LARVAL FORMS IN ECHINODERMATA

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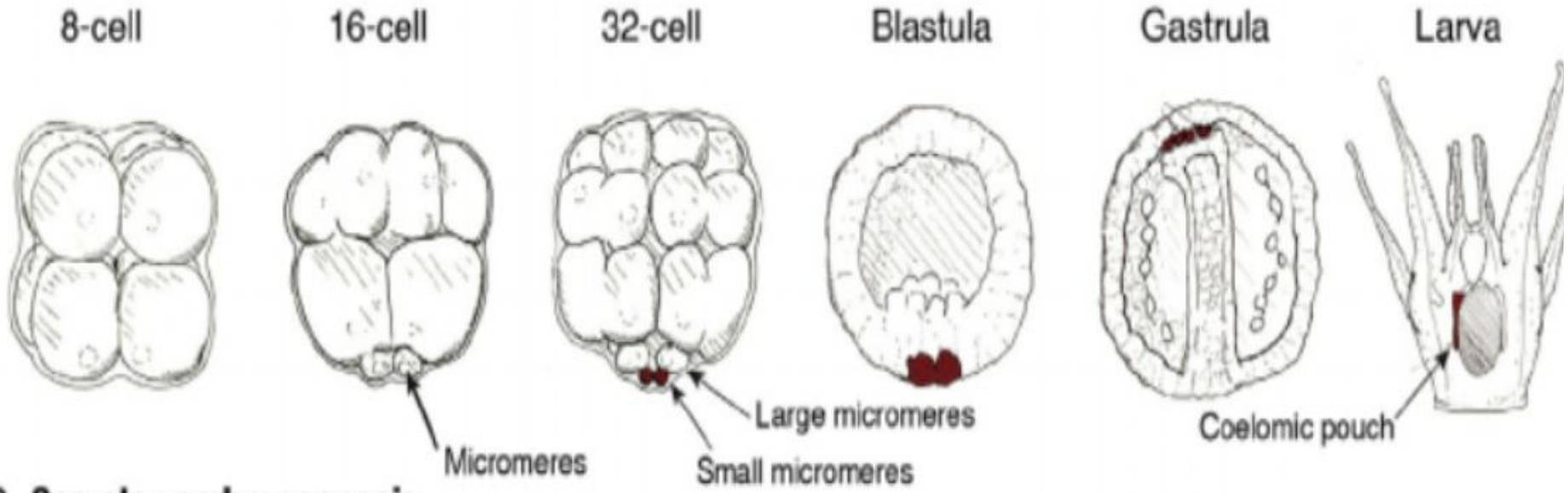
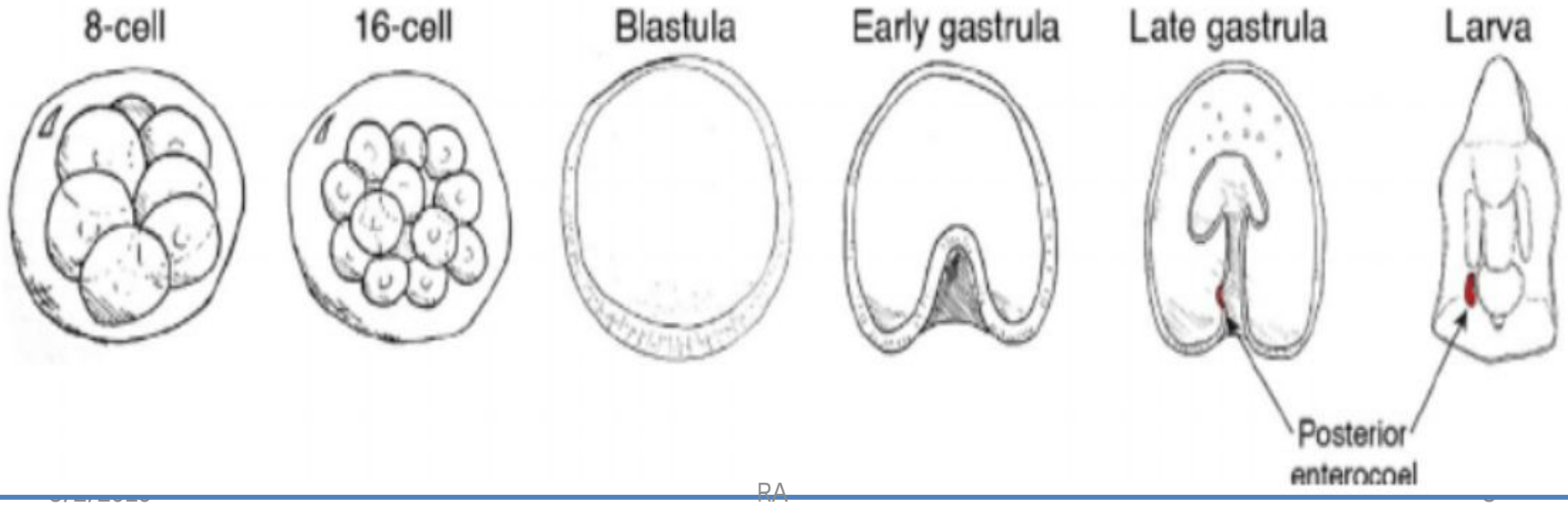
- In echinoderms eggs and sperms are released in water and fertilization takes place in water forming zygote.
- Echinoderms are deuterostomes and **hence cleavage is radial, holoblastic and indeterminate.**
- The larvae hatch in water and feed and grow through successive larval stages to become adults.
- 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.

