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TORSION IN GASTROPODA

Introduction :

All the living molluscs, except the Gastropoda, retain ancestral bilateral symmetry of the body, with mantle cavity lying posteriorly or laterally. Gastropods, on the other hand, possess an asymmetrical body with mantle cavity lying anteriorly, and the shell and the visceral mass coiled spirally and directed posteriorly. In spite of their asymmetry, Gastropoda are generally believed to have descended from an unsegmented and bilaterally symmetrical ancestor with a low conical shell, a straight alimentary canal ending in a posterior anus, and mantle cavity posterior, that is, lying behind the visceral dome. Anterior situation of the mantle cavity in gastropods is due to **torsion** or **twisting** of the visceral mass during development.

Definition of Torsion :

Torsion or twisting is a process, during larval development of gastropods, which rotates the viscero-pallium anti-clockwise through 180^{o} from its initial position,

so that mantle cavity, with its pallial complex, is brought in front of the body, in adult.

Torsion Versus Coiling :

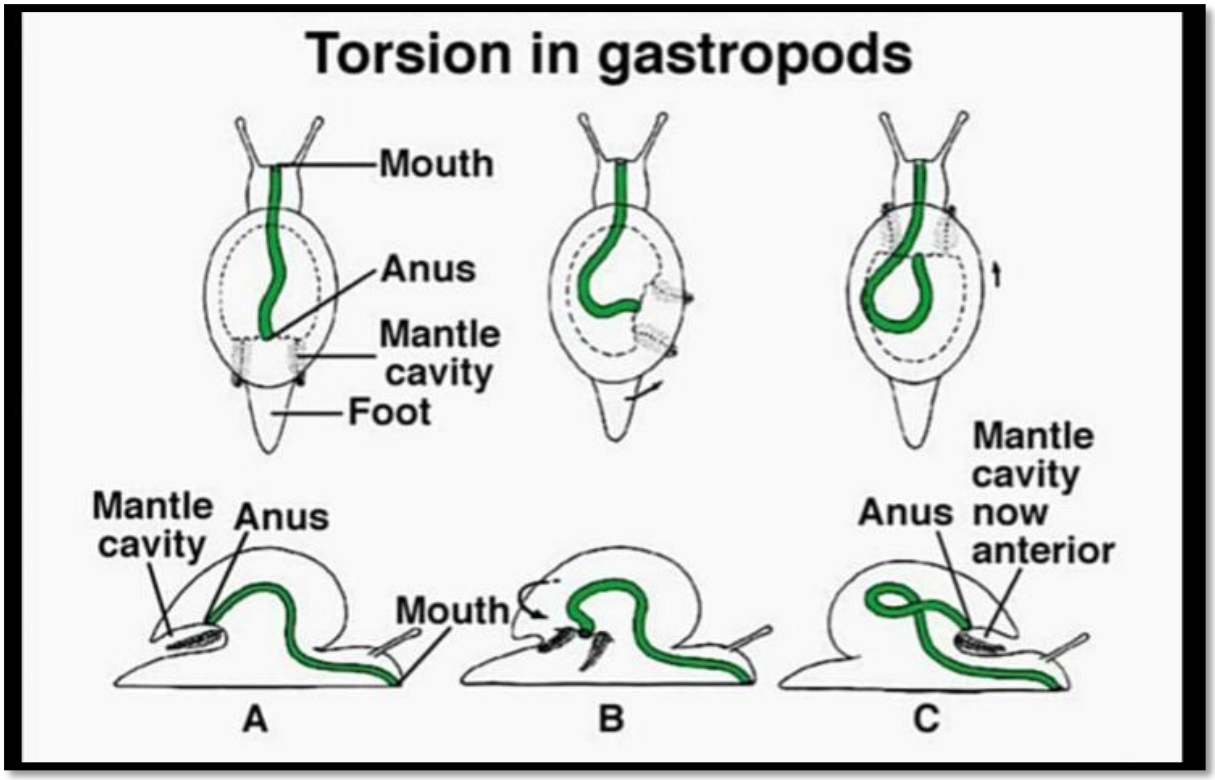
Torsion : Torsion is often confused with spiral coiling of visceral mass and shell, but the two are entirely distinct and quite independent. Torsion is not coiling of the shell which starts even much before coiling.

