B.Sc. Zoology (H) Part-I, Paper-I, Group-A, Topic- Torsion and Detorsion in Gastropods Lecture Notes By Dr. Arjun Pratap Singh

In freshwater and terrestrial molluscs, there is no free swimming larval stage. Both trochophore and veliger stages are passed inside the egg and a tiny snail hatches out of the egg. Early larva is symmetrical with anterior mouth and posterior anus and gills lie on the posterior side. As the larva develops shell its visceral mass starts twisting in anticlockwise direction to rearrange the visceral organs so that they are accommodated inside the coils of the shell and openings of organs are shifted to the anterior side where the shell opening lies.

During torsion visceral and pallial organs change their position by twisting through 180°. Posterior mantle cavity is brought to the front position. Gills and kidney move from left to right side and in front which helps in breathing. In nervous system the two pleurovisceral connectives cross themselves into a figure of 8, one passing above the intestine and the other below it. Alimentary canal twists in the visceral mass and opens by anus on the side of the head on the anterior side. After torsion the foot can be withdrawn after the head.

During torsion head and foot remain fixed and rotation takes place in the visceral mass only behind the neck so that the visceral organs of the right side come to occupy the left side and vice versa. Before torsion the visceral mass points forward and the mantle cavity is posterior in position. This position is called **exogastric**. After torsion the position becomes **endogastric** in which visceral mass points backwards and intestine lies in the whorls of the shell and anus opens on the anterior side.

Ninety percent of the torsion is affected by the **right retractor muscle** which is quite prominent in the larva while the left retractor muscle is rudimentary. Rest of the 10% of torsion is caused by the differential growth of the visceral mass. Torsion takes place quickly and is completed from 15-30 minutes.

Anticlockwise rotation of the visceral mass causes **dextral** (right handed) coiling of the shell, which happens in majority of the cases. However, rarely clockwise rotation of visceral mass also takes place, which causes **sinistral** (left handed) coiling of the shell.

SIGNIFICANCE OF TORSION

As gastropod shell has only one opening, it has to serve as entrance as well as exit for all visceral organs. Both mouth and anus must open on the anterior side. Mantle cavity also must open on the anterior side for easy respiration. Respiratory current opposes

locomotion after torsion which increases availability of water inside the branchial chamber. Visceral mass has to undergo rearrangement so that openings of kidneys, gonads and anus should migrate to the front side which is the only opening of the shell. The small chemoreceptor **osphradium** also migrates to the front side so that it could chemically analyse water current entering the mantle cavity. The bulky buccal mass migrates to the anterior side that provides stability during locomotion. Torsion allows foot to be retracted after the head for better protection of head.

DETORSION

Detorsion is reversal of torsion which takes place when during evolution shell is lost or a type of shell evolves that has openings on the opposite sides. In such situations twisting of visceral mass is not necessary. Hence, detorsion takes place during the larval stage and the animal again becomes bilaterally symmetrical. Nervous system becomes symmetrical and not twisted in the shape of 8. Pallial complex travels backwards. Ctenidium travels backwards or to the lateral side. Auricle moves behind the ventricle. Visceral loop and intestine become straightened.

Detorsion takes place in Pulmonata, such as *Acteon* and *Bulla* in which anus and ctenidium are directed laterally. In *Aplysia* (Opisthobranchia), detorsion takes place owing to the loss of shell. The gills are directed laterally but lie posterior to the heart and the body becomes symmetrical.

In *Pterotracheacoronata* (floating sea slug) the shell, mantle and visceral sac are lost and hence the animal becomes symmetrical, worm-like with a long proboscis for feeding.

Nudibranchs *(Eolis* and *Doris)* also undergo detorsion due to the loss of shell. *Doris* has symmetrical rhinophores and anal gills on the posterior side. The sea slugs, *Eolis* and *Iolidia* are symmetrical animals because they have undergone detorsion due to the absence of shell. They move with the help of a ventral foot and breathe with respiratory cerata that are present all over the body.