# Larval forms in Echinodermata

B.Sc. Part I, Paper I, Group: A, Animal Diversity

By- Dr.Vandana Kumari, Department of Zoology, R.C.S. College, Manjhaul

# Introduction

The phylum Echinodermata represents the largest animal phylum of exclusively marine animals. They include morphologically diverse animals. Echinoderms are deuterostomes. All adult forms of modern echinoderms have pentaradial symmetry. The cleavage is  radial, holoblastic and indeterminate. In most cases fertilization takes place in open water, the larvae hatch in water and through successive larval stages metamorphose to become adults. Larvae of Echinoderms are bilaterally symmetrical but they looses their symmetry during the process of metamorphosis. Different classes of Echinoderms show different larval forms.

# Echinoderm classes

Echinoderm has five  living classes:

- Asteroidea
- Crinoidea
- Ophiuroidea
- Echinoidea
- Holothuroidea
- One Extinct Class
- Blastoidea

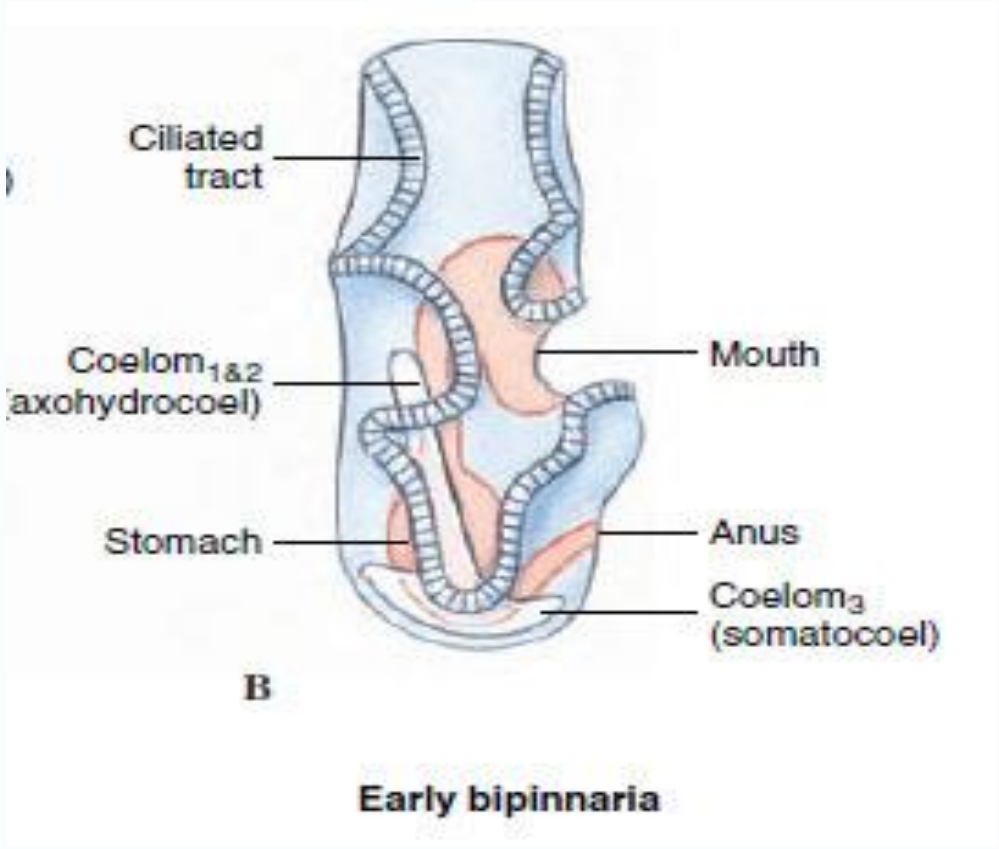
# Asteroidea Larval form

Three larval stages in the class Asteroidea

- Early bipinnaria
