Phylum Echinodermata

DR K SANTHOSH KUMAR M.Sc., B.Ed., Ph.D.
DEPARTMENT OF ZOOLOGY
POORNAPRAJNA COLLEGE, UDUPI

General Characters

Habitat:

- All existing echinoderms are marine,
- generally live at sea bottom

born - pelagic (free swimming in open water)

and

few are sessile (attached to the substratum)

Body Form: varies

unsegmented and body lacks head

The body is – star shaped,

spherical

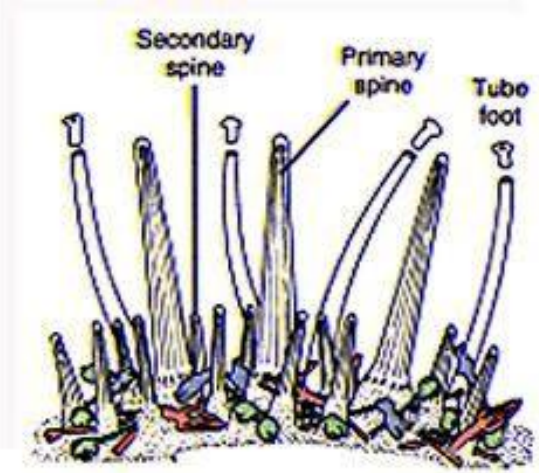
or

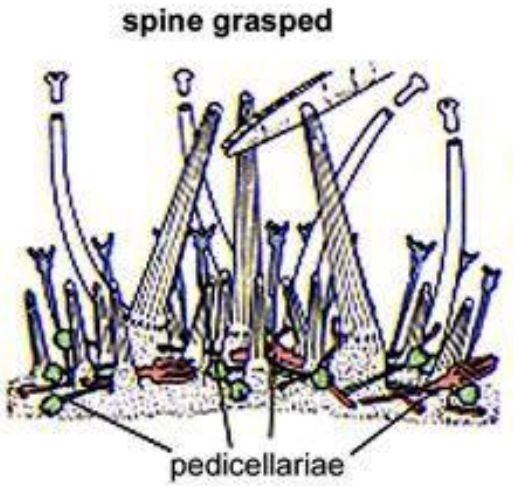
cylindrical

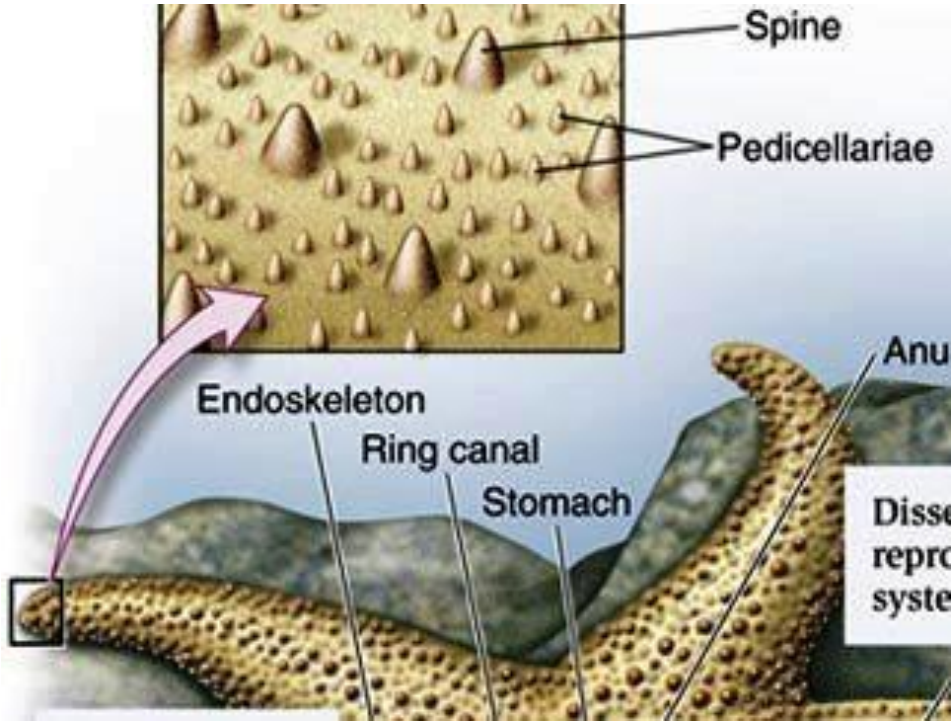
Spines and Pedicellariae

- spines
  - protective in function

- pedicellariae
  - keep the body surface clear of debris and minute organisms.







Symmetry:

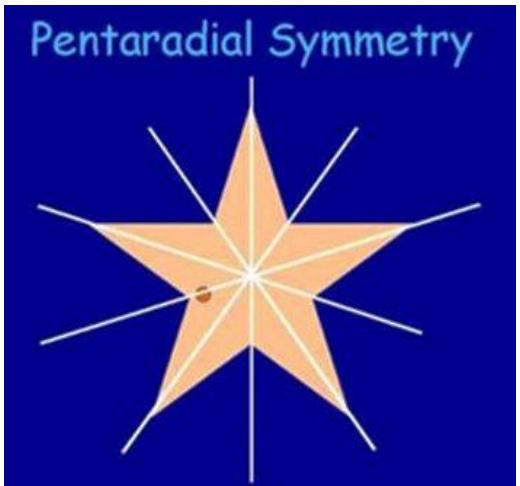
Larvae

– bilateral

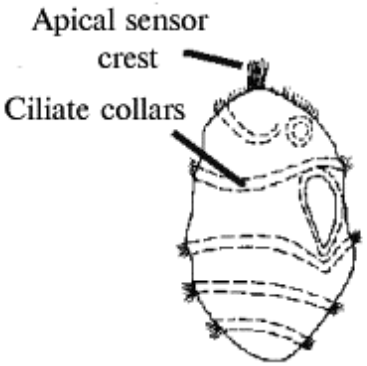
Adults

- pentamerous radial

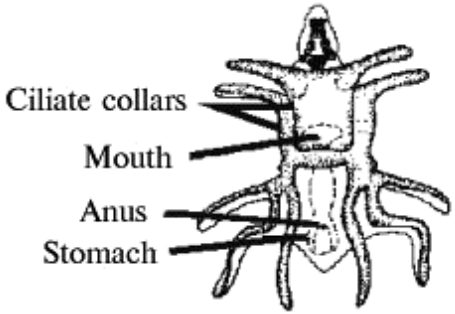
i.e., body parts are arranged in fives or multiples of five



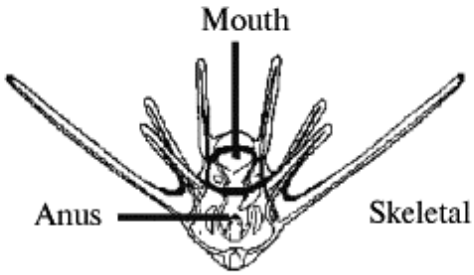
Echinodermata larvae (according to Barnes, 1980)



Sea lily vittelaria



Starfish brachyolaria



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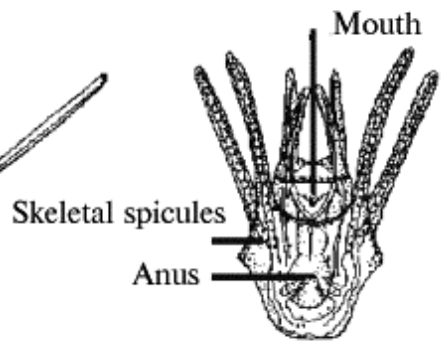
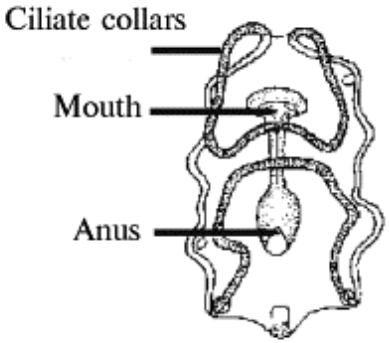
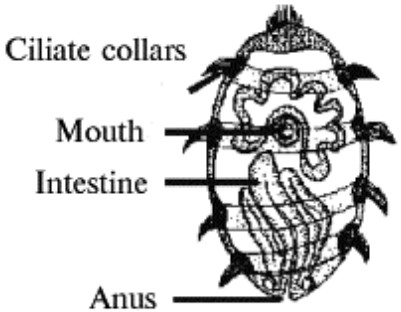


