

# ZOOACORO3T: UNIT 05

## MOLLUSCA- TORSION IN

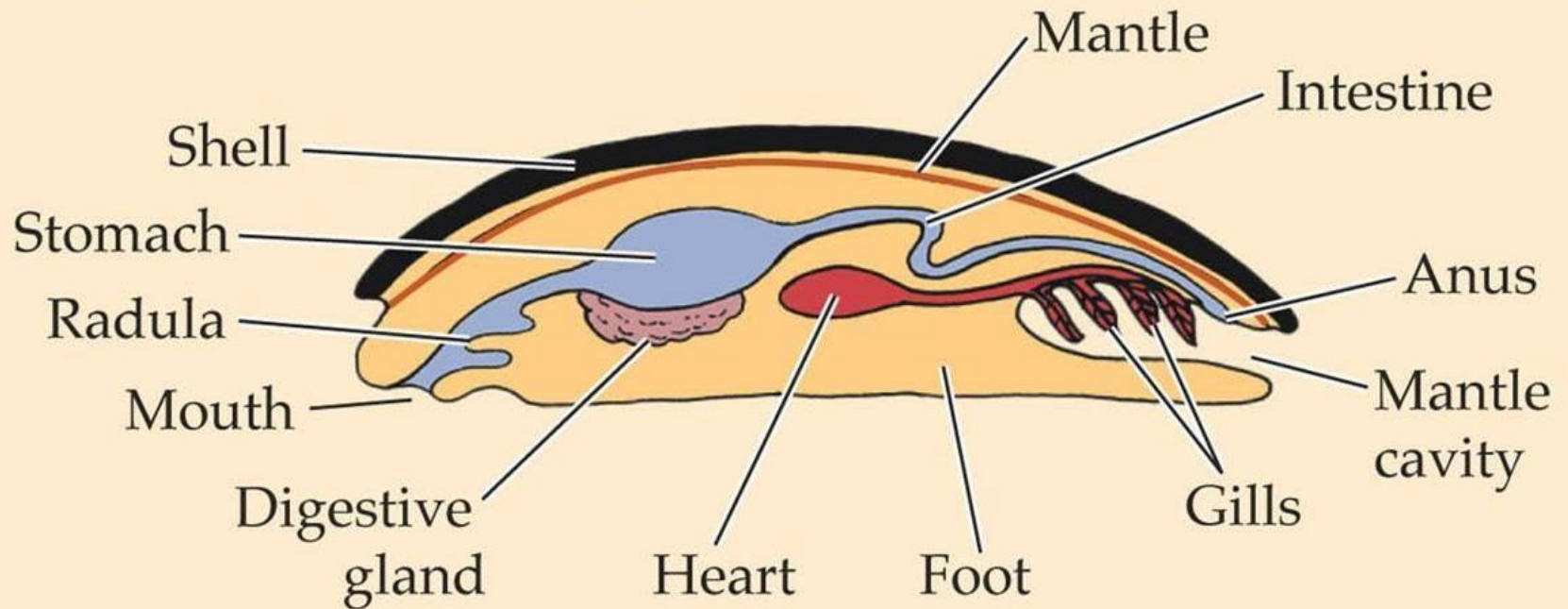
### GASTROPODS

#### What's a torsion?

Torsion may be defined as a pleisiomorphic character trait of evolutionary process present in larval gastropods of phylum mollusca, where the visceropallium of the body is rotated anti clockwise through  $180^\circ$  from its original position on head-foot complex arising the asymmetry in visceral organs formation and position.

