

# **RETROGRESSIVE METAMORPHOSIS IN UROCHORDATES**

- Urochordates, also known as tunicates or sea squirts, are a diverse group of marine animals belonging to the subphylum Tunicata within the phylum Chordata.
- One of the most intriguing phenomena observed in urochordates is retrogressive metamorphosis, a unique developmental process with significant evolutionary implications.
- **What is Retrogressive Metamorphosis?**
- Retrogressive metamorphosis is a type of development where an organism undergoes a regression or degeneration of certain structures during its transition from the larval to the adult stage.
- Unlike typical metamorphosis, where animals develop more complex features, retrogressive metamorphosis involves the loss or reduction of specific organs.
- Urochordates have a biphasic life cycle with distinct larval and adult stages.
- The larval stage, called the tadpole larva, possesses a notochord, dorsal nerve cord, and a tail, which are characteristics of chordates.
- Retrogressive metamorphosis occurs during the transition from the larval to the adult stage.

- Metamorphosis of the ascidian larva is unique and begins almost explosively.
- It involves transformation of an active non-feeding, pelagic, lecithotrophic (i.e., that feeds on its own yolk reserves) and tailed larva having many advanced features such as axial notochord, dorsal neural tube and special sense organs, into an inert, sedentary or sessile, simple (primitive) and plankotrophic filter feeding adult with only a pharynx with stigmata and endostyle, both indicating the chordate features of adult ascidian.
- In retrogressive metamorphosis the larva possesses advanced characters which are lost during the development and the adult is either sedentary or degenerated with primitive characters.
- Retrogressive Metamorphosis is a characteristic of Ascidian or Tunicates of Urochordate.
- Ascidians are sac-like marine invertebrate filter feeders which are composed of a tough outer "tunic" made of the polysaccharide cellulose, so they are also called Tunicates.
- Urochordate adults, being sedentary show degenerative characters while the free swimming tadpole larva shows advanced chordate characters which are lost during metamorphosis.

