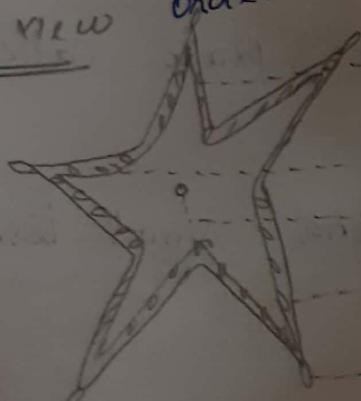
Starfish [Asterias rubens]

Phylum : Echinodermata

Class : Asteroidea

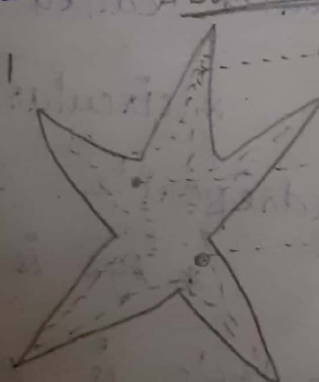
Order : Forcipulata

oral view



ambulacral groove  
foot tube  
mouth  
arm  
tentacle

aboral view



marginal spines  
anus  
madreporite  
pedicellariid

## General characters:

\* It is a marine, spiny skinned, radially symmetrical animal.

\* It lives in bottom of sea. It is cosmopolitan in distribution.

\* It is a carnivorous animal.

\* Star shaped body consists of central disc and five arms.

\* The lower surface of body is flat is called oral surface and upper surface is convex is called aboral surface.

\* The five arms represent radii.

It is covered immovable spines present.

\* The spines are supported ossicles, buried of the integument.

\* A number of minute dermal pores is present.

\* They are microscopic pincer-like bodies called pedicellaria.

\* circular, sieve-like plate called madreporite.

\* Eye is present and small terminal tentacle is present.

## Pedicellaria:

\* pedicellaria are pincer like structure in the skin of Echinodermata. They are modified spines not found in other animal group.

### Structure of typical pedicellaria:

\* It consists of stalk and three ossicle. [calcareous plate]. The stalk is flexible one end of stalk attached to the skin. The other end bears ossicle.

\* Two vertical ossicles is called jaws or valves. Jaws work like forceps.

\* pedicellaria is two types. They are:

1. pedunculate pedicellaria
2. sessile pedicellaria.

### 1. pedunculate:

\* It have a stalk, so it otherwise stalked pedicellaria. It has classified two types: 1. straight type 2. crossed type.

**STRAIGHT:** Two jaws remain straight on basal piece. Jaws work like forceps.

**CROSSED:** Basal parts and jaws are



curved and cross each other and work-like scissors.

## 2. sessile:

\* No stalk. It situated small depression of skin, that is called alveolus.

## Function of pedicellaria:

\* Help to clean surface of body.

\* organ of defence and offence.

\* They are used to capture the prey.

\* They protect ourself.

## Digestive system:

\* It form a alimentary canal and digestive gland.

### 1. Alimentary canal.

\* It has mouth, oesophagus, stomach, Intestine, Rectum and Anus.

\* stomach is divided into two pyloric and cardiac.

### 2. Digestive gland:

\* It is called pyloric caeca.

Five pairs is present. It form 4 types

of cells. They are:

1. ciliated cells
2. Enzymes producing cells
3. Mucous cells
4. storage cells

### feeding and digestion:

\* It is a carnivorous animal. The coelomic fluid distribute the digested food to the various part of the body.

### Respiration:

\* It is carried out by through dermal branchiae or papulae. They are present in aboral surface.  $O_2$  dissolved in seawater by the gills in exchange of  $O_2$ .

## Water vascular system:

\* It is otherwise called ambulacral system. It is a peculiar to Echinodermata. The essential parts of the systems are:

1. Madreporite

2. Stone canal

3. Ring canal

4. Radial canal

5. Tiedmann's bodies

6. Polian vesicles

7. Lateral canals

8. Tube feet

### Madreporite:

\* It is a hard rounded, calcareous plate on the aboral surface. Minute pores are present. Whole plate look like sieve.

