**Locomotion**

- Animals exhibit certain unique - life processes.
- The important life processes are - locomotion and reproduction.
- All living organisms produce young ones of their - own kind.
- Some protozoans reproduce - asexually.
- Majority of protozoans reproduce - sexually.
- Most of the sexually reproducing organisms produce - gametes.
- All most all adult organisms are diploid with - two sets of chromosomes (2n).
- Chromosomal number (2n) gets reduced to haploid set (n) in the - meiotic division that occurs during gametogenesis.
- Union of pronuclei of gametes restores the - diploid chromosomal number.
- The slowest locomotion is - amoeboid locomotion.
- The fastest locomotion is - ciliary locomotion.

**LOCOMOTION IN PROTOZOANS**

- Animals move from place to place for the sake of - Food, shelter and reproduction.
- Locomotion influenced by - external and internal stimuli.
- Movement of organisms from one place to other is called - Locomotion.
- Locomotory organelles found in protozoa are - Pseudopodia, Flagella, Cilia and Myonemes.
- Locomotory organelle in amoeboid locomotion - Pseudopodia.
- Amoeboid locomotion is seen in - Amoeba
- Locomotory organelles in swimming locomotion are - Cilia, Flagella.
- Examples for swimming locomotion - Paramecium, Euglena.
- Locomotory organelles of gliding type of locomotion are - Myonemes
- Example of Gliding locomotion - Euglena, Sporozoans
- Cellular extensions are - Pseudopodia
- Chief organelles for locomotion in Protozoa are - Pseudopodia, Flagella, Cilia.
- Organelles for Ingestion of food - Pseudopodia and cilia
- Microtubular structures that help in locomotion are - Myonemes.
- Protozoans in water are subject to forces of water resistance : Pressure drag and viscous drag.
- Pressure drug is - due to the difference of pressure between two ends.
- Viscous drag is - due to the water molecules attached to the surface.
- Viscous drag is more important for - Protozoans.
- Protozoans are not streamlined to minimize - the pressure drag.

**PSEUDOPODIA**

- The temporary outgrowths of the cell formed on the surface of the body are - Pseudopodia.
- Organisms with many pseudopodia are called - Polypodial organisms Eg : Amoeba
- Organisms with a single pseudopodium are called - Monopodial organisms - Eg : Entamoeba
- Pseudopodia are the characteristic of the classes- Rhizopodia and Actinopodia.
- Pseudopodia occur in few mastigophorans - Mastigamoeba.
- Based on their form and structure pseudopodia are - 4 types, Lobopodia, Filopodia, Reticulopodia and Axopodia or Actinopodia
- Lobopodia are - Blunt and finger like tubular pseudopodia containing ectoplasm and endoplasm with round tip Eg : Amoeba, Entamoeba.
- Filopoda are - Slender filamentous, pseudopodia with pointed tips. Eg : Euglypha, Lecithium.
Reticulopodia are - Filamentous branched, net like pseudopodia chiefly meant for food collection Eg: Elphidium, Globigerina.

Recticulopodia are also called - Myxopodia.

Primary function of Recticulopodia is - Ingestion of food.

Reticulopodia are common in - Foraminifers

Needle like pseudopodia, which develop radially on the body surface with a central axial filament are - Axopodia or Actinopodia

Pseudopodia with adhesive cytoplasm - Axopodia or Actinopodia

Main function of Axopodia is - Food collection.

Axopodia occur in - Helozoans (Actinosphaerium, Actinophrys) and Radiolarians (Collozoum)

FLAGELLA

Flagella are the locomotor organelles of - the mastigophore protozoans

Flagellum consists of - a long stiff axial filament or axoneme

Axoneme is surrounded by - Protoplasmic sheath

Axoneme arises from - The basal granule (or) blepharoplast (or) basal body (or) kinetosomes

Blepharoplasts are derived from - the centrioles

The number of flagella in Ceratium - Two

The number of flagella in Trichomonas - Four

The number of flagella in Giardia - Eight

The number of flagella in Trichonympha - Many

ULTA / STRUCTURE OR FLAGELLUM

The central axial filament (or) axoneme of flagellum shows - 9 + 2 arrangement.