A Sea urchin embryogenesis:



B Sea star embryogenesis:



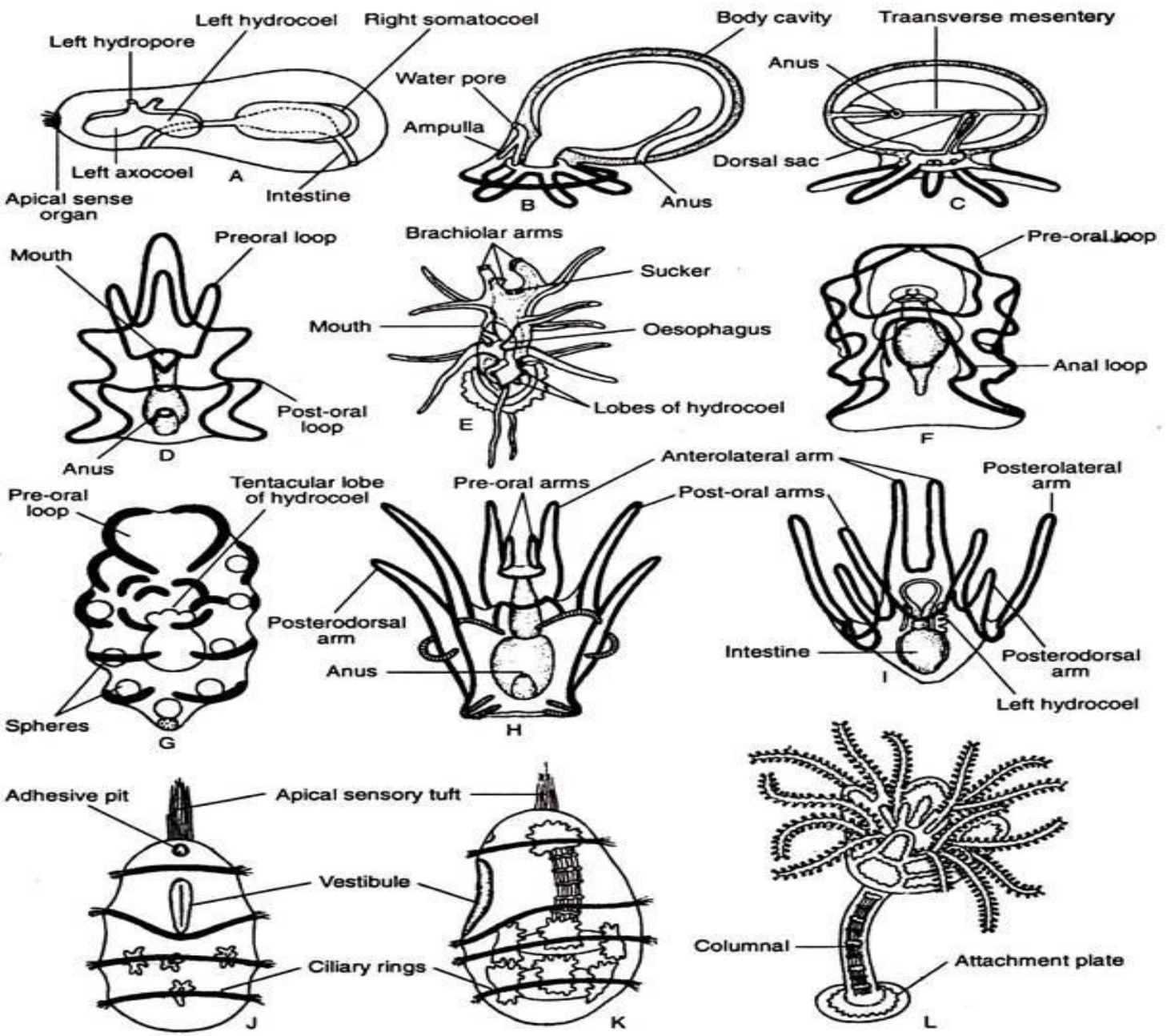
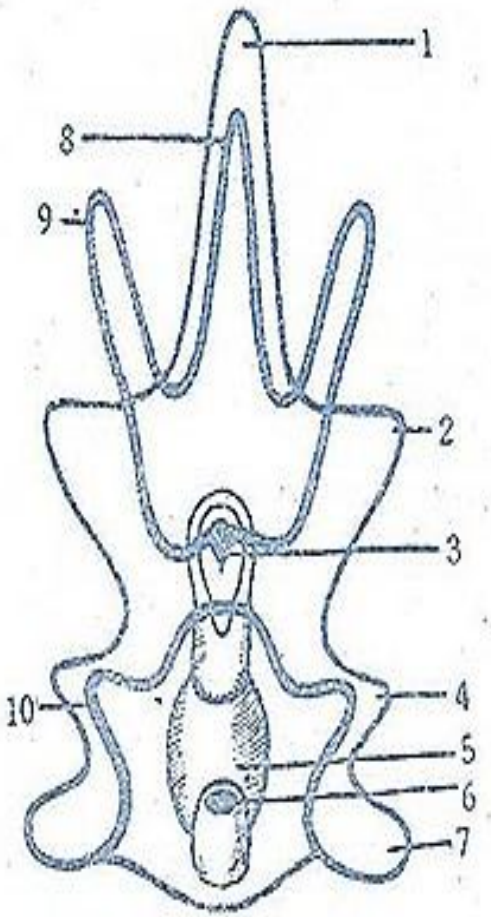