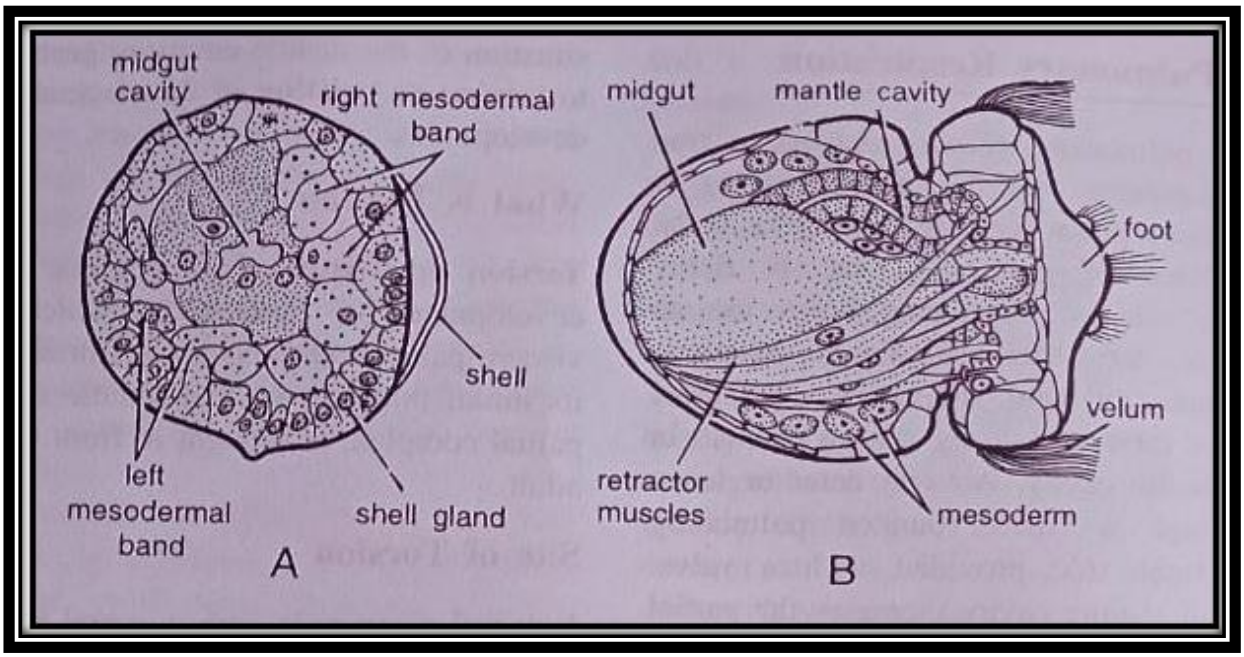
Coiling : Coiling is achieved by a more rapid growth of one side of the visceral mass than the other. Torsion and coiling are, therefore, separate evolutionary events. Torsion was a much more drastic event than the spiralling of shell.

How Torsion Occurs?