# Body plan of a mollusca

Generalized molluscan body plan



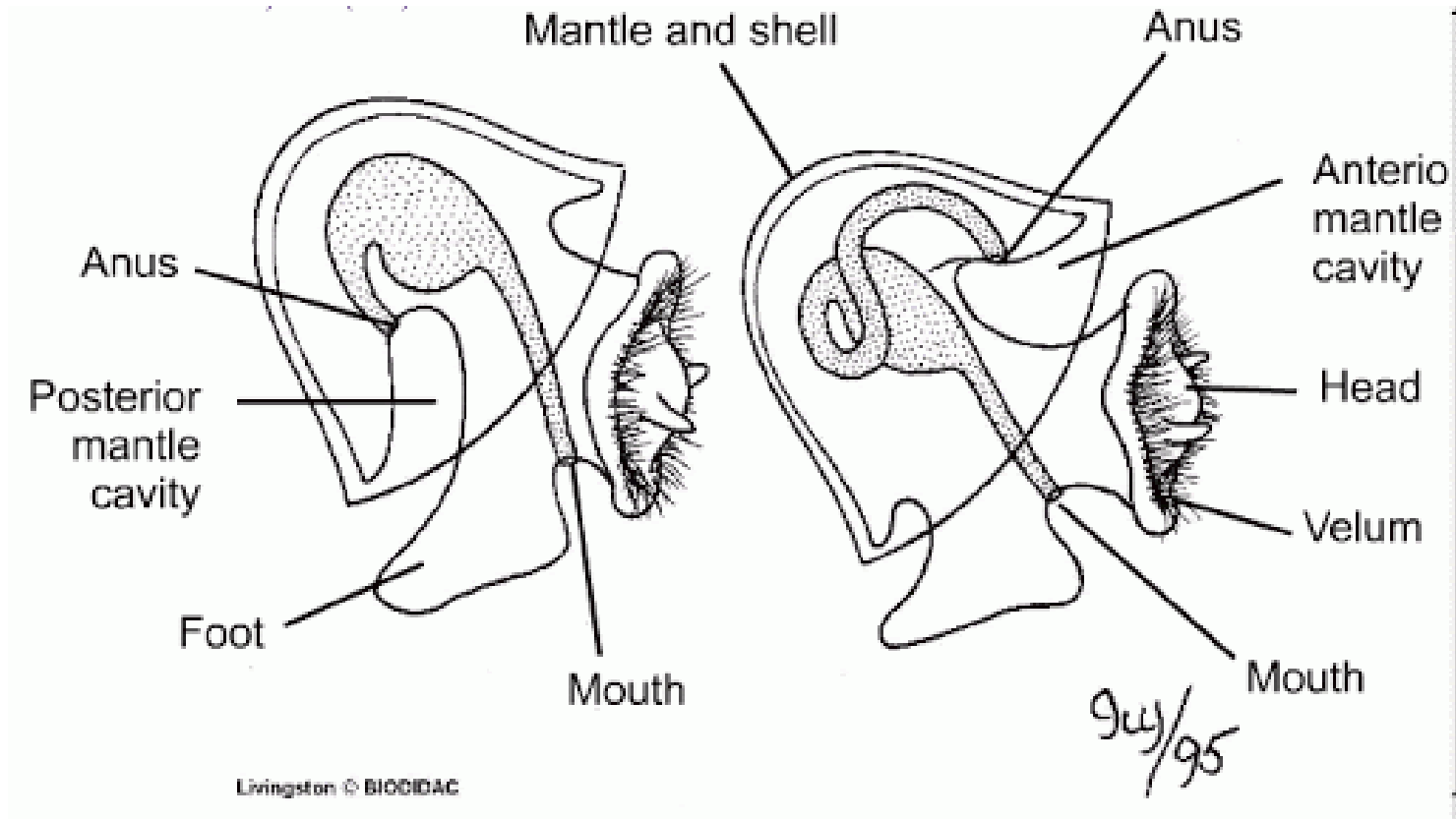
# Torsion a phenomenon occur during formation of embryo of a gastropod

- Visceropallium rotated anti-clockwise through  $180^\circ$  from its initial position on head-foot complex
- Probably the contraction of larval retractor muscles account for  $90^\circ$  of the rotation
- Differential growth of the body tissue accounts for the rest  $90^\circ$
- Site : behind the head-foot complex
- Time and duration: Complete very rapidly, but may last from 2-3mins to few hours or days

# Ways- 5 ways

- 180° rotation by muscle contraction alone
- 180° rotation achieved in 2 stages
- 180° rotation achieved by differential growth process alone
- Torsion achieved by differential growth process
- Torsion recognisable as a movement of visceropallium