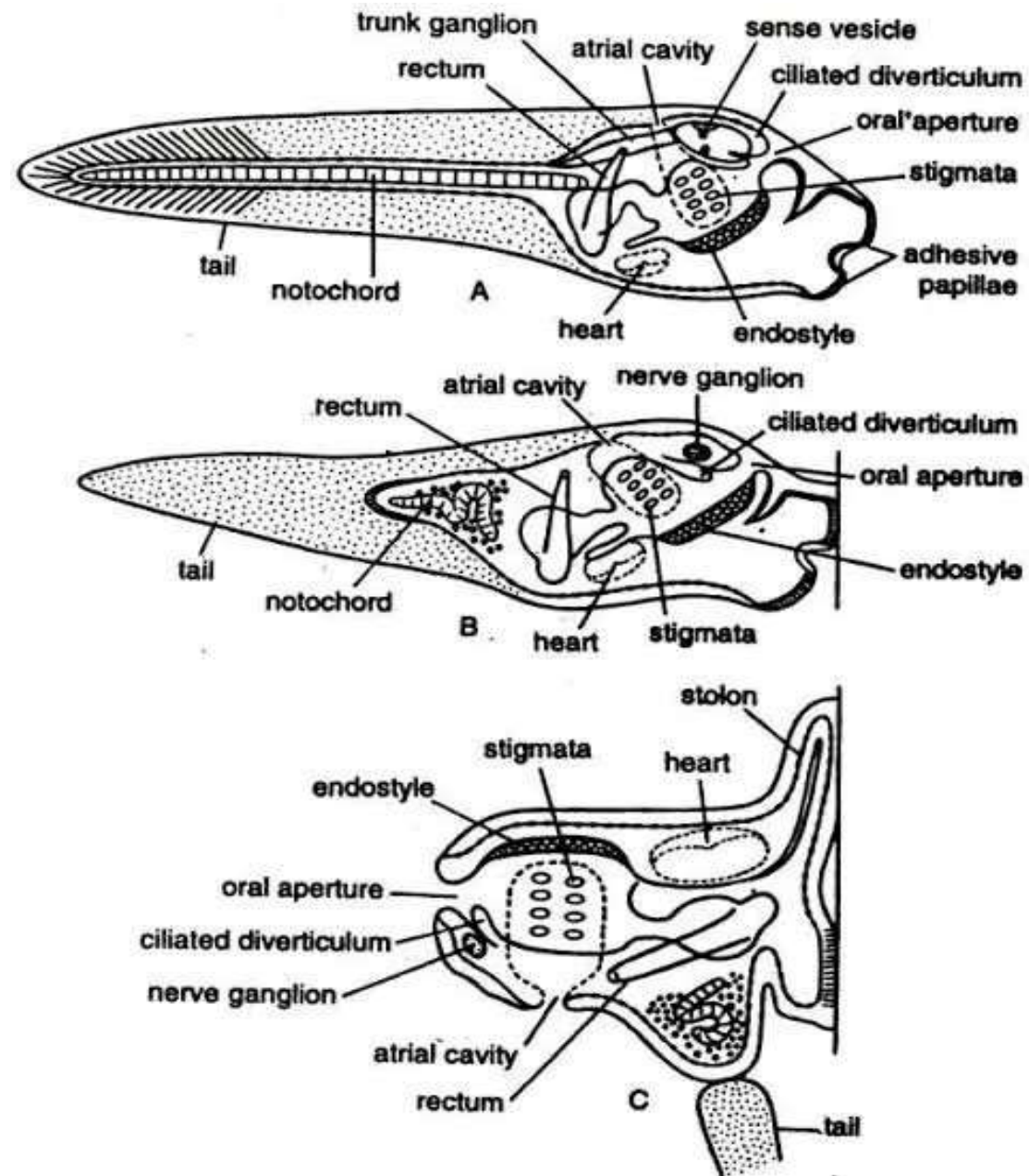


Fig. 30.6. *Ascidia* sp. Metamorphosis — free tailed larva into a fixed ascidian

- Retrogressive Changes:
- It involves degeneration or destruction of larval tissues and some structures such as follows:
  - a) The long tail with caudal fin starts reducing and finally disappear.
  - b) Caudal muscles, nerve cord and notochord disappear as they break down and are consumed by phagocytes.
  - c) Larval sense organs (the ocellus and the otolith) are lost and sensory vesicle is transformed into an adult cerebral ganglion.
  - d) Adhesive papillae and ectodermal ampullae disappear completely.
  - e) Anterior region between point of attachment (adhesive papillae) and mouth shows rapid growth, while original dorsal side with atriopore stops growth.
- This causes shifting of mouth through  $90^\circ$ . Therefore, the final branchial and atrial apertures in the adult represent the original anterior and dorsal sides of the larva.
- As a result of retrogressive metamorphosis the free swimming photo-positive and geo-negative ascidian tadpole larva changes in to fixed, inactive geo-positive and photo-negative adult. The chordate characters of larva like notochord, nerve cord and sense organs are completely lost in adult.

- **Importance of Retrogressive Metamorphosis**
- Retrogressive metamorphosis in urochordates is thought to reflect evolutionary adaptations to sessile, filter-feeding lifestyles.
- It represents a reduction in locomotion-related structures as these animals transition from free-swimming larvae to sedentary adults.
- **Ecological Significance**
- The adult urochordate form is specialized for filter-feeding, where water is drawn through a filtering apparatus to extract food particles.
- This feeding strategy is well-suited for stationary organisms and allows urochordates to thrive in various marine environments.
- **Evolutionary Implications**
- Retrogressive metamorphosis is considered an example of paedomorphosis, where an organism retains juvenile characteristics in its adult form.
- It provides insights into the evolutionary processes that shape the diversity of life forms and the adaptation to specific niches.

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