### Stone canal:

\* S-shaped internally stone canal line with cilia. One end opens to outside through madreporite. The other end opens into a ring canal.

### Ring canal:

\* The ring like vessels around the mouth.

Tiedmann's bodies:

\* It present in inner surface.  
yellowish colour and rounded shape.

\* Glandular shape gives of  
ring canal called Tiedmann's bodies.



Starfish  
polar vesicle:

\* The ring canal bears outside of structure, that is called polar vesicle.

The polar vesicle serve as a store house for the fluid of water vascular system.

Radial canals:

\* Ring canal gives the five radial canals.

Lateral canals:

\* Each radial canal gives pair of lateral canals.

Tube feet:

\* The tube feet hollow, elastic and thin wall. It consists of upper sac-like ambula middle tubular podium and terminal disc-like sucker.

Functions:

- \* locomotion
- \* food capture
- \* attachment.

locomotion  $\Rightarrow$  starfish has creeping movement.



creeps on tube feet. It can move the speed of 15 cm per minute.

Food capture  $\rightarrow$  tube feet used capture the prey.

Attachment  $\rightarrow$  The starfish can be attached to the rock by the tube feet.

### Circulatory System:

\* It is open type. It form two systems.

1. perihæmal system
2. Haemal system.

### perihæmal System:

\* It derived from coelom. It lined with ciliated epithelium. It is formed

1. Aboral ring sinus
2. Genital sinus
3. oral ring sinus
4. Axial sinus
5. Radial perihæmal sinus
6. lateral channels
7. Marginal sinus
8. peribranchial sinus.

1. Aboral ring sinus  $\rightarrow$  Around the intestine in the central disc on the aboral side.
2. Genital sinus  $\rightarrow$  The pair of genital branches is present. Each branch ends in a sac, called genital sinus.
3. Oral ring sinus  $\rightarrow$  Around the mouth. There are inner and outer oral ring sinuses is present.
4. Axial sinus  $\rightarrow$  Axial sinus, axial gland, stone canal are together called axial complex.
5. Radial perihæmal  $\rightarrow$  It arises from outer oral ring sinus.
6. Lateral channels  $\Rightarrow$  It arises from radial perihæmal sinus.
7. Marginal sinuses  $\rightarrow$  Each arm two marginal sinuses is present.
8. Peribranchial sinuses  $\rightarrow$  It located terminal branchia.

### Haemal system;

- \* The haemal system form three types. They are:
1. oral haemal ring
  2. aboral haemal ring
  3. Axial ring.

1. Oral haemal ring  $\rightarrow$  It around the mouth, It give five radial sinuses present in *starfish*.
2. Aboral haemal ring  $\rightarrow$  It present inside the aboral.
3. Axial gland  $\rightarrow$  It elongated and fusiform, spongy in nature, it is formed the network of connective tissues, amoebocytes and covering coelomic epithelium. A pair of gastric haemal tuft arising from haemal sinuses.

Functions: Axial gland produce the sex cell. Maintain a flow of blood  $\&$  by contractile activity and distribute the food material.

### Excretion:

\* No specialized ~~sex~~ excretory organ in *starfish*. Excretion made of possible by amoebocytes found in coelomic fluid. The nitrogenous excretory product consists of mainly of ammonia.

### Nervous system:

\* Nervous system in *starfish*

closely connected with epidermis on skin.

It has four types:  
(Superficial)  
or

1. Ectoneural nervous system
2. Deep oral nervous system
3. Aboral or Colonic
4. Endodermal nervous system.

1. Ectoneural ;

\* It consists of central circum nerve oral ring, present in mouth. In this nervous system developed from ectoderm cells. It is called Ectoneural nervous system. It is sensory in function.

2. Deep oral ;

\* It developed from mesoderm cells around the mouth. Large nerve is present in the arm.

3. Aboral ;

\* It is form aboral anal nerve ring. It is a mesodermal origin.

4. Endodermal,

\* This system continuation of ectoneural system. It located in wall of



Alimentary canal. Sensory in function.