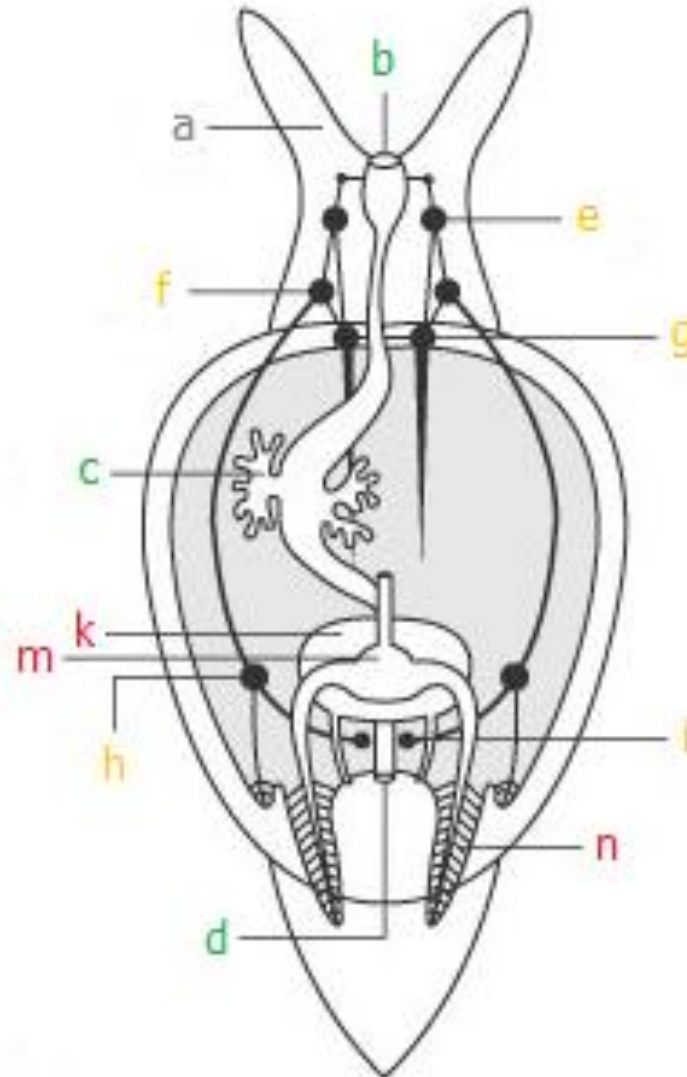
# Mechanism of torsion



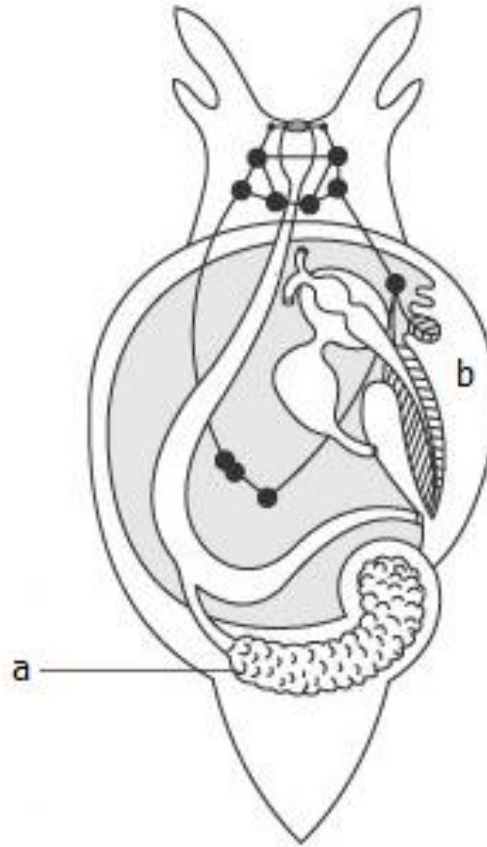
The process of torsion commences as soon as the larval retractor muscles develop contractile power.

- Accomplishes in 2 stages.
- Stage 1 : accounts for involvement of 90° rotation due to muscle contraction and mantle cavity shift it's position from posterior to anterior end.
- Stage 2 : accounts for differential growth involving remainder 90° of rotation.