Sea urchin echinopluteus



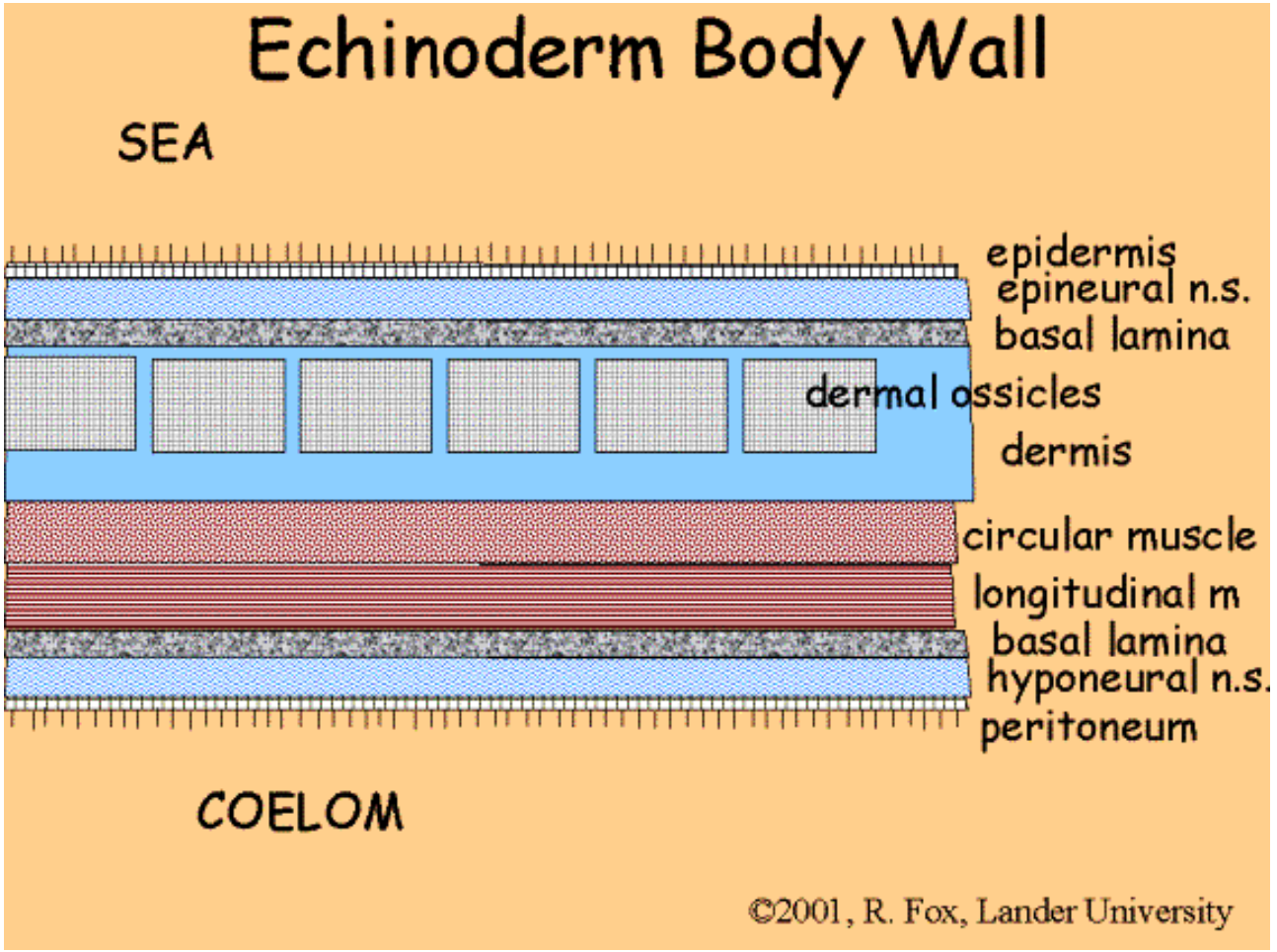
Holothurian auricularia



Holothurian doliolaria

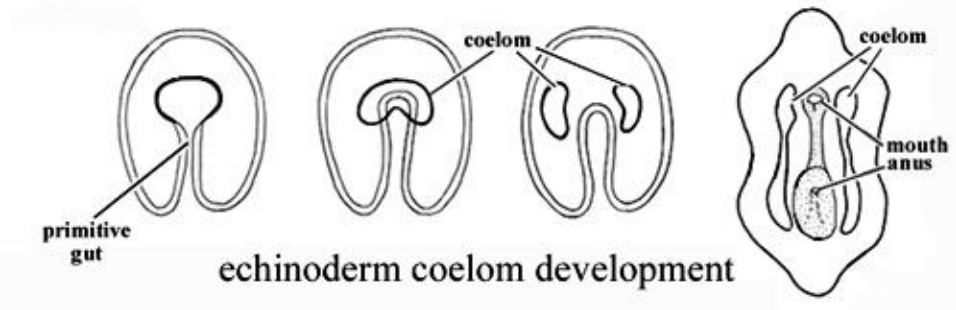
Body Wall:

- Epidermis is single layered and ciliated.
- In many – endoskeleton of calcareous plates in the dermis which are mesodermal in origin.

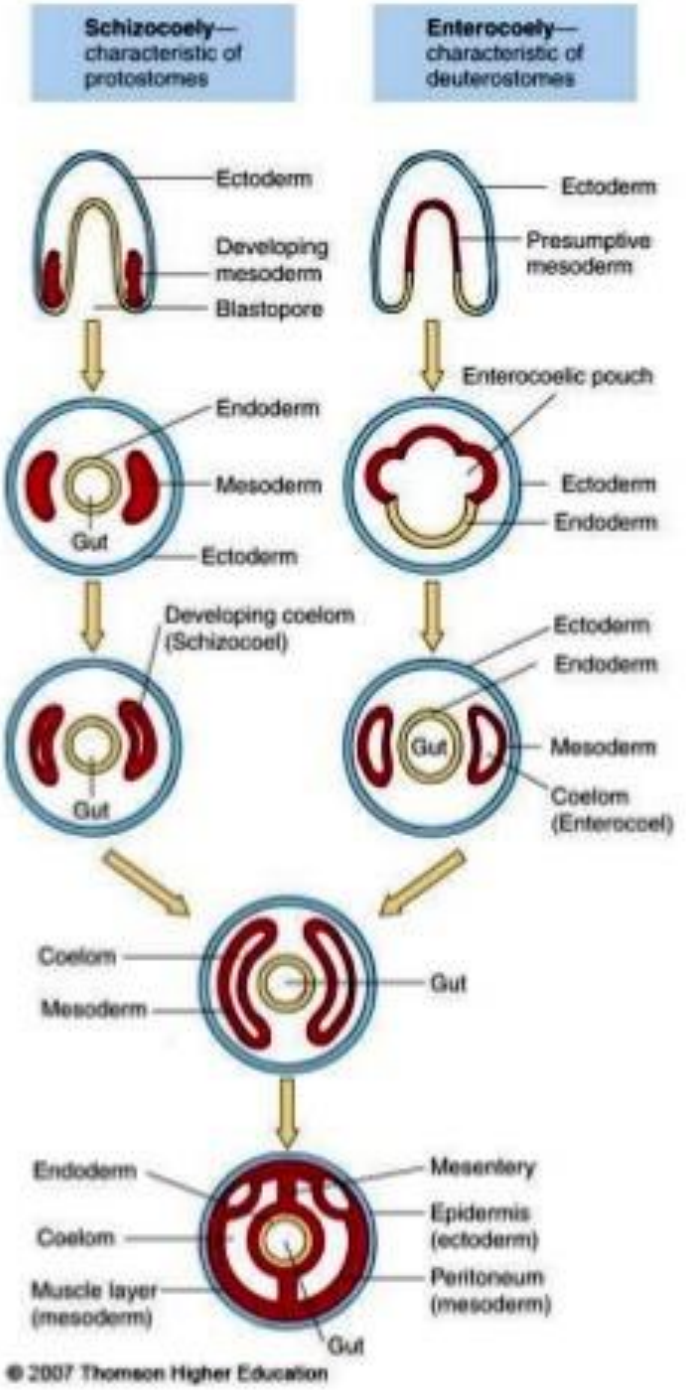


Body Cavity:

- There is a true enterocoelic coelom.



