LOCOMOTION IN Amoeba

- *Amoeba* sp. belongs to subkingdom Protozoa and phylum sarcomastigophora. They have pseudopodia as locomotory organelle. Pseudopodia are temporary extensions of cytoplasm from any parts of the body. Pseudo means false or temporary and podia means foot i.e. false foot. Pseudopodia are formed from ectoplasm but also have a core of endoplasm. Among sarcodina ,the following kinds of pseudopodia are found :

1. **Lobopodia:** These are short finger like projection with rounded –tipped pseudopodia containing both ectoplasm and endoplasm.
2. **Filopodia:** These are slender, filamentous hyaline projections, formed exclusively of ectoplasm. Filopodia have pointed tips and a tendency to branch and radiate in all directions.
3. **Reticulopodia or Rhizopodia:** These are thin, long filamentous structures of endoplasm which branch extensively and fuse together to form mesh works that act as food traps.
4. **Axopodia:** These are long, slender, stiff extensions of ectoplasm which radiate from circular body in all directions.

Pseudopia of amoeba: Amoeba possess short, finger-like with rounded tipped pseudopodia called lobopodia.These type of pseudopodia consists by both ectoplasm and endoplasm. Concentrated, granular centrally located cytoplasm is called endoplasm and peripherally located less dense, agranular cytoplasm is called ectoplasm. Anterior cap like projection formed during pseudopodia formation is called hyaline cap.

According to MAST the body of the Amoeba is made up of four parts-the thin and elastic plasma membrane, the plasma gel, the plasma sol and hyaline fluid in between the membrane and plasmagel.action and interaction between these four parts result in pseudopodia formation.

LOCOMOTION : locomotion in Amoeba is creeping in nature and is dependent upon an intimate and direct contact with a substratum. Creeping in Amoeba involves the productiob of finger like projections called the pseudopodia and the movement is called Amoeboid movement.

During locomotion Amoeba has been seen to walk on the tips of the pseudopodia. A good many theories have been advocated to explain the mechanism involved in the pseudopodia formation. During the formation of a pseudopodium the plasma membrane gets attached to the substratum. A local and partial liquefaction occurs in the plasmagel at a point. The rest of the plasmagel exerts pressure on the weakened area to produce a buldge. This pressure comes from osmotic and other forces. Posteriorly , the contracting plasmagel converts into plasmasol. Anteriorly ,the plasmagel tube is continuously regenerated by gelation of plasmasol and the pseudopodium grows. Thus the formation of pseudopodium and the resultant movement in amoeba are due to spontaneous and reversible sol-gel phenomenon.

The change of plasmasol to plasmagel involves a loss of volume ; therefore ,the protoplasm may stream forward to occupy the space made available in this way. For the amoeboid movement ,the following four types of changes occur in Amoeba:

1. The plasma membrane of body of Amoeba adheres to the substratum.
2. Conversion of plasmasol to plasmagel at the anterior advancing tip.
3. Conversion of plasmagel into plasmasol at the posterior end of the body.
4. Contraction of the gelated protoplasm and forward streaming of the plasmasol.