- Bipinnaria
- Brachiolaria

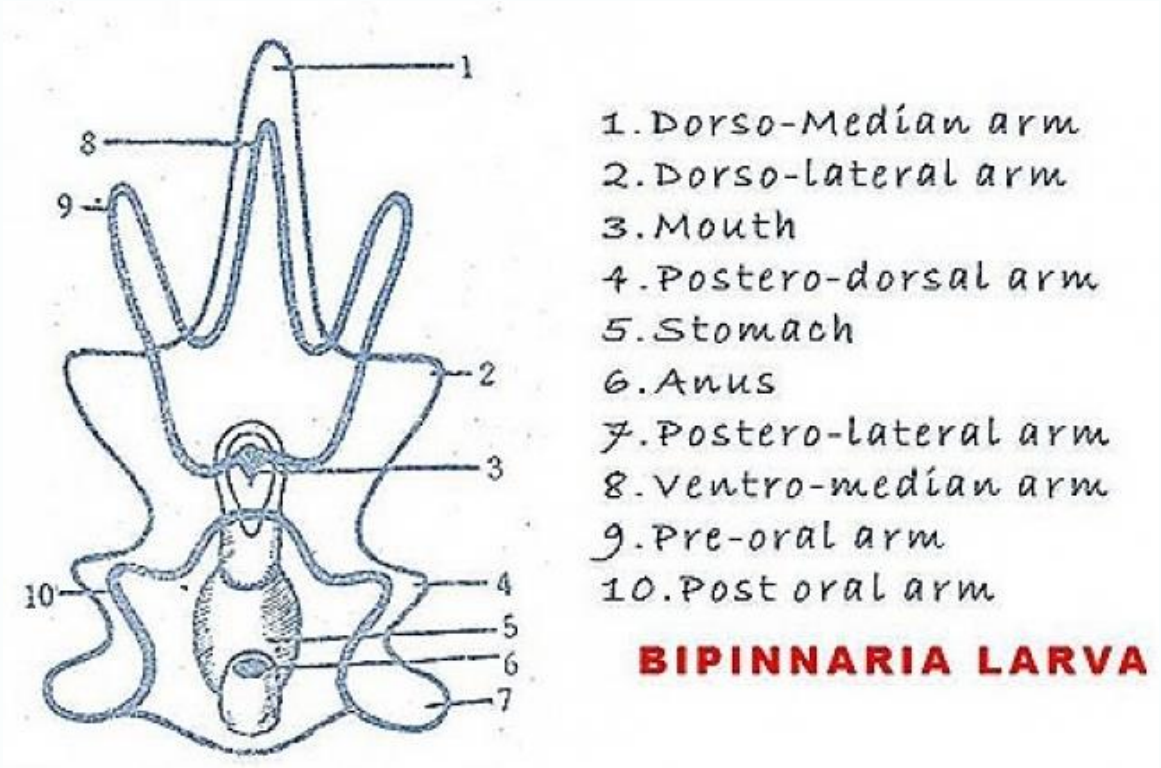
# Earlybipinnaria

**Earlybipinnaria** 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.



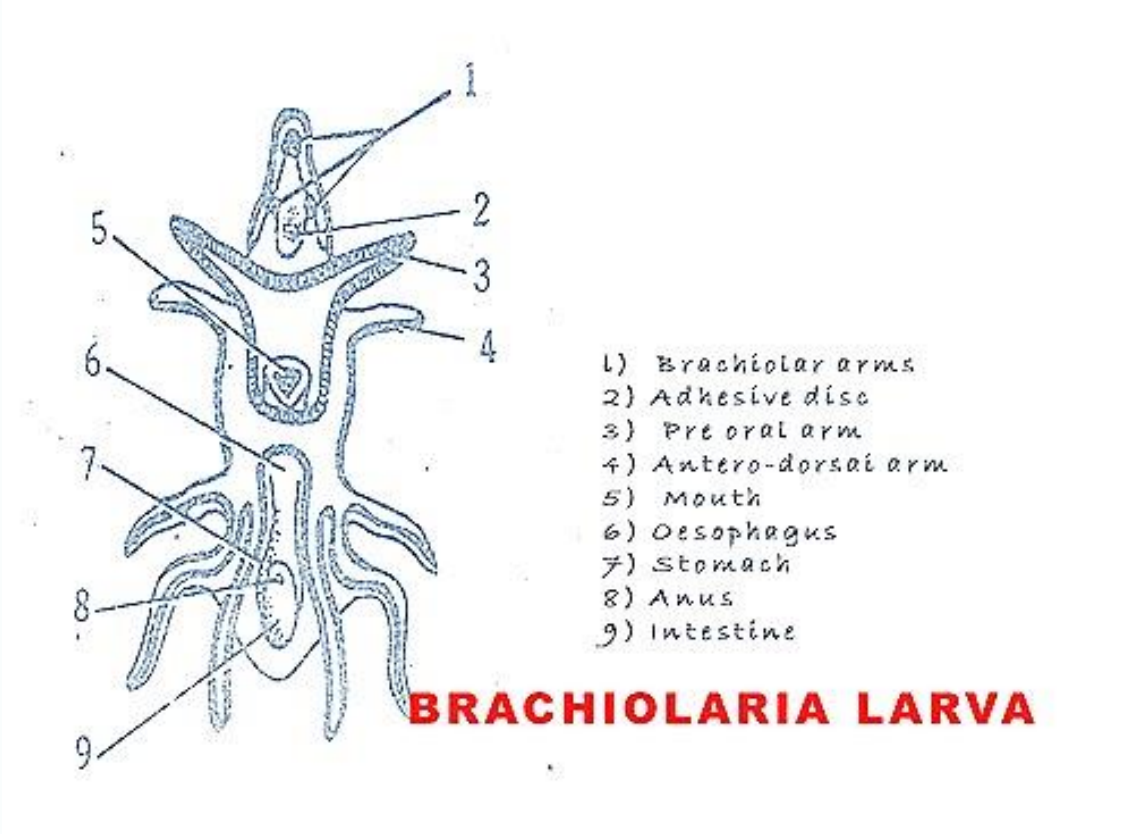
# Bipinnaria larva

**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. Preoral and postoral ciliary bands are also present. This larva resembles auricularia larva of Holothuroidea in general appearance.



# 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.



# LARVAE OF CRINOIDEA

Class Crinoidea demonstrate two larval stages, namely:

- Pentactula larva
- Penta crinoid larva

# Pentactula larva

**Pentactula** is the basic larval stage of Crinoidea but it passes inside the egg. There is one or two larval stages in sea lilies. **Doliolaria** larva, which is also called Vitellaria larva, is found in some sea lilies. It resembles doliolaria of holothuroids but has an **adhesive pit** on the ventral side with which it attaches to substratum and becomes sedentary. This larval resemblance demonstrates close evolutionary relationship between Crinoidea and Holothuroidea.