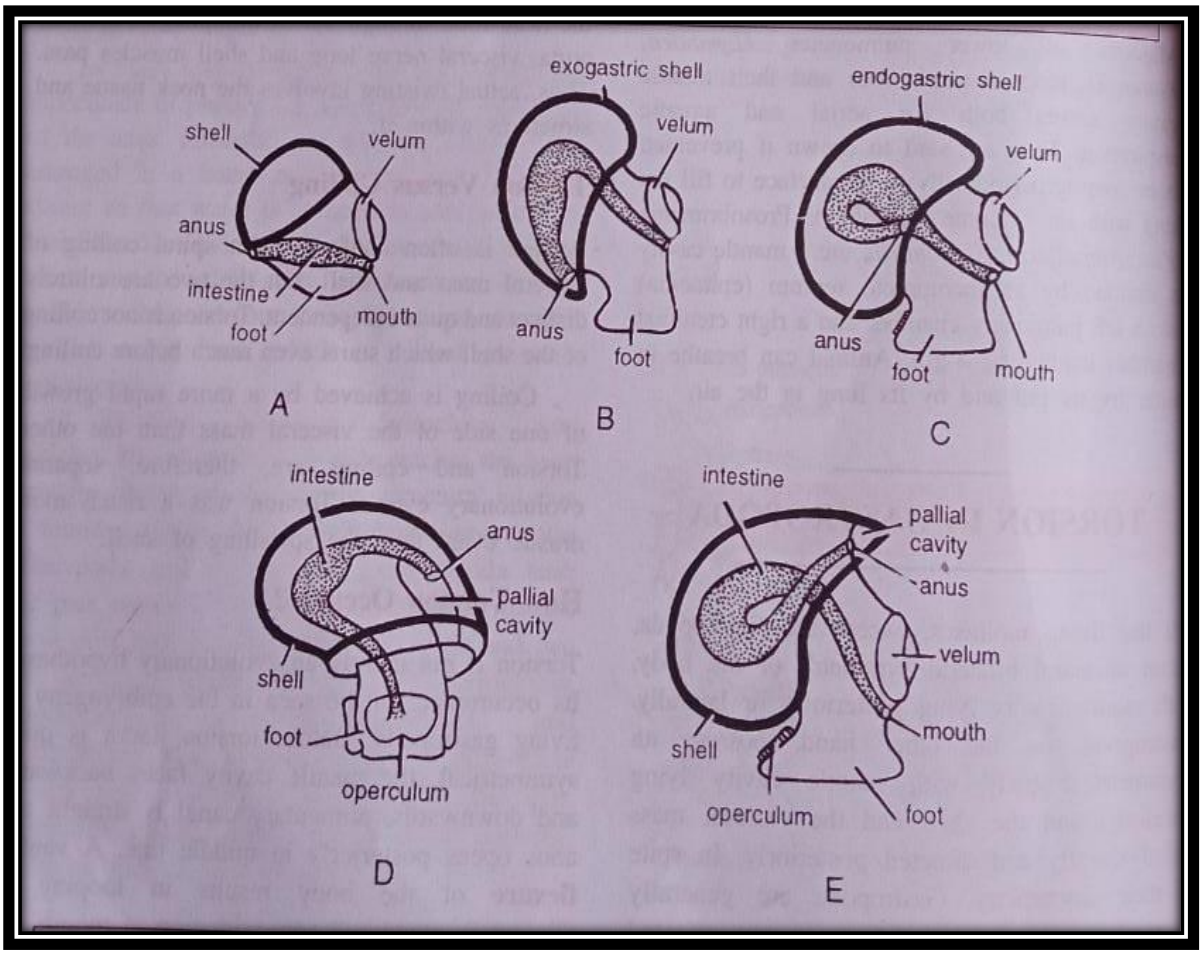
Torsion is not merely an evolutionary hypothesis. Its occurrence can be seen in the embryogeny of living gastropods. Before torsion, larva is quite symmetrical, the mantle cavity faces backwards and downwards, alimentary canal is straight and anus opens posteriorly in middle line. A ventral flexure of the body results in looping of alimentary canal and approximation of mouth and anus, Shell and visceral mass, originally saucer- shaped, become first cone-shaped and later

spirally coiled. Shell lies dorsally and forms a coil on the anterior side; such a shell is called exogastric.





Mechanism of torsion. **A.** T.S. early veliger of ***Haliotis*** showing disproportionate growth of right mesodermal cells. **B.** 48 hour larva of ***Patella vulgata*** showing a symmetrical retractor muscle.



Five successive stages in the development of a gastropod to show occurrence of torsion. **A.** Early veliger a or pretorsional stage in lateral view. **B.** Larva with ventral flexure and an exogastric shell in lateral view. **C.** Stage showing 90^{o} of lateral anticlockwise torsion. Shell becomes endogastric. Mantle cavity and anus move right side. **D.** 90^{o} torsion stage in posterior view. **E.** Adult stage with complete or 180^{o} torsion in lateral view

Ventral flexure is followed by a lateral **torsion**, so that dorsal or exogastric shell becomes ventral or **endogastric**. Lateral torsion is probably due to arrest of growth on one side and active extension on the other. Generally, growth of the right side becomes retarded so that mantle cavity and pallial complex gradually pass round to right side, and so to the anterior side, on account of greater growth of the visceral sac towards the left. But the whole process completes in

2 or 3 minutes in *Acmaea*, so that it cannot be regarded due to differential growth. On the contrary, it is due to muscular contractions. Actual mechanism of torsion is supposed to be the asymmetrical position and pull of the larval retractor muscles running from the velar lobes to the shell. They are present only on the right side, there being no related muscles on the left side. Contraction of larval retractor muscles brings about the rotation or torsion. Only narrow neck of the larva is actually twisted. Consequently, everything between the head and anus undergoes an anticlockwise rotation or torsion through an angle of 180 around a vertical axis passing in a dorso-ventral direction.

Thomson (1958) after careful study recognises five ways in which torsion can be brought about :

1) Complete or 180^{o} rotation, achieved by muscles contraction alone, is known only for ***Acmaea*** (**Archaeogastropoda**).
2) 180^{o} rotation achieved in two Stages, first 90^{o} movement by contraction of larval retractor muscles and later a slower 90^{o} rotation by differential growth. It is the commonest mechanism which is known today, e.g.**, *Haliotes, Patella***.
3) 180^{o} rotation by differential growth processes alone, e.g., ***Vivapara***.
4) Rotation by differential growth processes, with anus coming to a position appropriate to adult state, e.g., ***Aplysia***.

Torsion no longer recognisable as a movement of viscero-pallium, the organs in post-torsional position from their first appearance, e.g **., *Adalaria*.**

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