

RETROGRESSIVE METAMORPHOSIS IN UROCHORDATA

Metamorphosis is a change from the juvenile to adult stage in which larval stage is quite different from the adult stage. 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. Similar type of retrogressive metamorphosis takes place in Urochordates i.e. in ***Herdmania*** where the free swimming tadpole larva shows advanced characters that are lost in metamorphosis and **adults show degenerative characters**. Urochordate adults, being sedentary show degenerative characters while the free swimming tadpole larva shows advanced chordate characters which are lost during metamorphosis. Parasitic crustaceans, like *Sacculina* and copepod parasites and stylopids and scale insects (Insecta) also show retrogressive metamorphosis.

LIFE CYCLE OF *HERDMANIA* DEPICTING RETROGRESSIVE METAMORPHOSIS

Herdmania is hermaphrodite, self-fertilization do not occur due to protogyny. The female gamete mature earlier than sperm and discharged into sea water after it the mature male gamete fused with an ovum in the sea water. The holoblastic cleavage occurs in the zygote and it becomes hollow ball called **blastula**. The blastula contains **blastocoel**, upper layered cells called **micromeres** and lower cells known as a **megameres**. The former layer forms ectoderm while the another forms endoderm. The blastula forms **gastrula** by epiboly. The division of micromeres causes invagination in the blastocoel and thus **archenteron** in formed which opens in blastopore. The blastopore becomes closed for the following further development. The gastrula increase on longitudinal axis, its dorsal surface becomes flattened and ventral surface becomes cortex. Finally, after subsequent changes gastrula develops into larva which is called **Ascidian Tadpole Larva**.

STRUCTURE OF TADPOLE LARVA:

The tadpole larva of *Herdmania* is only 1-2 mm long when it hatches out of the egg. It does not feed and hence has only 3 hours of survival during which it has to swim about in search of a suitable substratum for attachment. The larva needs advanced features for its free swimming existence, which is so necessary for dispersal of the population to distant places which the sedentary adult has no means to do.

The advanced chordate characters of the larva:

- There is a **rod-like notochord** in the tail to which are attached muscle bands for swimming.
- There is a **dorsal hollow nerve cord** which is enlarged to form brain at the anterior end. A photoreceptor ocellus and a balancing organ, the statocyst are attached to the brain.
- There are only two pairs of gill slits in pharynx but the mouth is closed by a membrane and intestine is rudimentary.
- **Endostyle** on the ventral side of pharynx is very well developed which functions like thyroid gland and helps in metamorphosis.
- Heart is on the ventral side of gut but is non-functional.
- The larva possesses three ectodermal adhesive papillae on the anterior end which help in firm attachment on the substratum.

Changes in larva during metamorphosis:

- Larva attaches to the substratum with the help of chin warts, head downward and tail up.
- Rapid growth takes place between the chin warts (adhesive papillae) and mouth and almost no growth on the opposite side of body.

- Due to rapid growth on one side, body starts rotating in such a way that mouth gradually migrates to the upper side.
- Meanwhile pharynx enlarges and stigmata increase in number. Intestine becomes functional and atrial opening is formed on the opposite side of oral aperture.
- Both tail and notochord are gradually absorbed in the body during metamorphosis.
- The hollow nerve cord is reduced into a solid nerve ganglion on the dorsal side.
- Sense organs, namely ocellus and statocyst are lost.

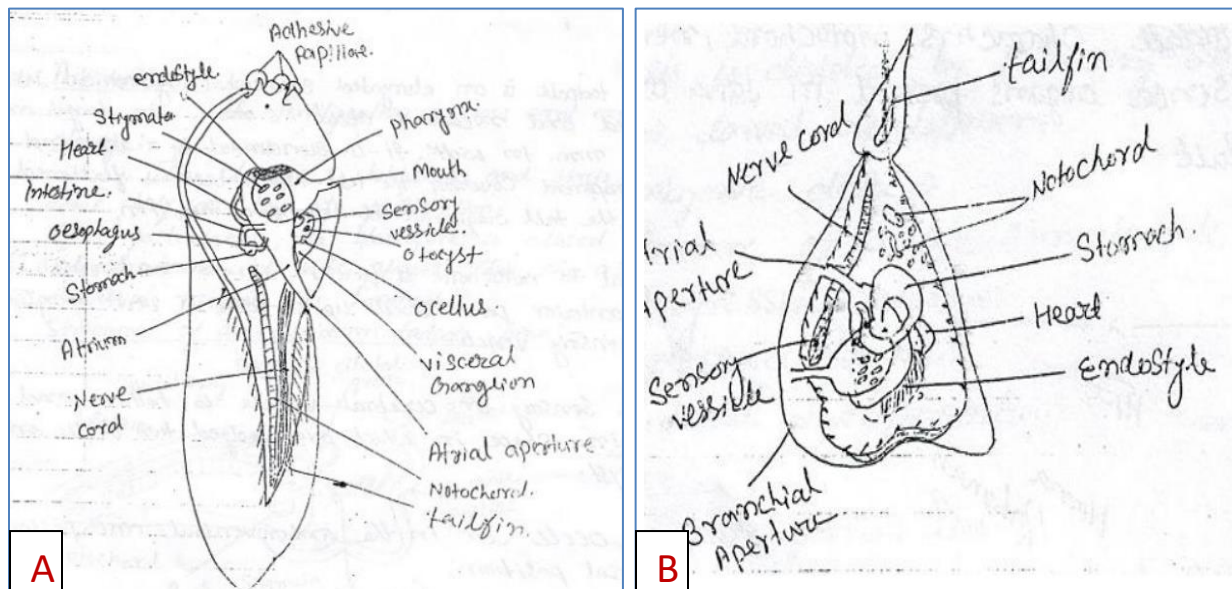


Fig.: (A) Structure of tadpole larva, (B) Reabsorption and breaking of tail to metamorphosis into sedentary adult.

When the metamorphosis is over, *Herdmania* is transformed into a bag-like sedentary animal attached to the rock by a foot and having branchial and atrial openings for inlet and outlet of water respectively. Pharynx becomes enormously enlarged with a large number of stigmata for filter feeding and digestive system becomes well developed. However, other advanced chordate characters of the larva are degenerated into simple structures, due to which it is called **retrogressive metamorphosis**.