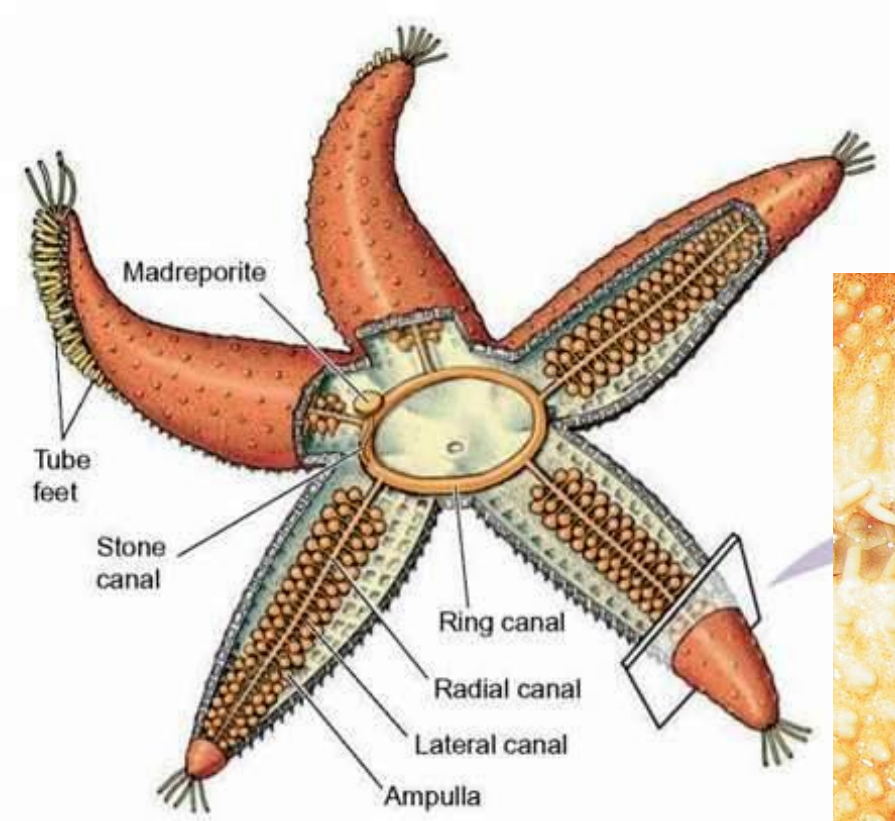
echinoderm coelom development

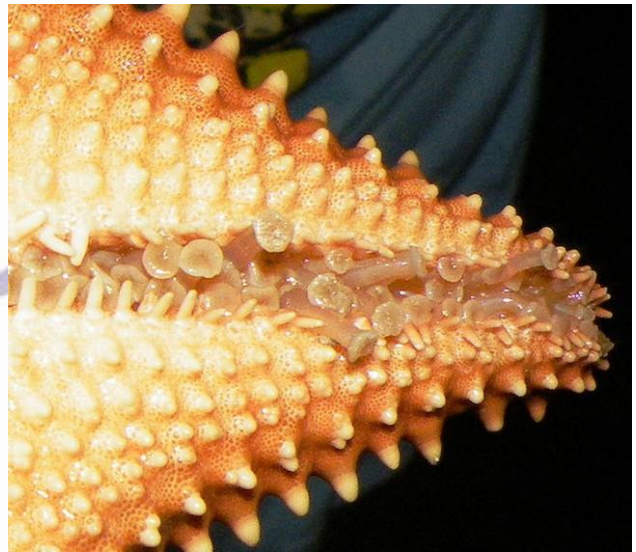


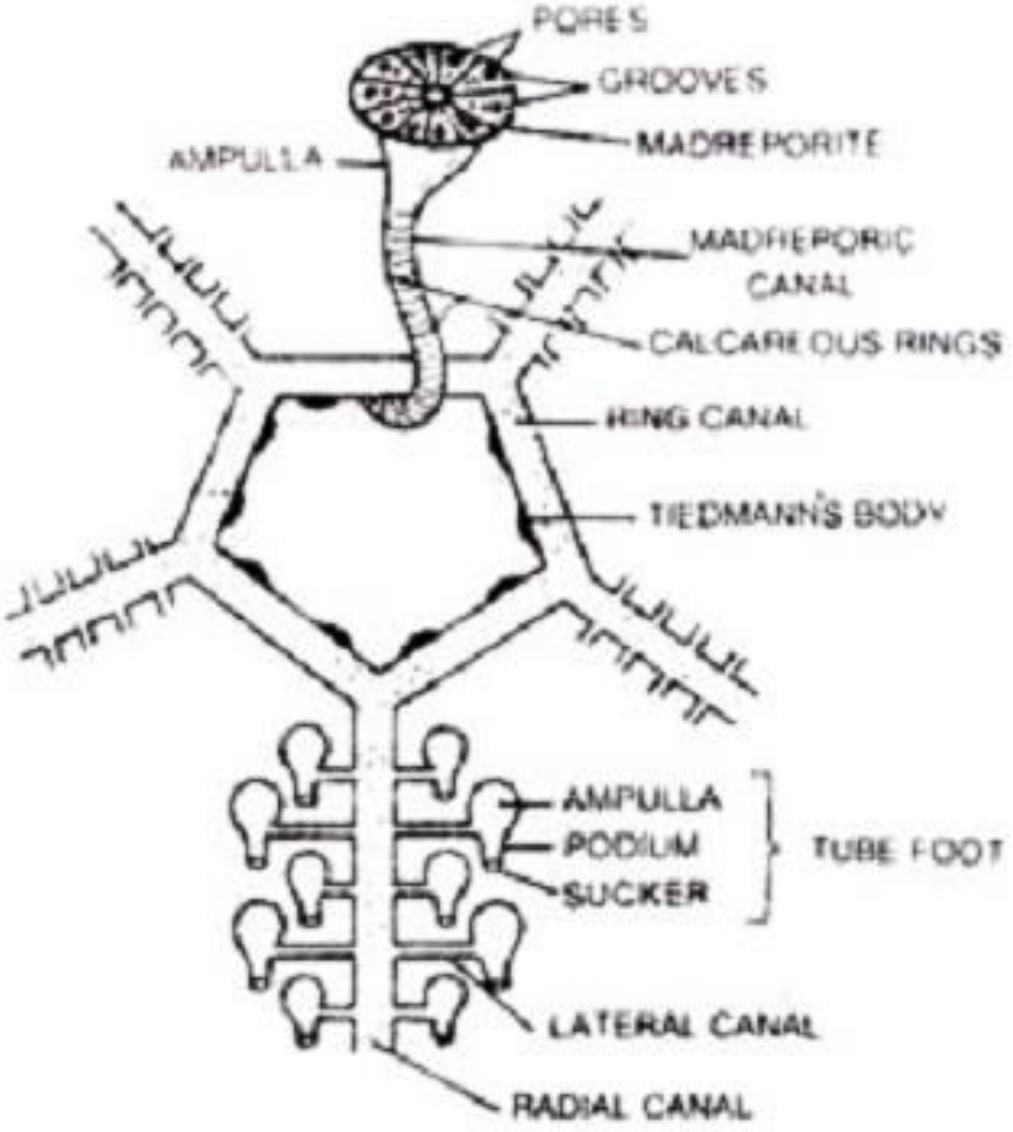
Water Vascular System (= Ambulacral System):

- is of coelomic origin

- A perforated plate – madreporite - allow water into the system
- Tube teet - help in locomotion, capture of food and respiration.






PORES
GROOVES
MADREPORITE
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MADREPORIC CANAL
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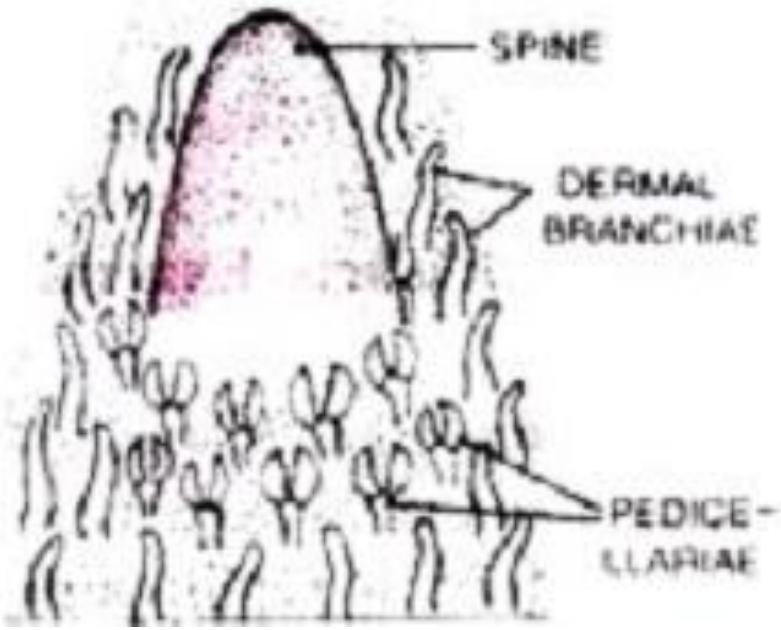
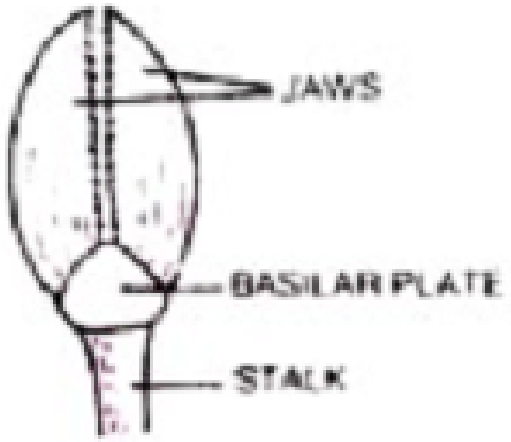
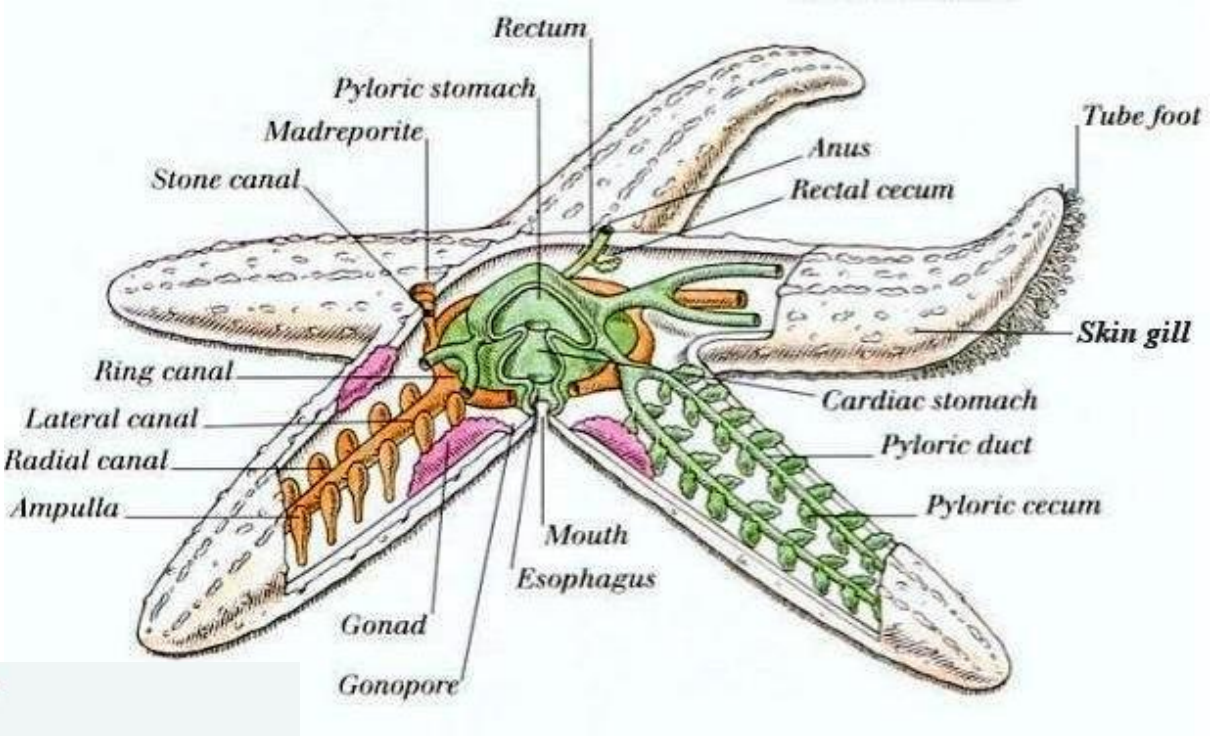
RADIAL CANAL