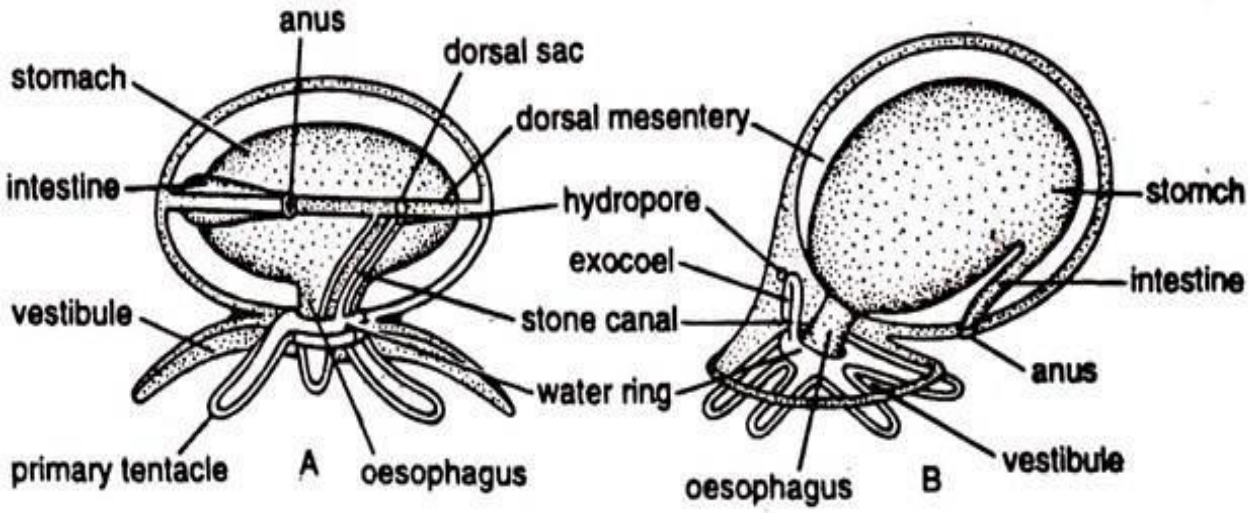
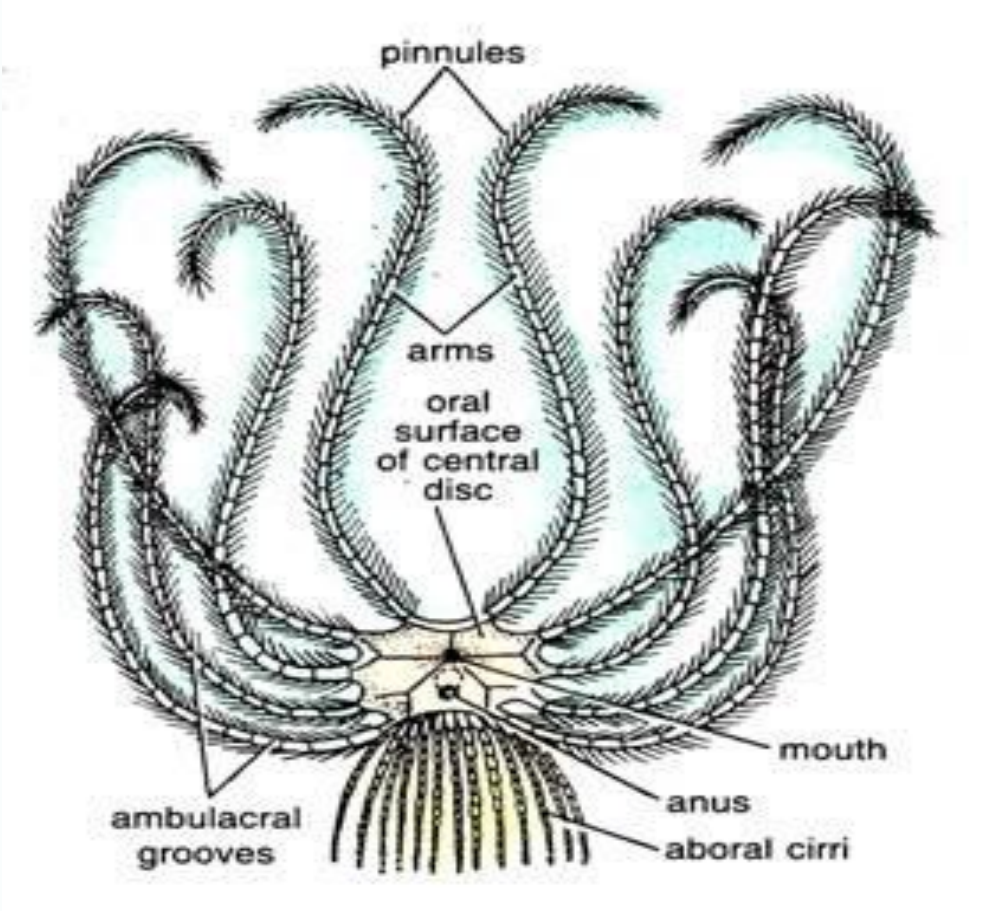



Fig. 27.15. Pentactula (ancestor larva) A. Bilateral form. B. Radial condition after torsion

