

Retrogressive Metamorphosis : Unit V (5.7)

Metamorphosis Gr., meta = after + morphe = form + osis = state) is the shape change in form during post-embryonic development and in many cases, signals a dramatic change in habitat of the animal such as pelagic to benthic existence.

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.

This type of metamorphosis which shows degenerative or retrogressive changes from larva to adult is called retrogressive metamorphosis.

It involves the following three types of changes:

(i) Retrogressive,

(ii) Progressive and

(iii) Molecular changes.

(i) Retrogressive Changes:

These changes involve destruction and disappearance of some of the larval structures such as follows:

a. Long tail of larva with caudal fin shortens and finally disappears.

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 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°. Therefore, the final branchial and atrial apertures in the adult represent the original anterior and dorsal sides of the larva.

(ii) Progressive Changes:

Some larval structures necessary for survival become more elaborated and specialised in each adult, such as:

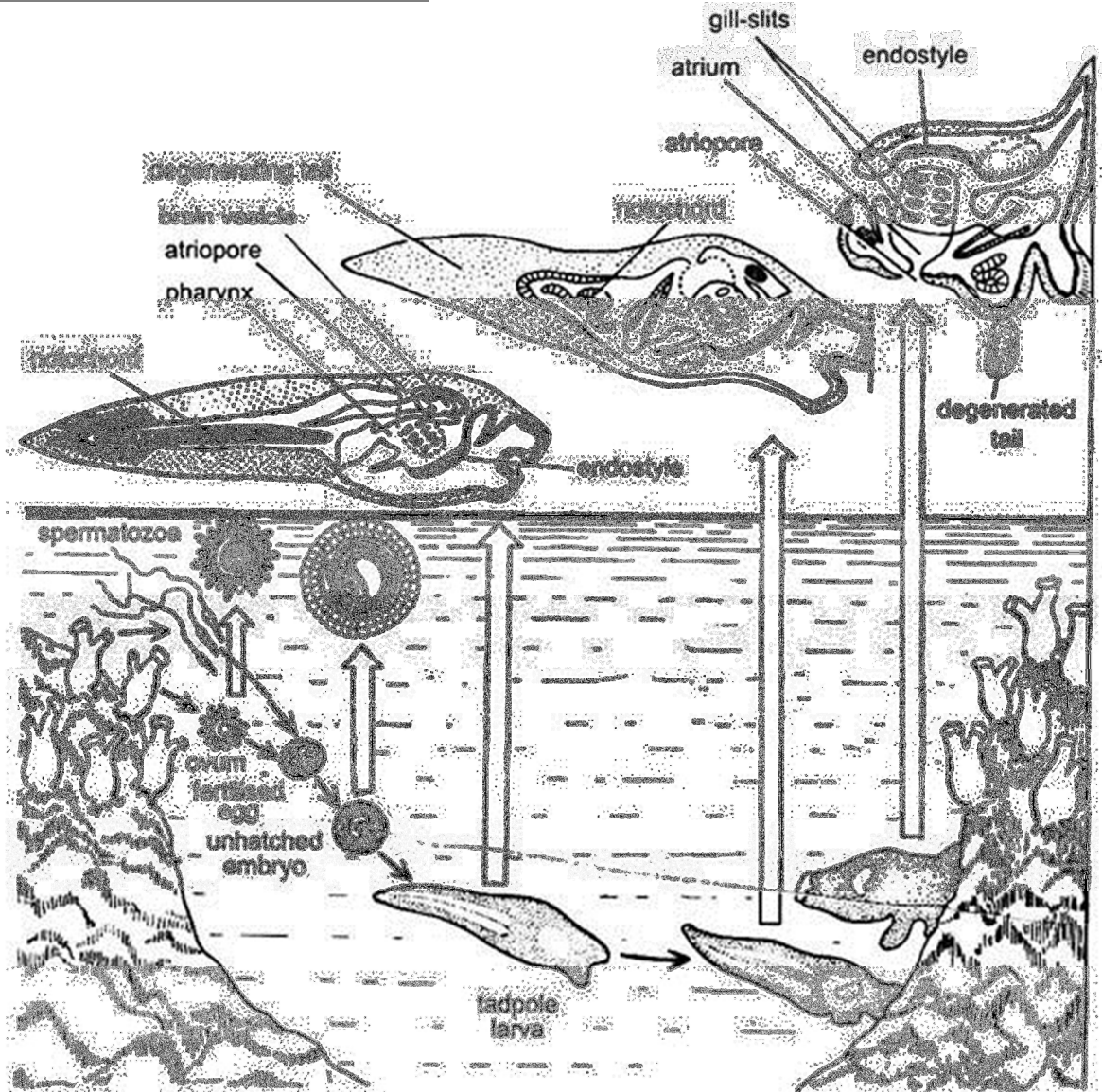


Fig. 35.4. Life cycle of a simple ascidian, showing retrogressive metamorphosis of tadpole larva, later its attachment with the solid substratum.

a. Due to loss of tail, the trunk becomes pear-shaped and four larger ectodermal ampullae grow out of its four corners. These ampullae firmly anchor the metamorphosing tadpole to the substratum and also serve for respiration as a blood-like fluid keeps circulating through them. Soon two more smaller ectodermal ampullae appear dorso-laterally.

b. Anterior region between point of attachment (adhesive papillae) and mouth exhibits rapid growth, while original dorsal side with atriopore stops growth. This causes shifting of mouth through 90°. The body too rotates so that general form of the adult sessile organism is assumed.

c. Adult neural glands and nerve or cerebral ganglion are formed by the neural tube and trunk ganglion come to lie mid-dorsally between mouth and atriopore. The trunk ganglion itself persists as visceral nerve.

d. With the absorption of its test covering, the mouth becomes functional and filter-mode of feeding by incoming ciliary water currents.

e. Pharynx greatly enlarges, develops blood vessels and stigmata multiply rapidly, forming the branchial sac.

f. Stomach enlarges, intestine elongates and gets curved and liver develops.

g. Atrial cavity becomes more extensive.

h. Circulatory system with heart and pericardium develops.

i. Gonads and gonoducts develop from larval mesodermal cells.

j. Test or tunic spreads to cover entire animal, becomes thick, tough and vascular and attaches the animal by forming a foot if necessary.

Thus, foregoing metamorphic changes mark the beginning of a sedentary, actively feeding, sexual adult life which soon starts producing gametes, first ova and later sperms.