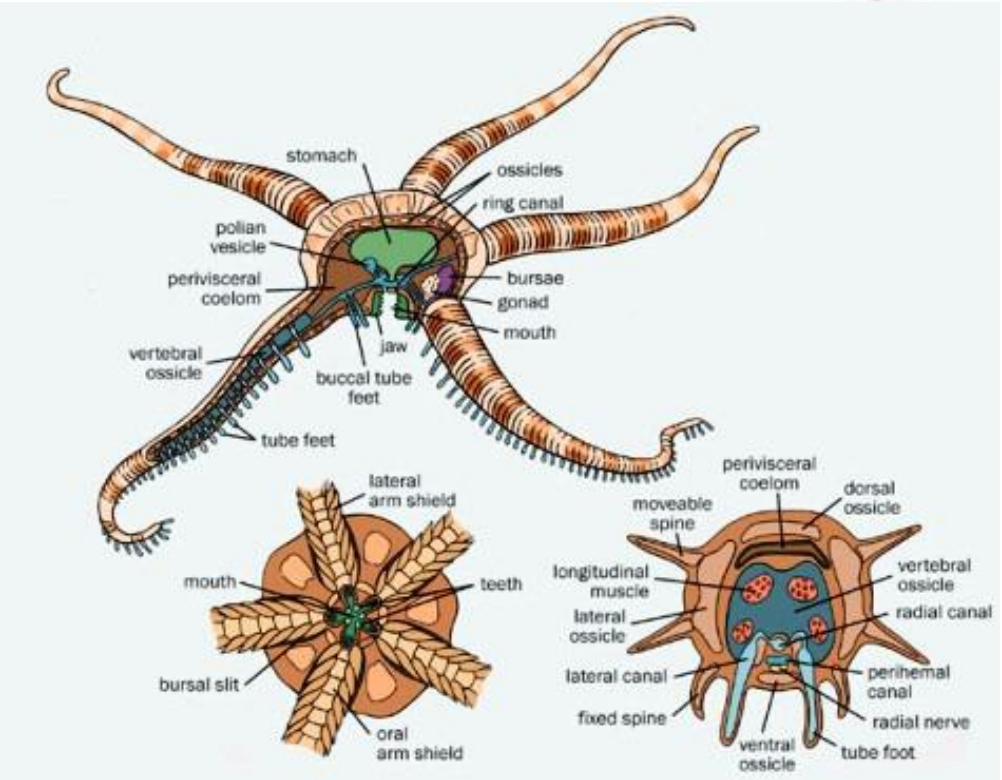

SPINE
DERMAL BRANCHIAE
PEDICELLARIAE


JAWS
BASILAR PLATE
STALK

Digestive Tract:

- usually complete





Brittle stars
-incomplete digestive tract.

Haemal and Perihaemal Systems: coelome origin.
(blood vascular system-absent)

- Thus the so called circulatory system is open type

and

- blood is often without a respiratory pigment.
- no heart.

Respiratory Organs:

- Gaseous exchange occurs by
    a) Papullae-Star fish.
    b) Peristomial gills - Sea urchin.
    c) Genital bursae - Brittle star .
    d) Respiratory trees - Holothurians.

- Exchange of gases also takes place through tube feet.

Excretory Organs:

- Specialized excretory organs are **absent**.
- Nitrogenous wastes are diffused out via **gills**.

(Ammonia is chief excretory matter)

Nervous System:

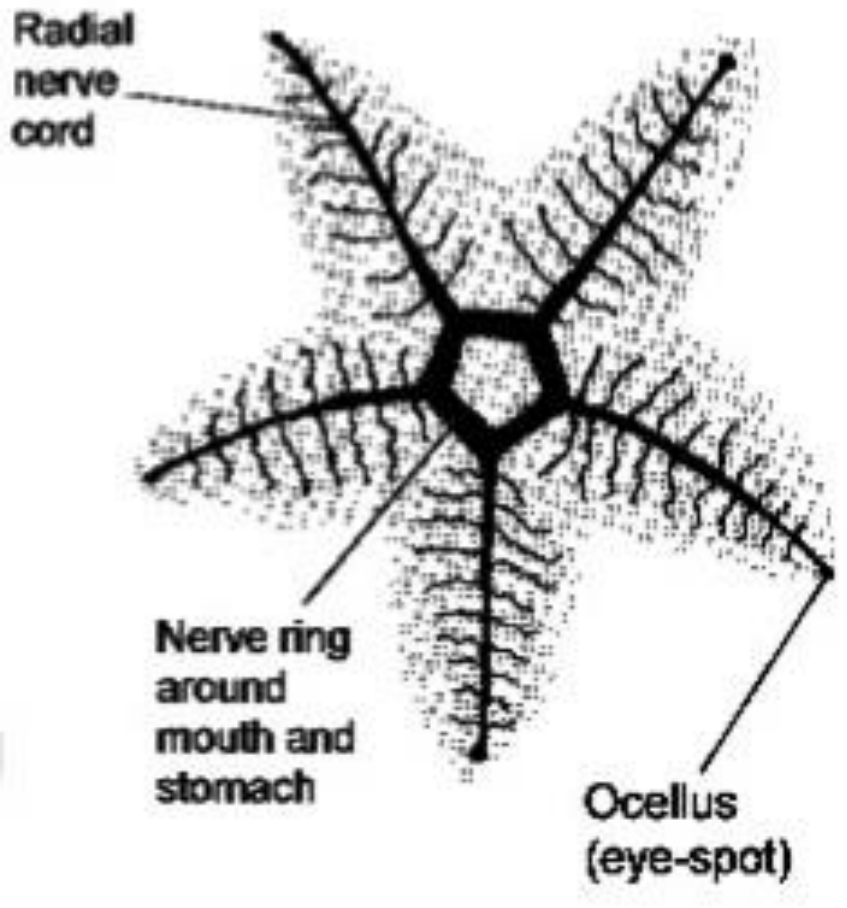
Brain as such is absent.

- consists of

a nerve ring

and

radial nerve cords.



Sense Organs:

- poorly developed.

Sexes and Fertilization:

- Except a few individuals, **the sexes are separate**.
- **no sexual dimorphism**.
- Fertilization is **usually external**.