# Stages of Torsion :1.Pre-torsional Stage

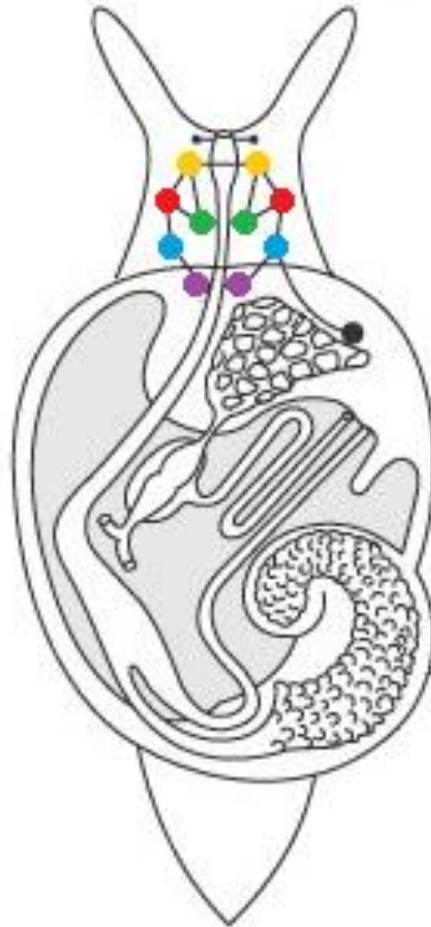


## 2. Torsional stage showing 90° rotation





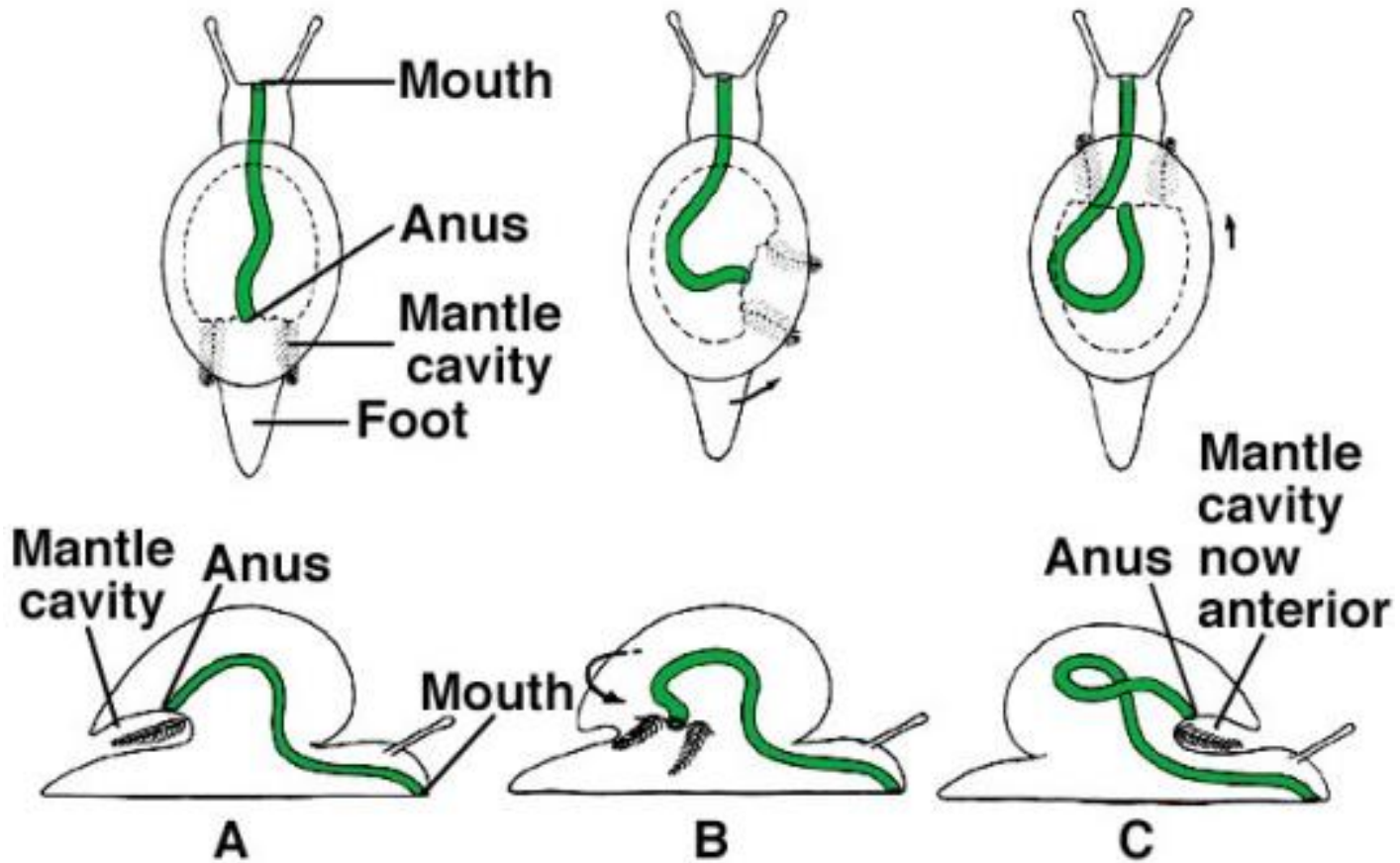
### 3. Torsional stage after 180° torsion