Fig. 21.39: Different larval forms in Echinodermata. A. Hypothetical *Dipleurula* larva. B. Bilateral stage of *Pentactula* larva. C. *Pentactula* larva after torsion of radial position. D. *Bipinnaria* larva. E. *Brachiolaria* larva. F. *Auricularia* larva. G. Transitional stage from *Auricularia* to *Doliolaria* larva. H. *Echinopluteus*. I. *Opiopluteus*. J. *Doliolaria* or *Vitellaria* larva of *Antedon*. K. Late *Doliolaria* larva of *Antedon*. L. *Pentacrinoid* stage of *Antedon*.

LARVAE OF ASTEROIDEA

- There are **three larval stages** in **Asteroidea** in the course of their development to adult stage.
- **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 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.



1. Dorso-Median arm
2. Dorso-lateral arm
3. Mouth
4. Postero-dorsal arm
5. Stomach
6. Anus
7. Postero-lateral arm
8. Ventro-median arm
9. Pre-oral arm
10. Post oral arm

BIPINNARIA LARVA

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 HOLOTHUROIDEA

- Class Holothuroidea demonstrate two larval stages, **namely, auricularia and doliolaria larvae**.
- **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.
- **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.

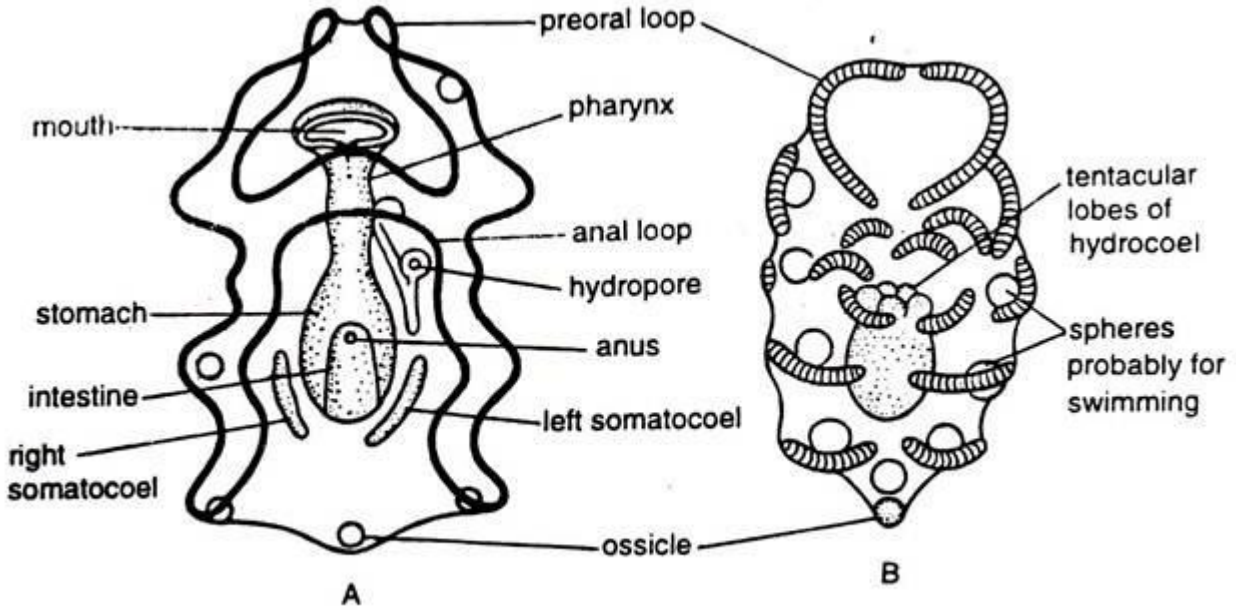


Fig. 27.12. A. Auricularia larva B. Transitional stage from Auricularia to Doliolaria larva

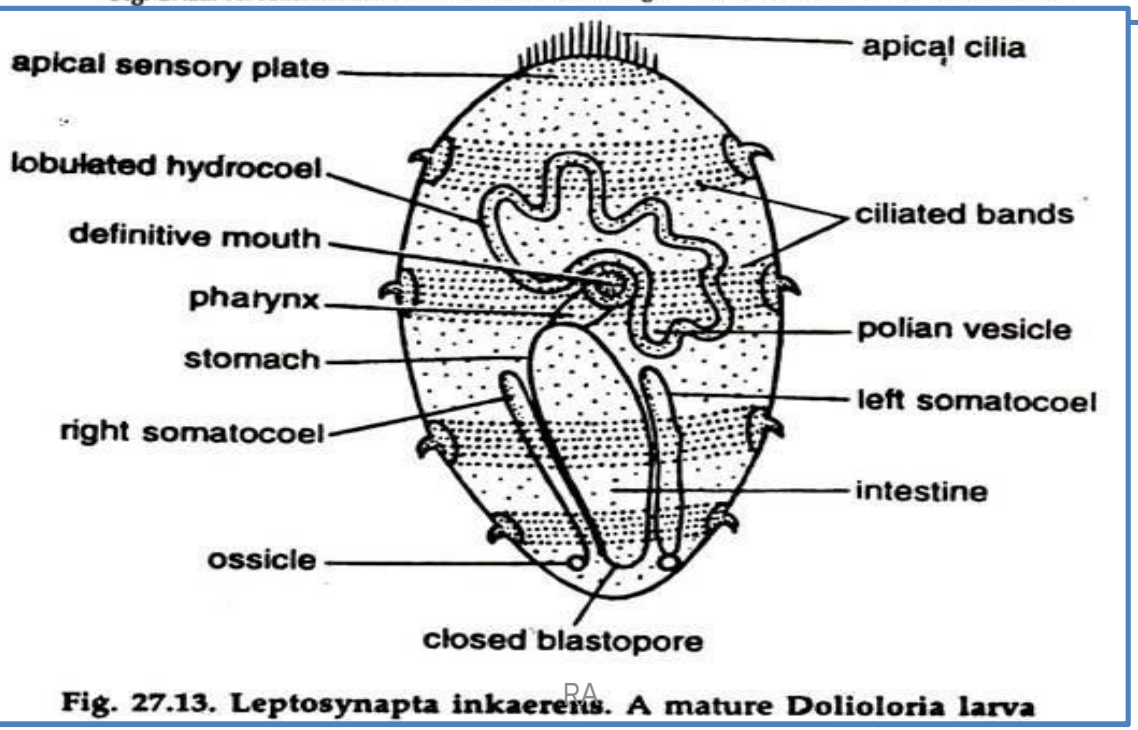


Fig. 27.13. Leptosynapta inkaerens. A mature Dolioloria larva

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 posterodorsal arms.
- Mouth, anus and gut are well developed.