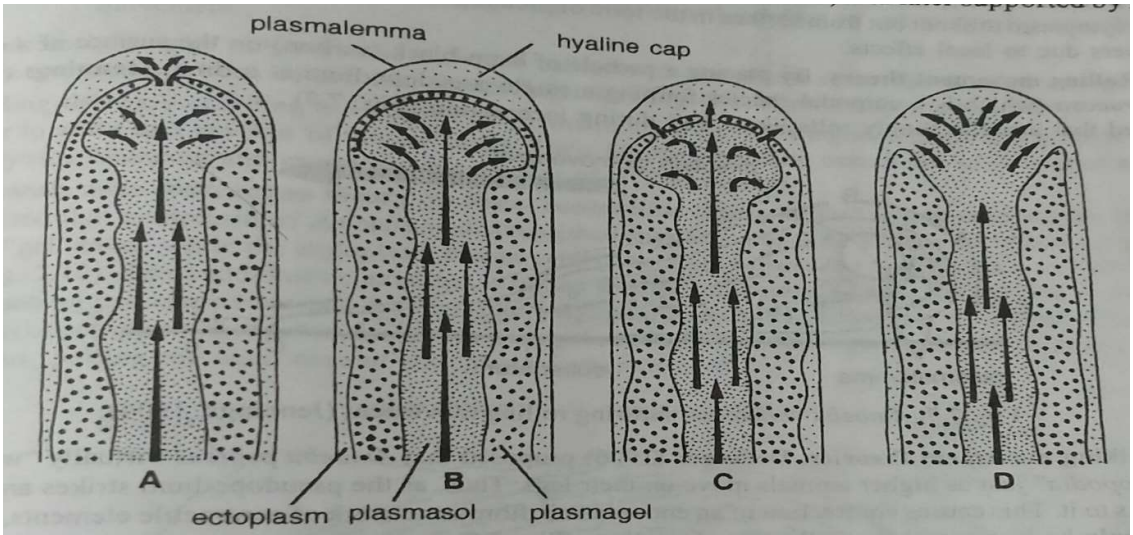


Fig. 7.6. Mechanism of amoeboid movement as explained by sol-gel theory.

oted that amoeba simply rolls like a ball

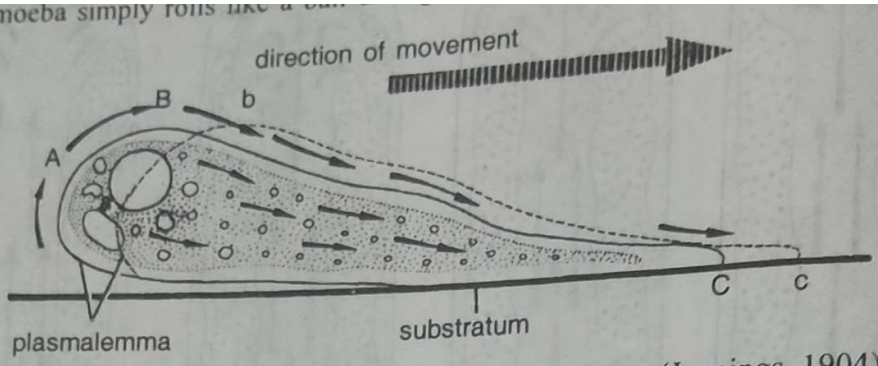


Fig. 7.7. *Amoeba verrucosa* showing rolling movement (Jennings, 1904).