# Effects of torsion

- Mantle Cavity shifts
- Relative positions of visceral organs: anus, ctenidia and renal orifices; auricle and ventricle; visceral sac
- Looping of alimentary canal: become 'U' shaped
- Effect on nervous system

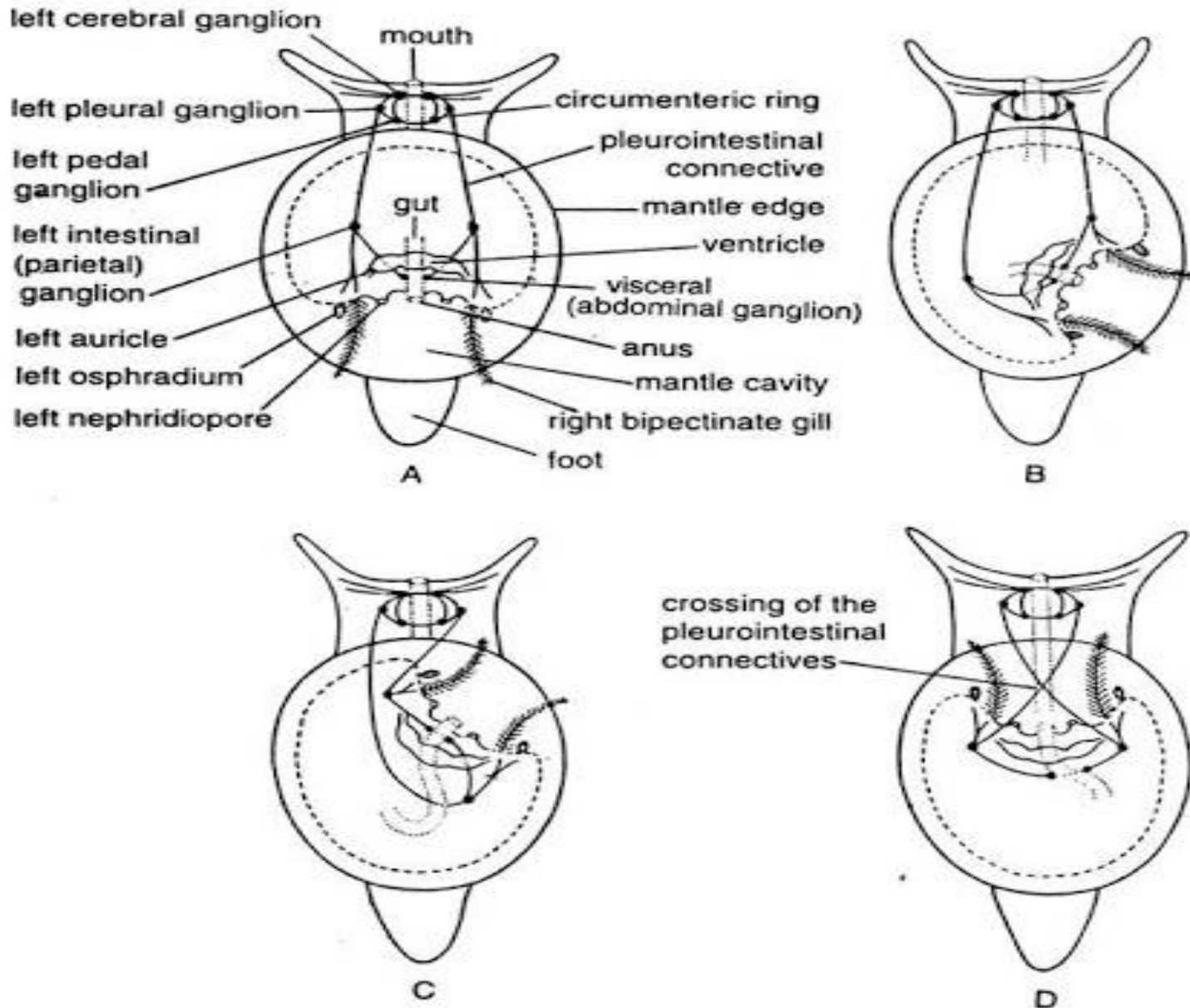
# Effects on Alimentary canal and mantle cavity