Sense organ

\* sense organ has two types:

1. Neuro sensory cells.
2. Eyes.

Neuro sensory cells:

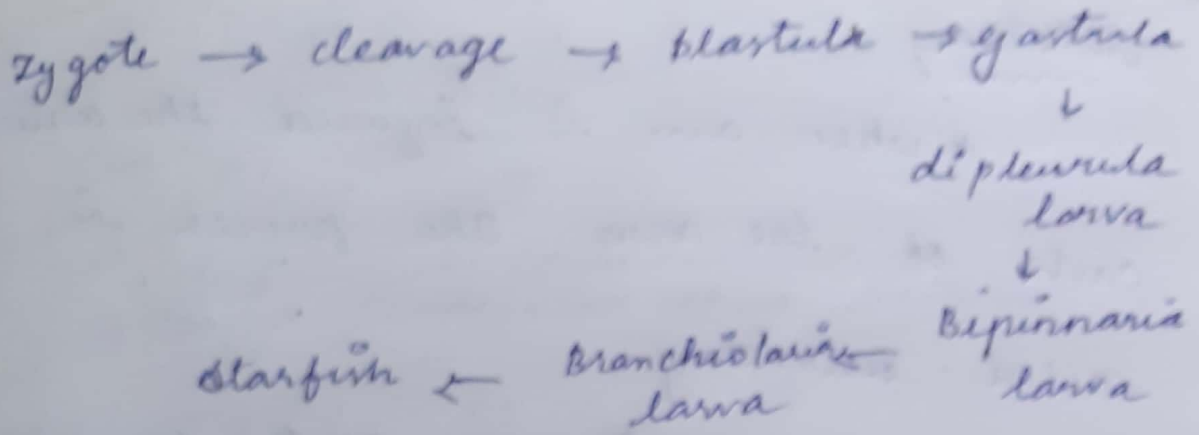
\* present in epidermis. They are abundant, tentacles, tube feet, pedicellariae they may be tactile or olfactory in function.

Eyes:

\* It have five eyes, situated in beneath the tentacles. Present lens and covered by cuticle. Pigment cells and Retinal cells is present.

Reproductive system;

\* Sexes are separate. Gonads is present. Gonads arise from gonoduct. Gonoduct open to a gonopore. Development is indirect. Fertilized egg is zygote.



\* Gastrula swimming in water to dipleurula larva. It is free swimming larva. Gut, mouth, oesophagus, stomach and intestine is developed. The dipleurula larva developed to bipinnaria larva.

\* It is a second larva of starfish. It is minute, microscopic, free swimming, bilaterally symmetrical.

\* Branchiolaria larva, it swims and feed like bipinnaria.

\* Metamorphosis it get attached to substratum of larva. Bilaterally symmetrical transferred into radial symmetrical.

### Regeneration:

\* The power of regeneration in starfish.

## Autotomy :

\* when arm is injured the animal casts of the arm. The process is called autotomy.

\* The casts of parts generally regenerate.

## Larval form of Echinodermata:

1. Dipleurula larva
2. Bipinnaria larva
3. Branchiolaria larva
4. Ophiopluteus larva
5. Echinopluteus larva
6. Auricularia larva
7. Doliolaria of Holothuroidea
8. Doliolaria of Crinoidea
9. Pentacrinoid.

\* The Echinoderm develops direct or indirect. Many types of larva occurs in echinoderms.

1, 2, & 3  $\Rightarrow$  refer starfish.

A) It is the larva of ophiuroidea. The larva has a pair of ~~Pre~~ oral arm and post oral arm. A pair of posterior dorsal arm and a pair of posterior lateral arm. The



larva appear like v-shaped.

5) It is the larva of echinoidea. The arms is supported by calcareous rod. The larva is provided a pre-oral, post oral arm and a pair, Antero lateral arm and antero dorsal arm.

6) It is the larva of Holothuroidea. Arms are supported calcareous rod.

7) It is a sea cucumber larva. The larva is also called pupa. Metamorphosis begins during free swimming life.

8) It is the larva of antedon. It is a free swimming larva and bilaterally symmetrical. Sensory tuft is present.

9) It is the second larva antedon. It look like sea lilly. It has stalk, tentacles and mouth is present, antedon is a free swimming larva.