Asexual Reproduction:

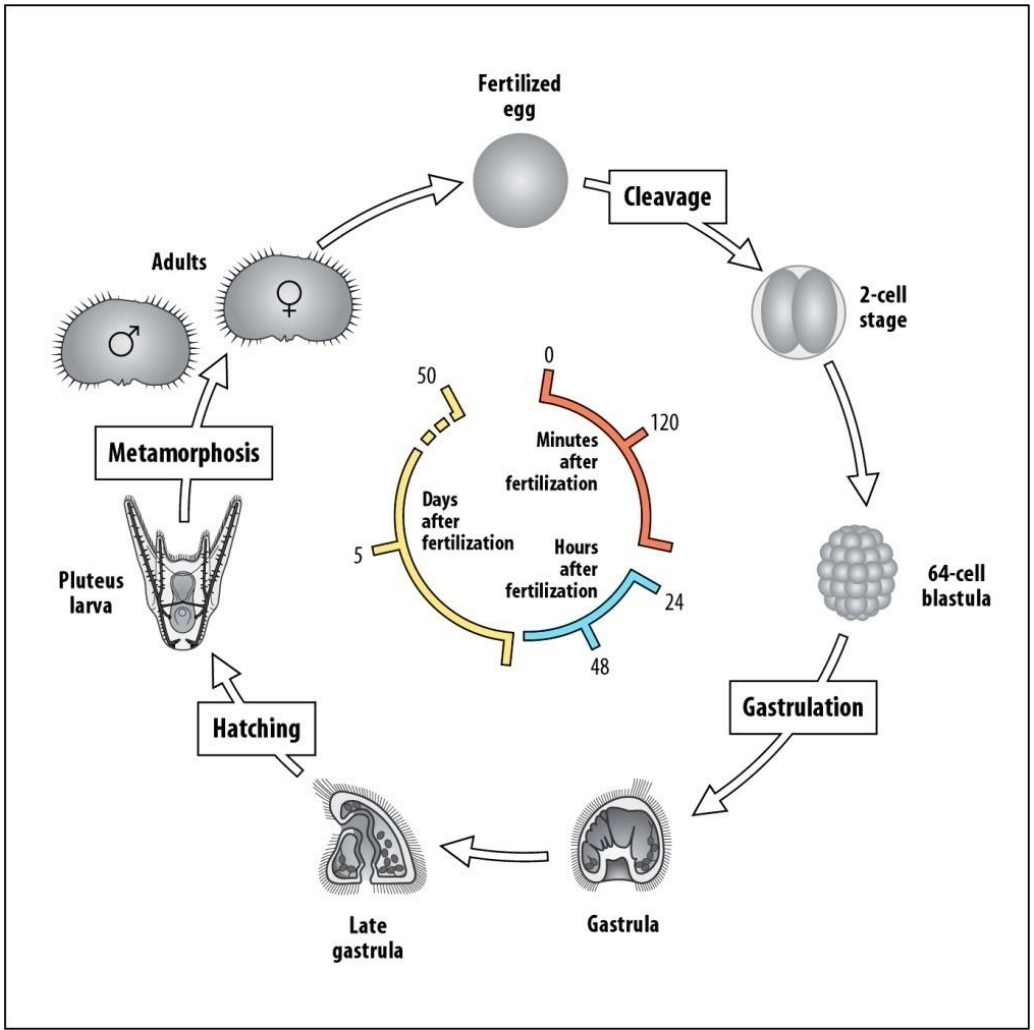
- (Some forms) **-** by **self division**.

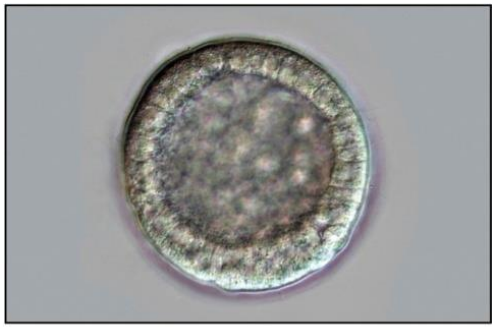
Autotomy and Regeneration:

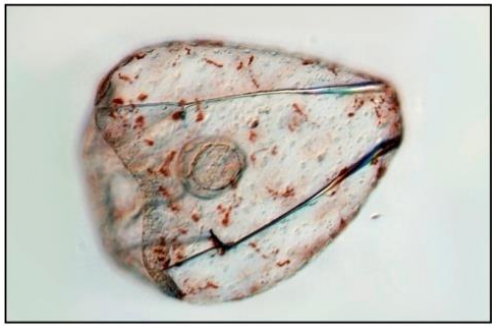
- Phenomena are often well marked in echinoderms.

Development:

- indirect and includes a ciliated, bilaterally symmetrical larva
- Larva undergoes metamorphosis to change into the radially symmetrical adult.







Unique Features:

(i) Presence of spines and pedicellariae.

(ii) Ambulacral system (water vascular system),

(iii) Haemal system,

(iv) Mesodermal endoskeleton of calcareous plates,

(v) Bilateral symmetry in the larva and radial symmetry in the adult.

Degenerate Characters:

(i) Lack of head,

(ii) Simple sense organs,

(iii) Incomplete digestive tract in some forms,

(iv) Reduced circulatory system,

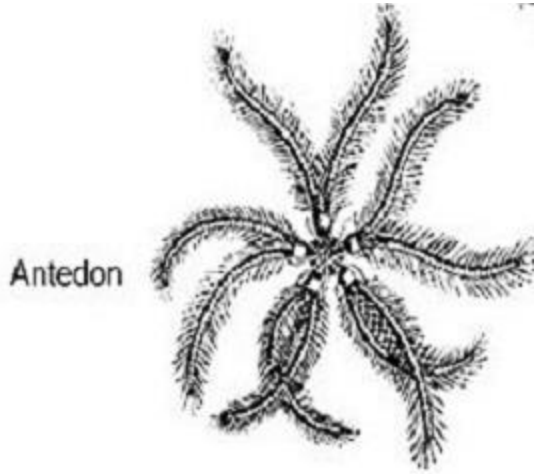
(v) Absence of excretory system.

Classification

SUB PHYLUM : PELMATOZOA

- Mostly extinct echinoderms.
- Mouth and anal aperture present on the oral surface.
- Tube feet are primarily food catching, they do not show suckers.

Pelmatozoa has only one living class.



Class : Crinoidia

- Extinct and living forms.
- Living members are with stalk.
- Oral surface is directed upwards.
- Mouth is usually central.
- Anus is usually excentric and present on the oral surface.
- Arms movable, simple mostly branched, usually five or ten in number.
- Madreporite, spines and pedicellariae are present.
- Larva is doliolaria.

Ex : Antedon, Metacrinus.

SUB PHYLUM: ELEUTHEROZOA

- Mostly living echinoderms.
- Stem or stalk is absent.
- Body structure is usually pentamerous.
- Oral surface has mouth and it is downwards.
- Anus usually on the aboral surface.


Holothuria

Class 1: Holothuroidea

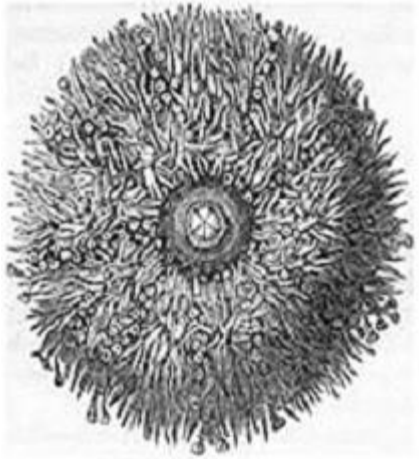
Body bilaterally symmetrical, usually elongated in the oral aboral axis having mouth at or near one end and anus or near the other end.

Ex: Holothuria, Elphidia, Cucumaria.

Class 2: Echinodea

- Body is spherical, disc like, oval or heart shaped.
- Body is enclosed in an endoskeletal shell or test of closely fitted calcareous plates covered with movable spines.
- Ambulacral grooves are absent.
- Pedicellariae are stalked and three jawed.
- Sexes are separate.
- Larval form is echinopluteus larva.

Ex : Echinus, Diodema.



Echinus

Class 3: Asteroidea

- Body is flat, pentagonal or star shaped.
- Oral and aboral surfaces are distinct.
- Sexes separate, gonads radially arranged.
- Development includes bipinnaria or brachiolaria larva.

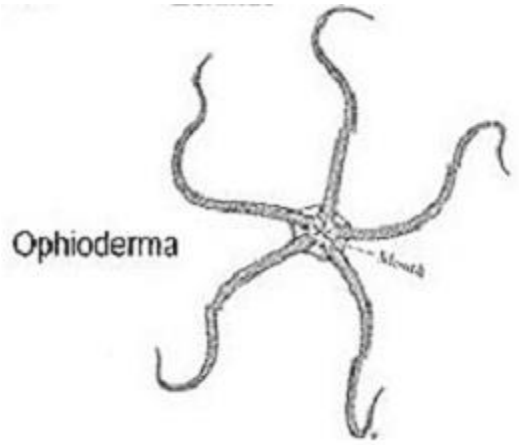
Ex: Asterias, Astropecten.