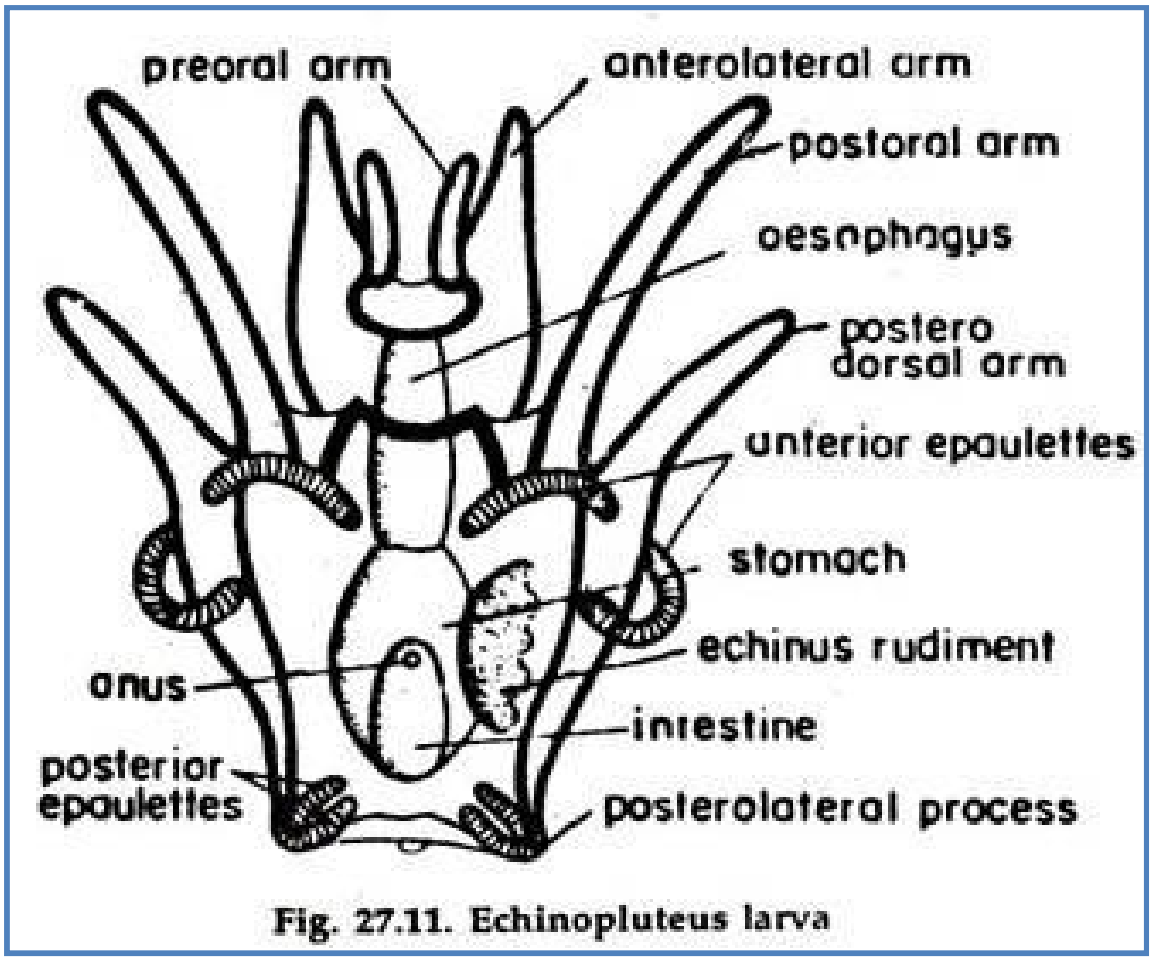


Fig. 27.11. Echinopluteus larva

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.