Whatever the mechanisms involves, torsion has remarkable impacts on changing the position of mantle cavity and as well as shapes of organs resulting in loops or crosses

- Shifting of mantle cavity: Originally lies ventrally and posteriorly before torsion; now comes dorsally and open just behind the head.
- Changes in relative positions of visceral organs: Anus, Ctenidia and renal orifices that are projected backward before torsion, now projected forward; auricles formally lies behind ventricle now comes in front of it and posterior face of visceral sac becomes it's anterior face, named endogastric coil.
- Looping of alimentary canal : alimentary canal origiunally straight before in antero-posterior body axis before torsion, become 'U' shaped due to shifting of position of anus at anterior side at the level of mouth.
- The coiling of the shell is not associated with the torsion and was a separate evolutionary event and the shell remained a symmetrical spiral.

# Effects on Nervous system



## Effects on nervous system shows many types of formation in different species: 1. Formation of Chiastoneury or Streptoneury

- Due to torsional rotation of the visceral mass, the developing nervous system in the post-torsional larva suffers a twist in its pleuro-parietal connective.
- Original right parietal ganglion comes to lie on the left, dorsal to the gut and called the supra-intestinal ganglia; and left comes to right side below the level of gut at close to pedal ganglia, called infra-intestinal ganglia.
- As parietal ganglia have reversed the sides, the pleuro-parietal connective cross each other, giving the entire visceral loop twisted in a figure of '8' , a condition named Chiastoneury or Streptoneury.
- Simple Chiastoneury present in *Pila sp* and complicated forms are present in *Patella sp*, also sometimes present with a zygoneury.

## 2. Formation of Zygoneury

- There exists connection between the pallial nerves from the pleural ganglion and the nerve from the intestinal ganglia into the mantle. This type of secondary pleuro- intestinal connection is regarded as Zygoneury. *Ex. Triton sp, Heliotis sp*
- Such connection on the right side also exists in some forms.
- If zygoneurous condition is present on both the sides, such a condition is called the Dialyneury.