Asterias

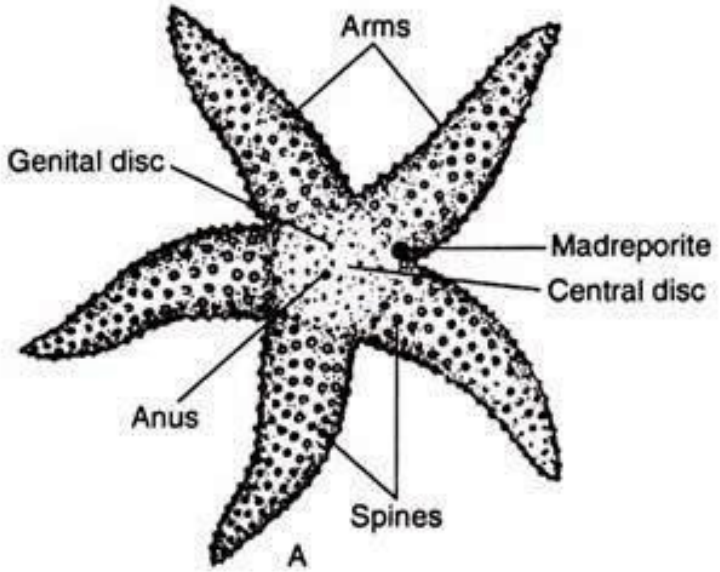
Clsss 4: Ophiuroidea

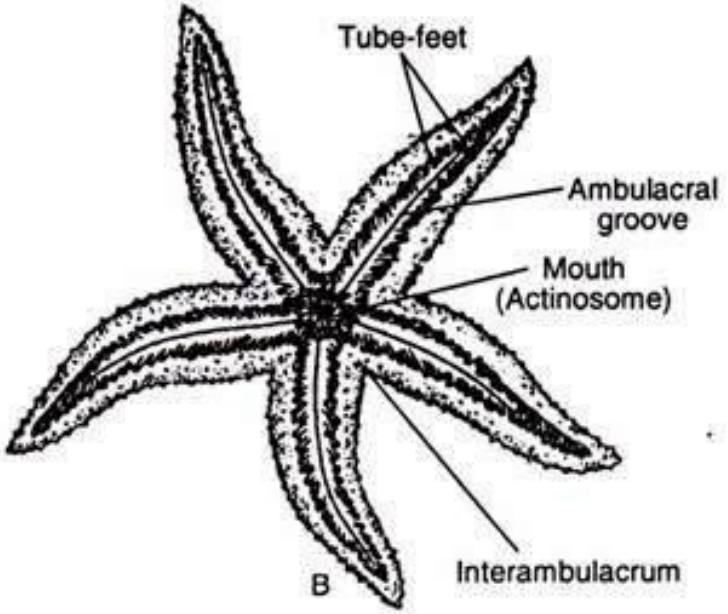
- Body is flattened with a pentamerous or rounded central disc.
- Oral and aboral surfaces are distinct.
- Arms usually five, rarely six or seven, are long and slender.
- Ambulacral grooves are absent.
- Madreporite is on the oral surface.
- Sexes are separate.

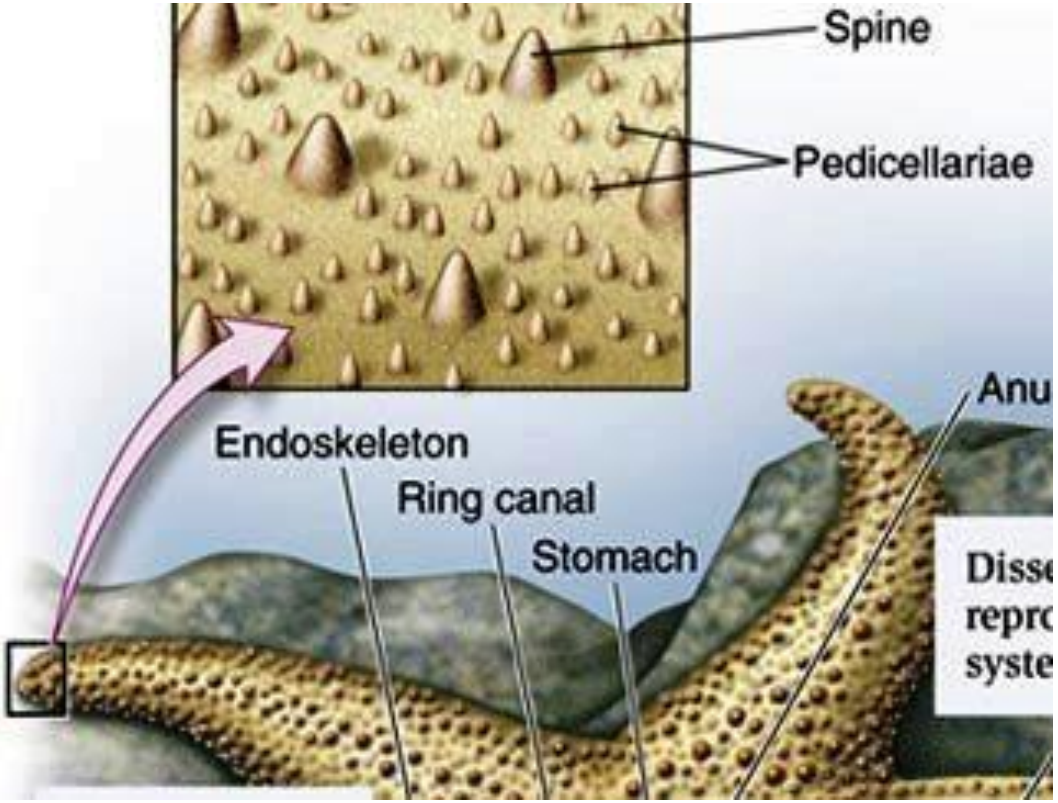
Ex : Ophioderma, Ophiothrix.