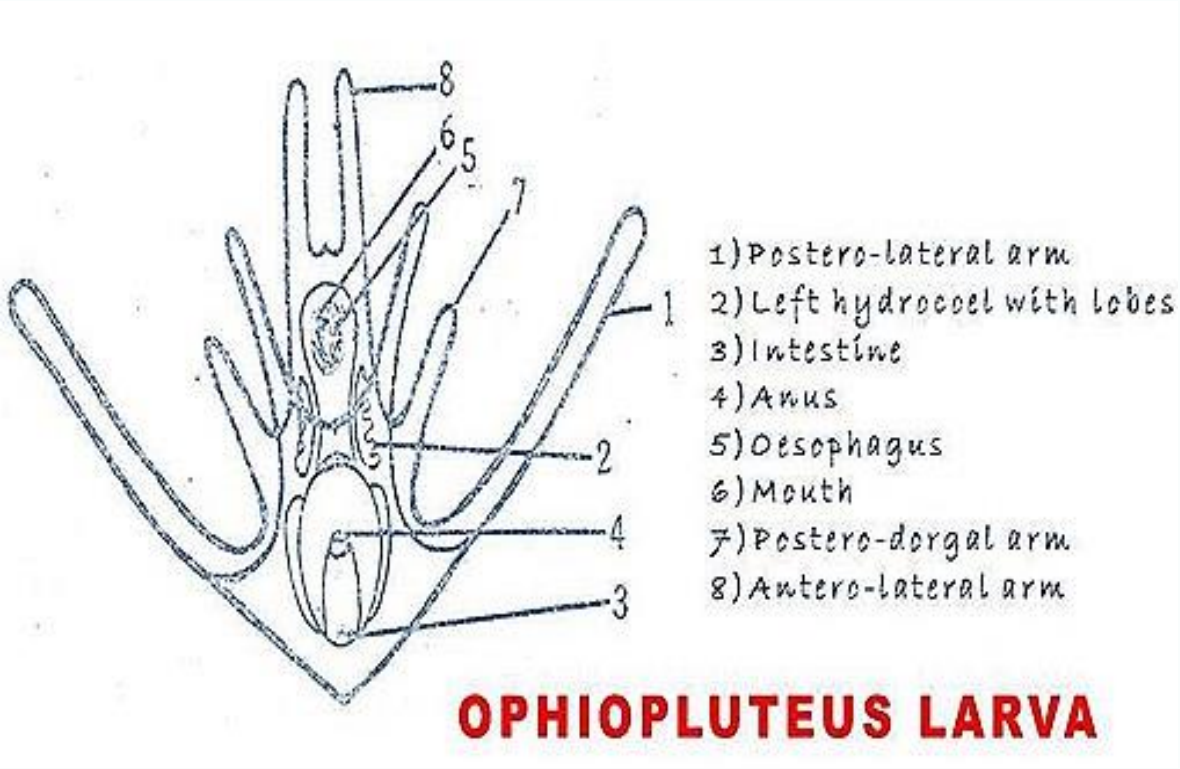
# Pentacrinoid larva

**Pentacrinoid** larva is sedentary and attaches to substratum with an attachment plate. Body is supported by a stalk. There are 10 cilia bearing tentacles which are used for capturing food. Both mouth and anus are on the same side of the disc.