# Chiastoneury and Zygoneury

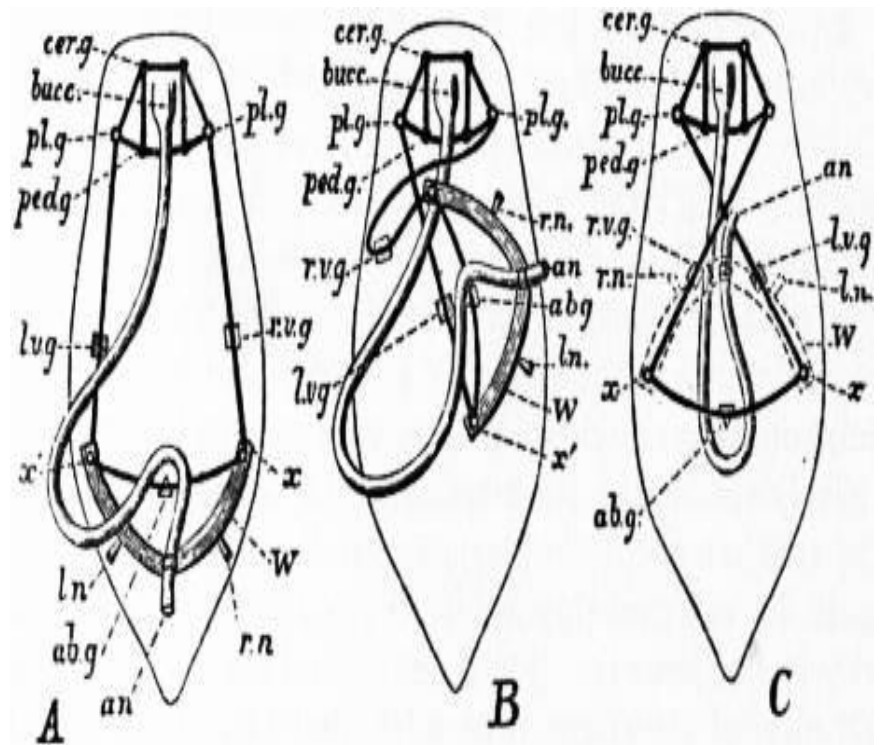
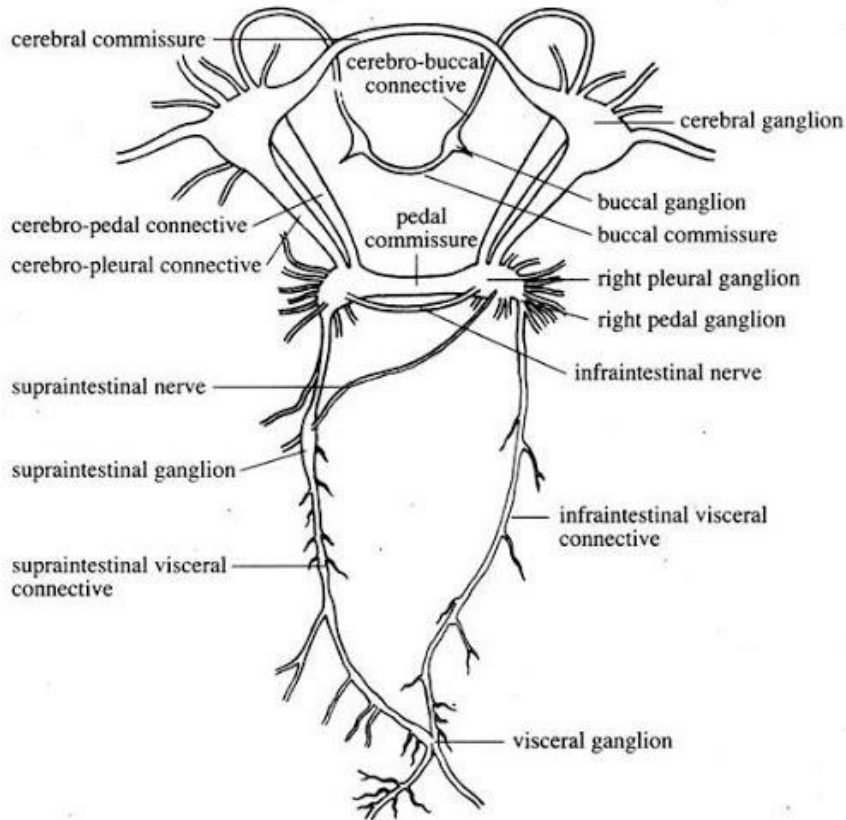


Fig. 2.108 : Nervous system of *Pila*.