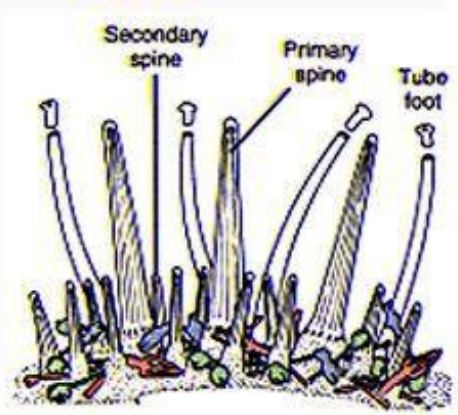


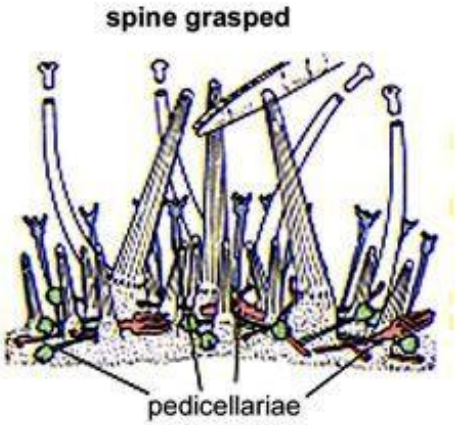
External features of Asterias

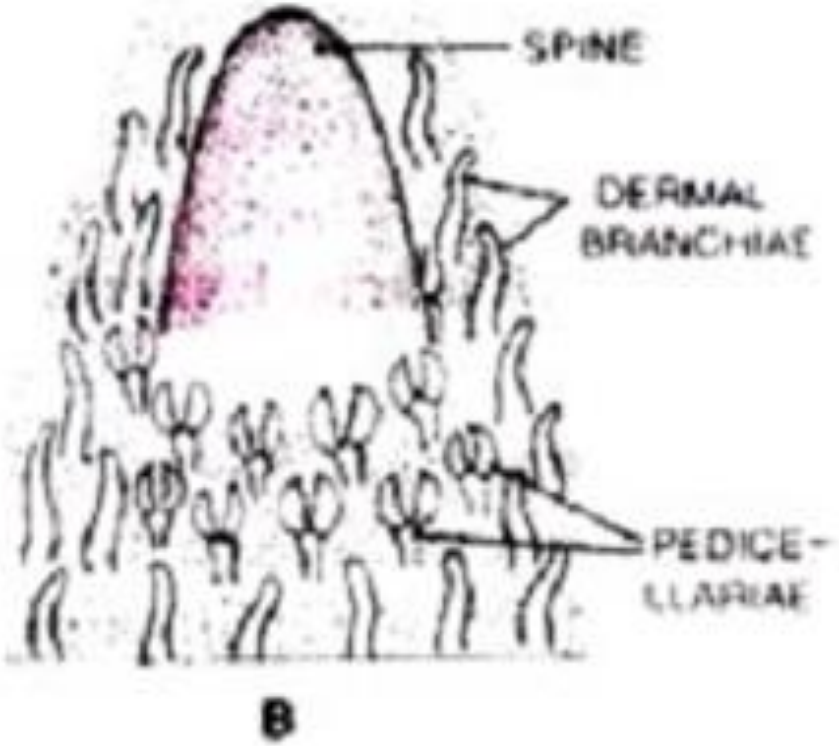




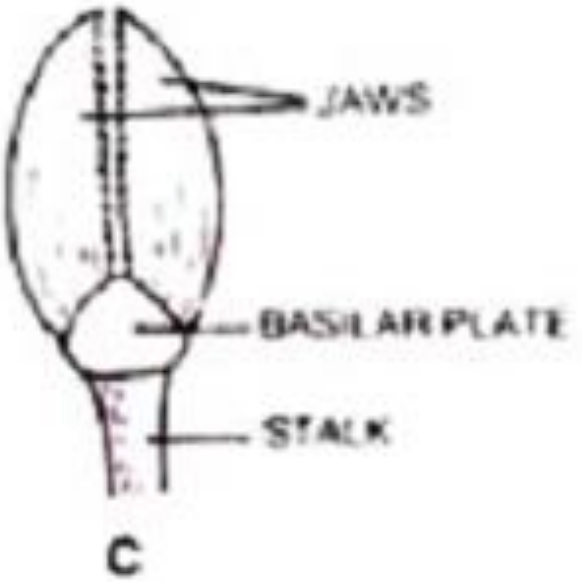



Secondary spine
Primary spine
Tube foot


spine grasped
pedicellariae

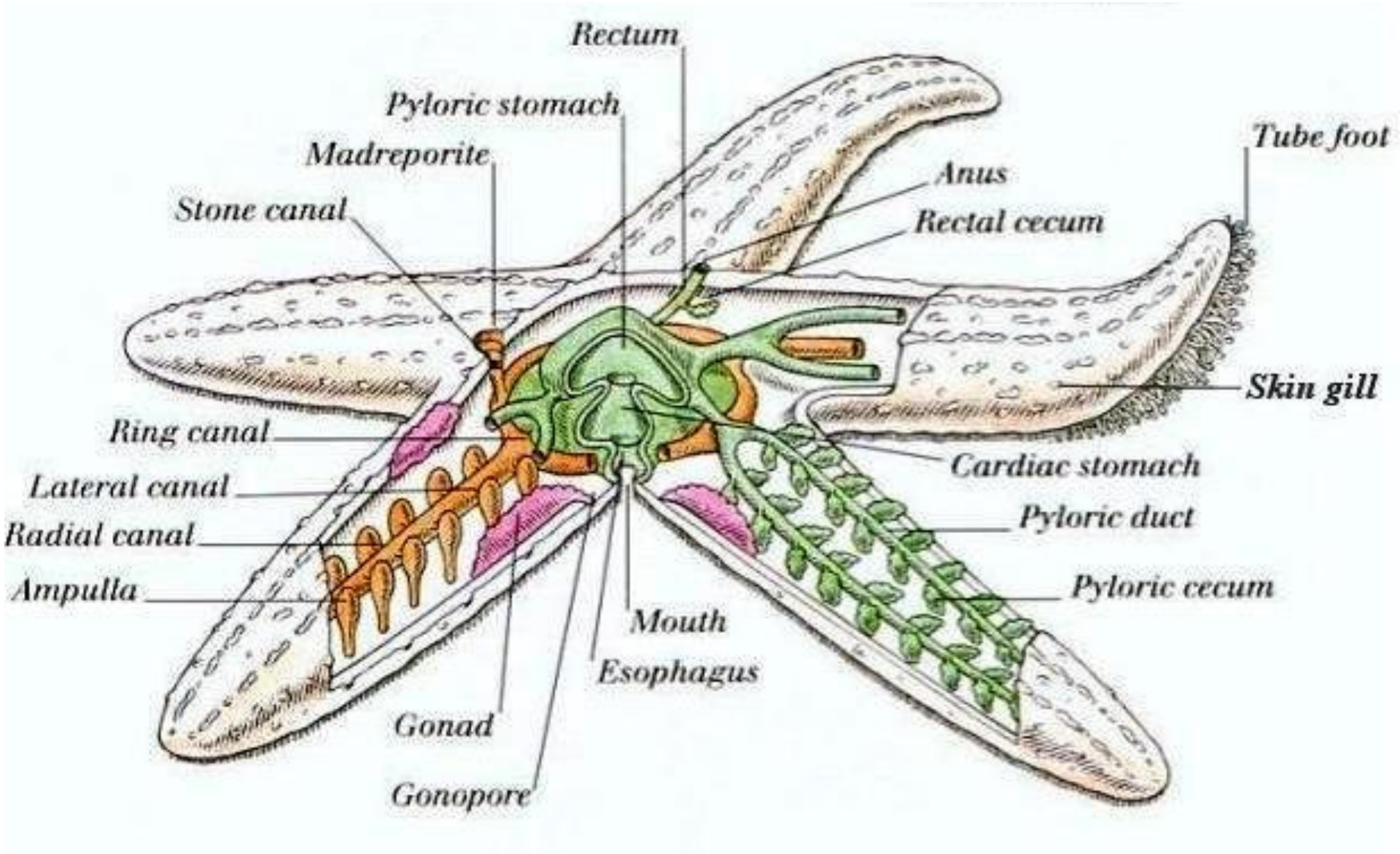

SPINE
DERMAL BRANCHIAE
PEDICE-
LLARIAE

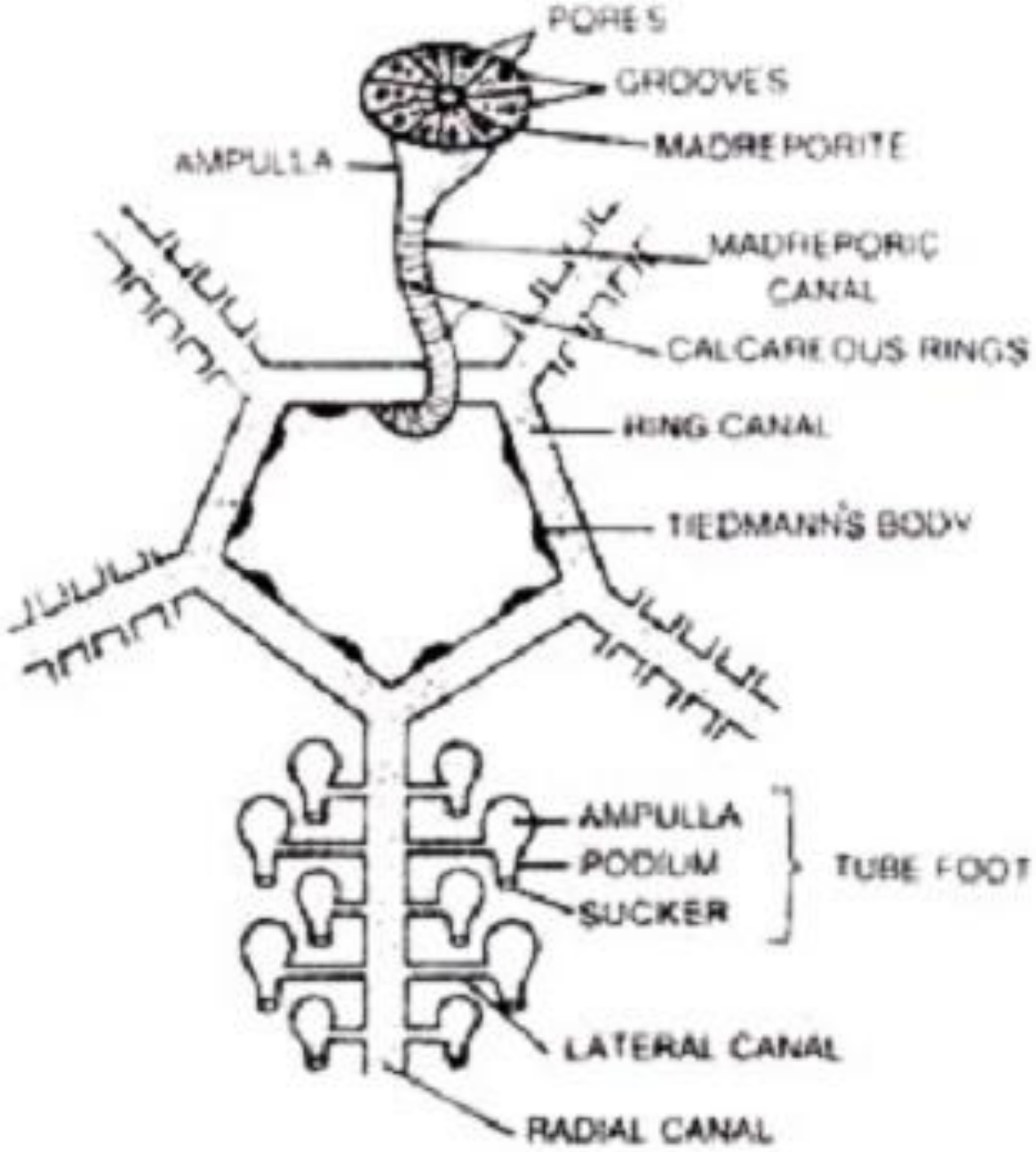
B


JAWS
BASILAR PLATE
STALK

C

Water vascular system of Asterias

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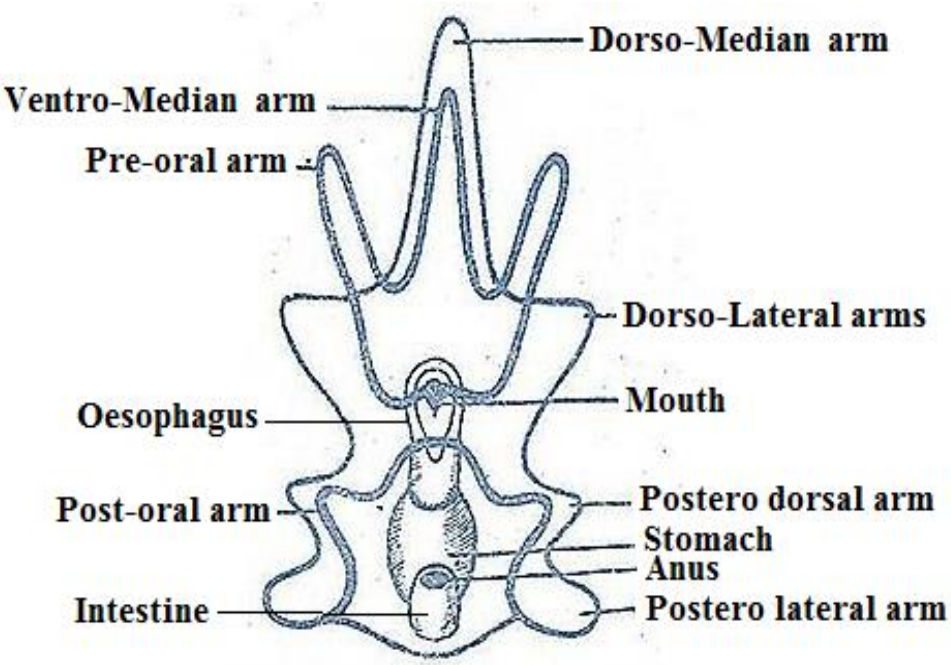
LARVAL FORMS IN ECHINODERMATA

Bipinnaria Larva

- develops from dipleurula larva.
- characteristic of the class Asteroidea.
- free-swimming larva.
- bilaterally symmetrical.



- Alimentary canal
- Mouth developed from archenteron on anterior end
- Anus developed from blastopore at the posterior end
- Body with outgrowths – arms - covered by ciliated bands- locomotion
- It has two unpaired arms and five pairs of paired arms.
- transforms into brachiolaria larva.