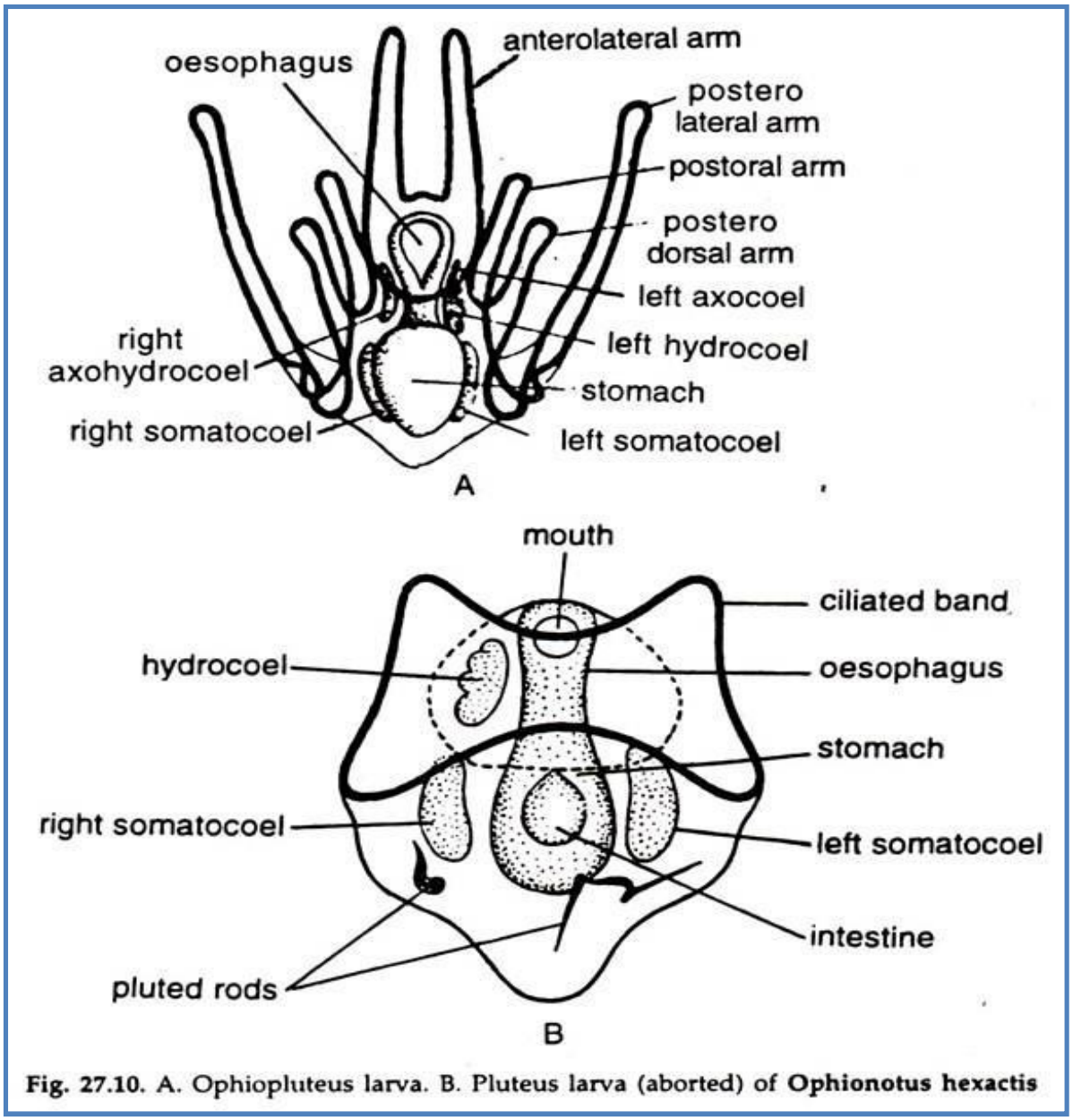


Fig. 27.10. A. Ophiopluteus larva. B. Pluteus larva (aborted) of **Ophionotus hexactis**

LARVAE OF CRINOIDEA

- **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.**

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.
- **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.

Homology and phylogeny of echinoderm larvae:

Except for the crinoids, a sedentary group, the larvae of Asteroidea, Holothuroidea, Echinoidea and Ophiuroidea exhibit some fundamental resemblances.

1. Preoral and postoral loops.
2. Ciliated bands V-shaped.
3. Presence of gut with its divisions and openings.
4. Coelom enterocoelic.
5. These and other common features indicate they had a common ancestor.