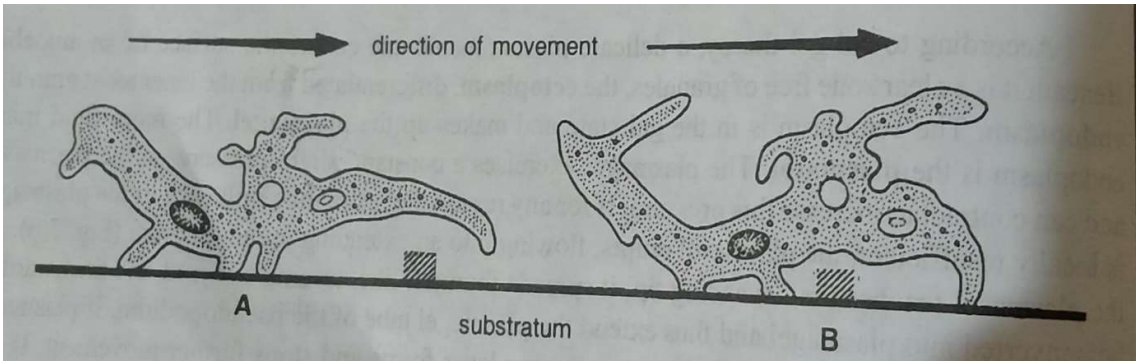


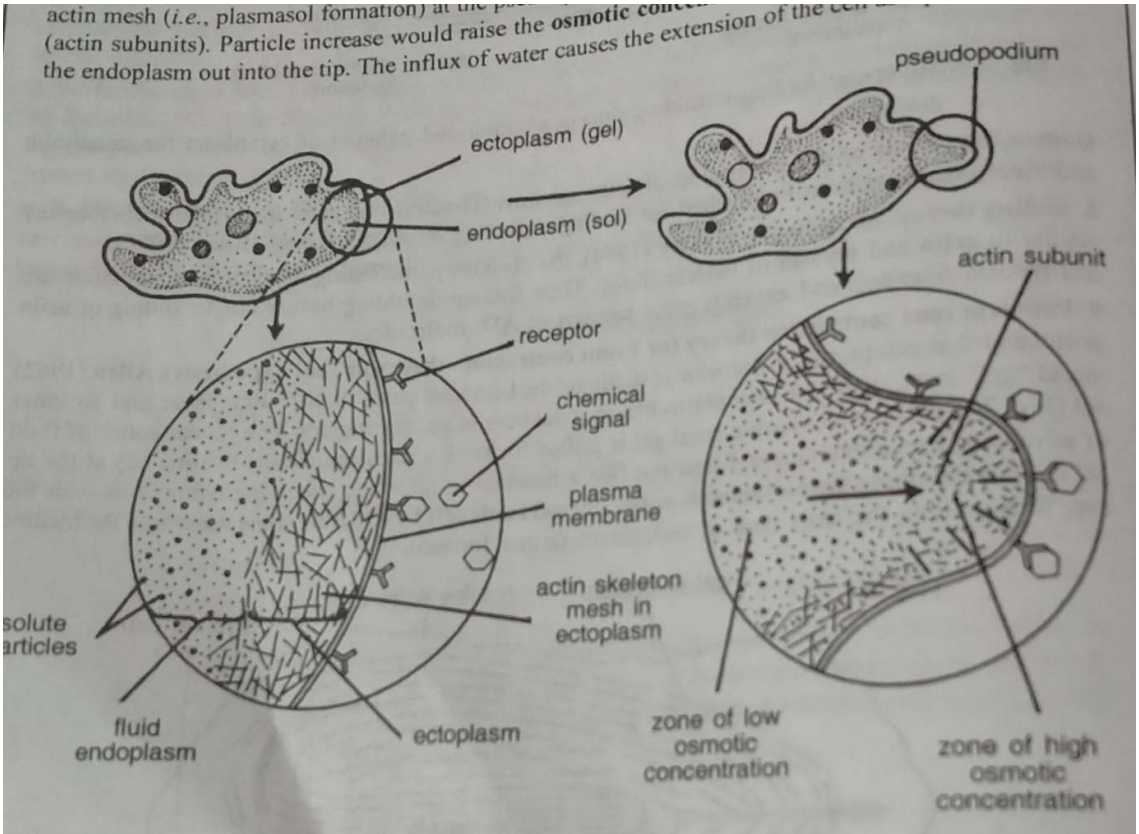
Fig. 7.8. *Amoeba proteus.* Walking movement due to contraction in the protoplasm.

6. Sol-gel theory. This theory is the most accepted theory of pseudopodium formation. It only when cytoplasm was recognized

ROLE OF MICROFILAMENTS IN AMOEBOID MOVEMENT

At present it is known that motive force in Amoeba is generated by sliding interaction between actin and myosin filaments. Actin is the major structural protein in the force producing event. This contractile proteins has been identified in Amoeba. These actins exist as G-actin or globular monomers and F –actin or polymeric filaments of G-actin filament unit. Actin in amoeba can reversibly bind with heavy meromysin to form arrow-head shaped complexes.

Myosine acts as mechanochemical transducer in the force –producing event.The protein has a globular head and a rod like body. It reversibly binds with actin filaments. Due to action of ATPase and actin –myosine filament creosslinking, pseudopodium is formed.Those binding proteins allow the microfilaments to push and pull on the cell membrane to help the cell move.presence of ca++ ion help myosine filaments to slide.



g. 7.11. *Amoeba.* Osmotic theory of flow of endoplasm during amoeboid locomotion. Actin mes creates gel state of ectoplasm. A—Chemical signals bind to membrane receptors and initia depolymerization of the actin mesh. B—Depolymerized actin subunits raise osmot concentration of this region of ectoplasm and water flows in. The influx of water caus the extension of the cell as pseudopodium. Peripheral to the pseudopodial tip, actin subun repolymerize as skeletal mesh, extending the ectoplasmic gel state forward like a progressi sleeve.