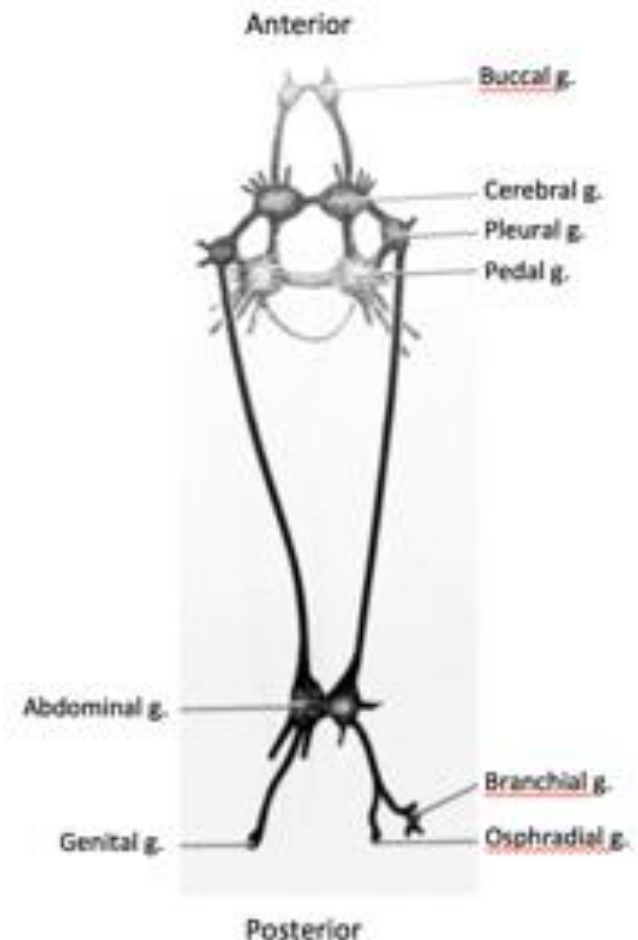


## Signification of Torsion: As torsion impart an evolutionary significance on gastropods as it appears in ontogeny of the living gastropods.

- **Garstang's View:** Supports the view that torsion represents a larval adaptation for protection of head, as anterior replacement of mantle cavity in the larva resulted in greater protection of the head along with foot by situating at only a single aperture in shell.
- **Morton's View:** postulates that anteriorly placed mantle cavity contains chief 4 purposes in adult gastropods: respiration, excretion, digestion and sensory functions.
- **Ghiselin's view :** the primitive gastropods developed a conical shell on the dorsal surface for protection instead of shield-like shell to maintain the balance of body the shell of the gastropods prolonged anteriorly. But for the crawling purpose it was disadvantageous bearing such anteriorly prolonged shell. The shell containing anterior-prolonged side rotated into the posterior through  $180^\circ$  during torsion. So it has become advantageous in the adult stage.

Detorsion: Torsion, a pleisiomorphic evolutionary trait present in gastropods of phylum mollusca, in some cases reverts to a certain extent, if not fully back, leading to untwisting of the visceral hump and loop; thereby restoring the symmetry of visceral organs.

- Present in opisthobranchs and pulmonates; Ex. *Aplysia sp*
- Effects of detorsion:
- Euthyneury: a condition is the result of either detorsion or double torsions, the anterior concentration of the different ganglia at cerebral position by shortening the commissures and connectives but visceral loop restoring the symmetry, as the suprainstestinal ganglion has moved to become fused with the right pleural ganglion and the infraintestinal ganglion is similarly fused with the left pleural ganglion. The different ganglia on the circumenteric nerve ring are well-separated.



## Significance of detorsion: It has a prominent evolutionary significance as reverting the pleisiomorphic form of torsion.

- Restoration of symmetry would be considered as their secondary adaptation.
- Respiratory function: liberation of gills from an enclosure(shell) to an advantageous naked form to open incurrent water flow.
- Absence of Shell enacts the idea of adaptation of high speed locomotion.
- Establishment of quick response to chemical sense and well developed neuronal response because of loss of shell.
- Aggression of ganglia at head position opines the idea of primitive brain formation.