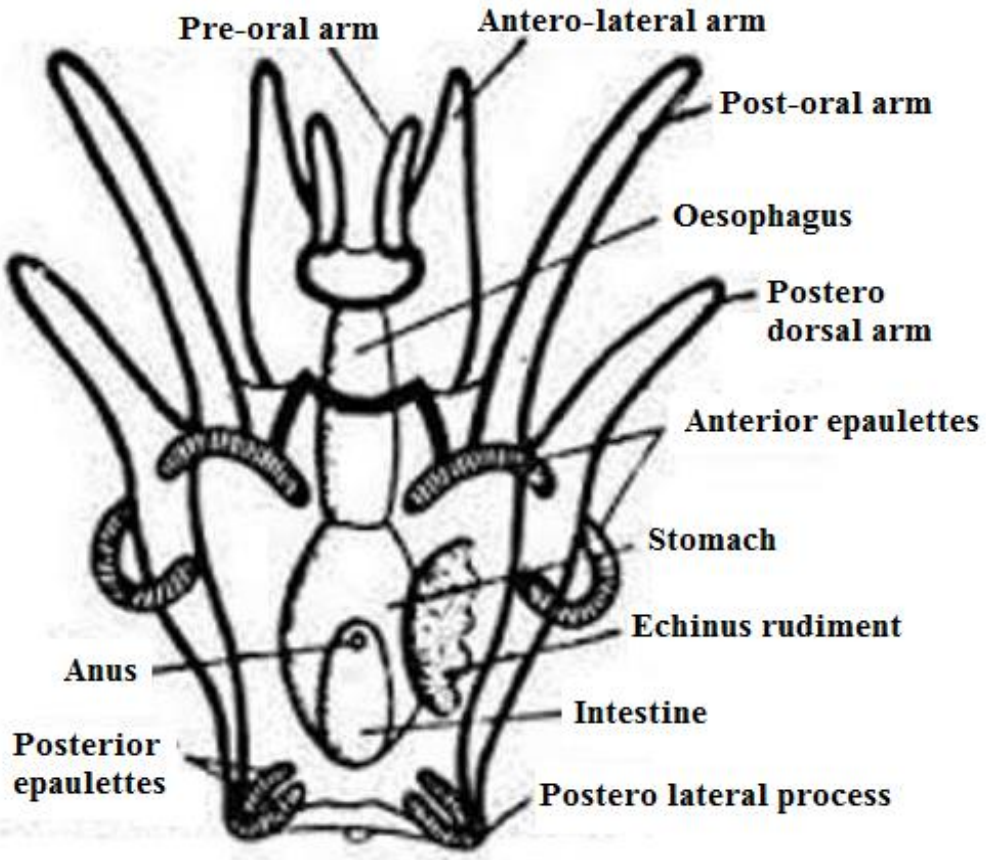
Echinopluteus

- larva of Echinoidea.
- has small pre-oral lobe & a single ciliary band
- Arms supported by calcareous rods.
- Bears a pair of pre-oral arms,
- a pair of post-oral arms,

  pair of antero lateral arms,

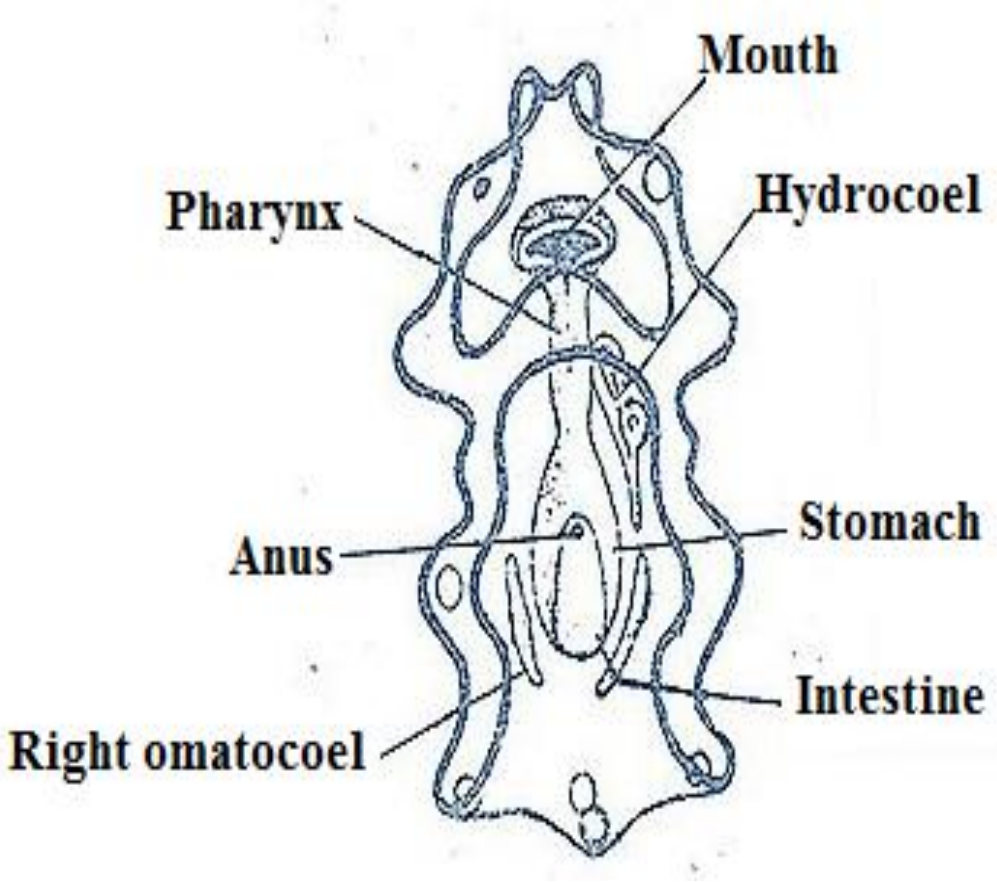
  pair of antero dorsal arms

  a median posterior arm.
- The postero lateral arms are very short & directed backwards.



Auricularia

- larval form of Holothuroidea.
- bilaterally symmetrical.
- a single longitudinal ciliated band.
- well developed pre-oral lobe.
- Arms are not supported by calcareous rods
- (calcareous structures - wheels, spheres, star shaped bodies...etc).



Doliolaria of Crinoidea

- larva of Antedone.
- free-swimming larva.
- bilaterally symmetrical.
- barrel shaped.
- four or five ciliary bands.
- ectoderm thickens to form an apical plate.
- apical plate bears a tuft of cilia called apical sensory tuft.
- adhesive pit between first and second ciliary bands - used forattachment.
- mouth between the second and third ciliary bands.