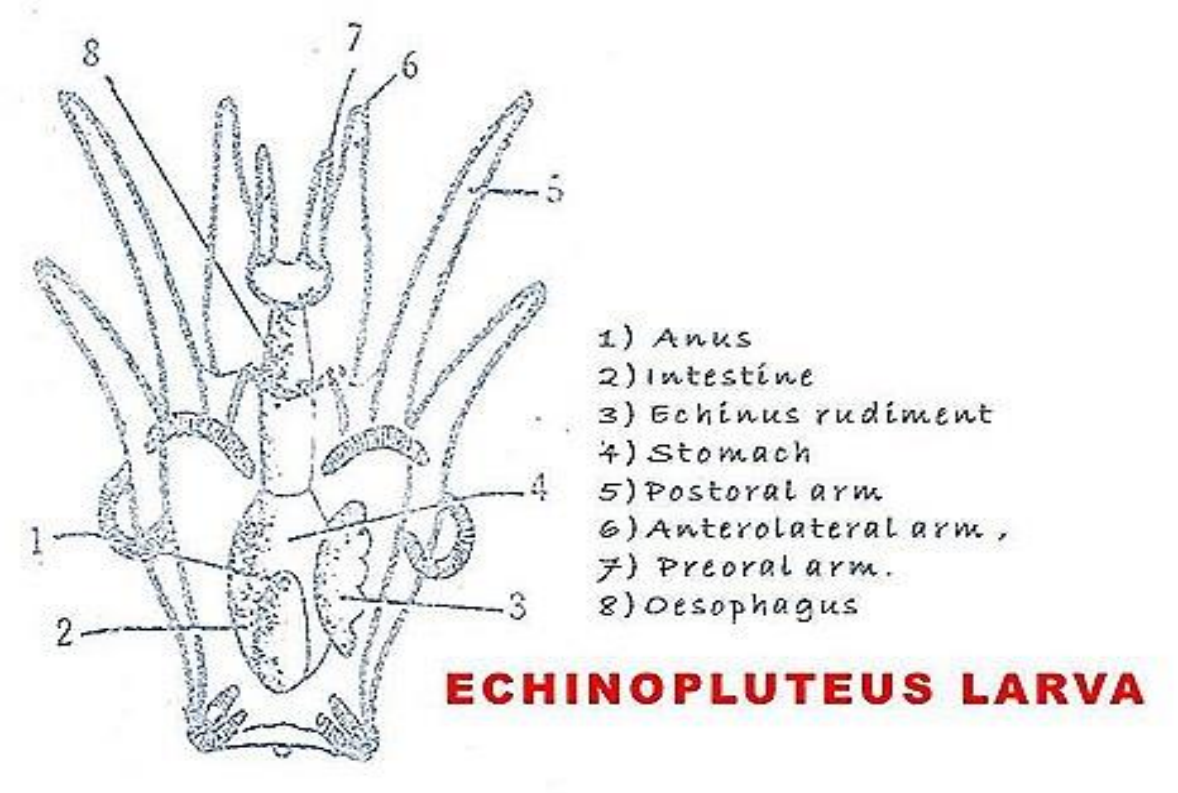
# LARVAE OF OPHIUROIDEA

**Ophiopluteus** is the only larva of Ophiuroidea that resembles echinopluteus larva of Echinoidea in general features. Anterolateral, postoral and posterodorsal arms are present but preoral arm is absent. Instead, it has very long posterolateral arms. All arms are supported by calcareous skeletal rods. This larva metamorphoses to become adult.



# LARVAE OF ECHINOIDEA

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. Preoral arm is present but posterolateral arm is absent. The other three arms are anterolateral, postoral and poster dorsal arms. Mouth, anus and gut are well developed.



# LARVAE OF HOLOTHUROIDEA

Class Holothuroidea demonstrate two larval stages, namely:

- auricularia larvae
- doliolaria larvae

# Auricularia

**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 well developed mouth, gut and anus.

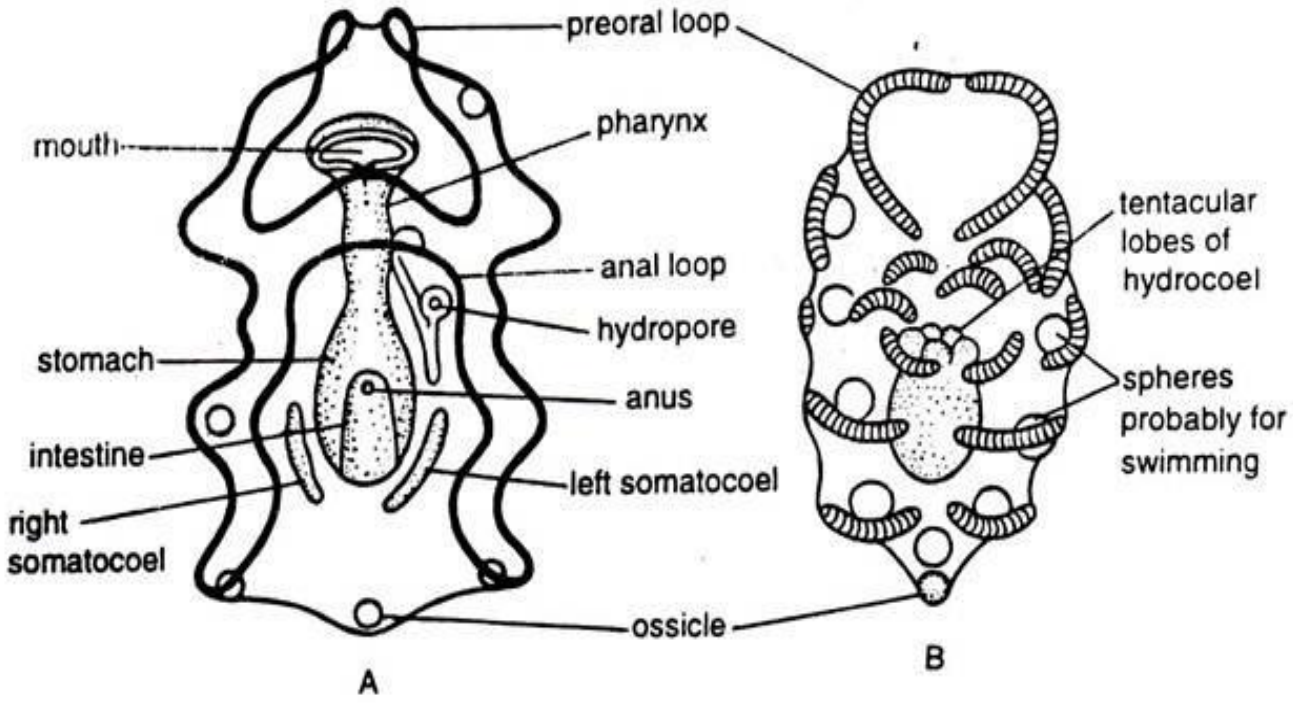
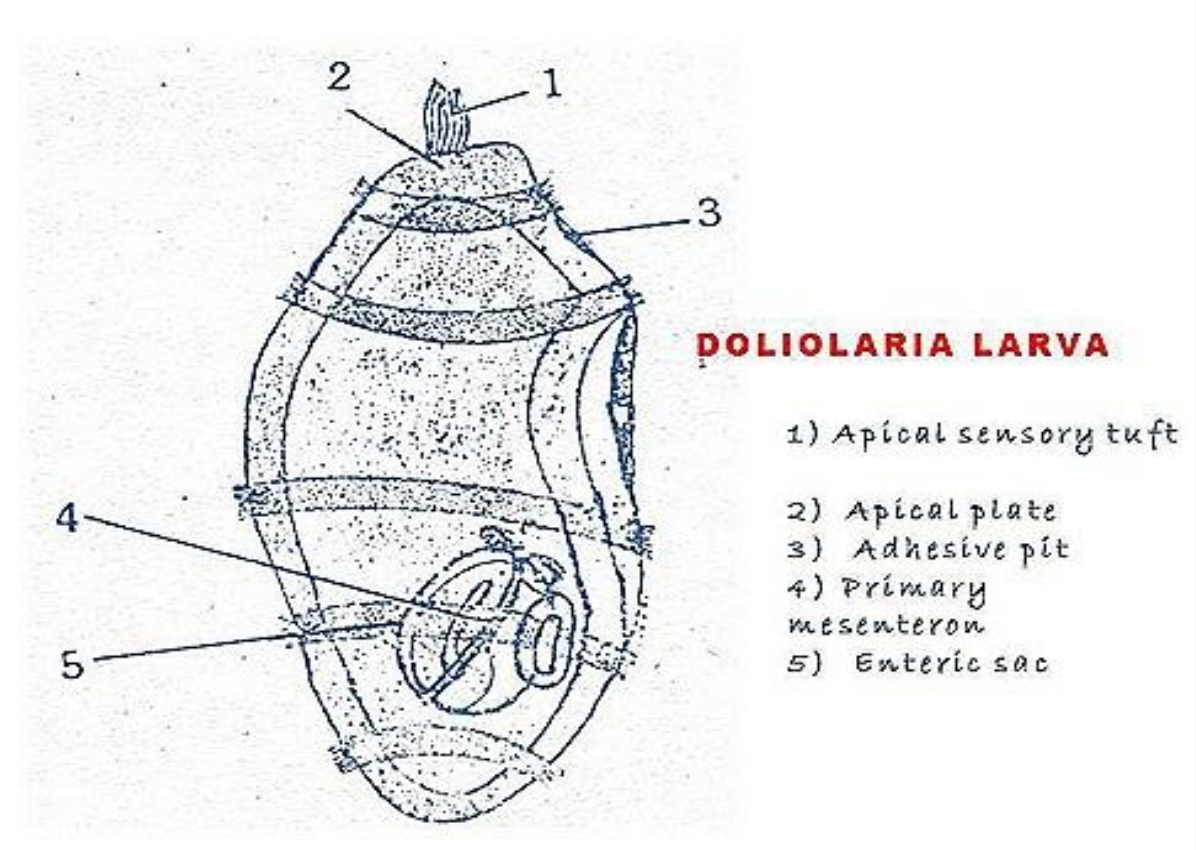



Fig. 27.12. A. Auricularia larva B. Transitional stage from Auricularia to Doliolaria larva

# Doliolaria larva

**Doliolaria** larva is the next stage after auricularia. It has barrel like body with 5 ciliated bands surrounding it. Mouth or vestibule is on the ventral 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.



# Inference

The affinities among larval stages of echinoderms demonstrate evolutionary relationships among different classes. However, the same relationship cannot be shown in the cladistic classification of echinoderms, which is based on adult characteristics. Adults are highly modified organisms in echinoderms.