The two central longitudinal tubules are enclosed by - inner sheath.

The central singlet microtubules are surrounded by - Nine peripheral "doublets".

Nine peripheral doublets form a - Cylinder.

The doublet of the outer ring are connected to the centre by - radial spokes.

Each doublet of the outer ring has - a pair of dynein arms.

Peripheral doublets are surrounded by - Membranous outer sheath also called Protoplasmic sheath.

Basal granule is formed by the bases of - Peripheral tubules.

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Below the level of pellicle the basal granule is formed as - 9 triplets

Minute hair like structures present along the length of some flagella are called - Mastigonemes or Flimmers.

Mastigonemes are - solid and 5 nm thick.

Mastigonemes are - tubular and 20 nm thick.

If mastigonomes are not present on a flagellum and is with a terminal filament, it is - Acronematic type Eg : Chlamydomonas, Polytoma

If, mastigonemes are in one row along the length of the axoneme, it is - Stichonematic type Eg : Euglena, Astasia.

If mastigonemes are in two or more rows along the length of the axoneme, it is - Pantonematic type Eg : Peranema, Monas.

If, mastigonemes are in two or more rows along the length of flagellum and ends as named axial filament - Pantacronematic type Eg : Urecoerus.

If the flagellum is simple without flimmers and terminal named filament is - Anematic type (simple) Eg : Chilomonas, Cryptomonas

CILIA

Short but highly vibratile organelles in large numbers on the body of protozoans are - Cilia.
- Cilia are found in - Ciliophoran protozoans.
- Cilia are locomotary organelles, throughout their life in the class - Ciliophora.
- Primitive form like holotrich is - Paramecium.
- The advanced form like peritrich is - Vorticella.
- Cilia are present only in young condition but in the adults they are modified into sucking tentacles in - Suctoria Eg : Acinata.
- The central axoneme or axial filament of a cilium or flagellum is formed by - Microtubules.
- The arrangement of microtubules in the axoneme of a cilium or flagellum is - 9 + 2.
- The structures connecting kinetosomes are called - Kinetodesmata.
- Kinetodesmata are also called - Neurofibrils.
- The longitudinal row of Basal granules and their kinetodesmata together called - Kinety.
- A network of kinety present in the ectoplasm of Paramecium is - Infraciliary system.
- A neuromotorium centre near cytopharyx is - Motorium.
- Motorium and infraciliary system together called - Neuromotor system.
- The neuromotor system coordinates & controls - Ciliary movement.
- If neuromotorium is destroyed, the cilia loose coordination and stop - beating of cilia.
- Fastest locomotion in protozoa - Ciliary movement.
- Organelles that help both in locomotion and ingestion of food are - pseudopodia and cilia.

**DIFFERENCES BETWEEN FLAGELLA AND CILIA**

- Flagellum length is - 150 µ.
- Cilium length is - 5 to 10 µ.
- Flagella produce - Undular movements.
- Cilia produce - Pendular movements.
- Flagella help in - Only locomotion.
- Cilia help in - Both feeding and locomotion.
- Flagella - Do not fuse.
- Cilia fuse to form - Membranelles, undulating membranes and cirri (compound ciliary organelles).
- Flagella are seen only - at one end.
- Ciliar are present - throughout the body surface or part of the cell.
- Number of flagella : Generally - 1 or 2 or 4 or 8 or many.
- More number of flagella are present in - Trichonympha.
- Cilia are generally - more in number.

**AMOEBOID LOCOMOTION**

- Locomotion caused by pseudopodia is called - amoeboid or pseudopodial locomotion.
- Amoeboid locomotion is common in - Rhizopoda, (Amoeba, Entamoeba).
- Amoeboid locomotion also exhibited by - amoeboid cells, macrophages, monocytes and neutrophils.
- "Sol-Gel Theory" or "Change of Viscosity Theory" advocated by - Miss L.H. Hyman.
- Sol-Gel Theory was confirmed by - Pantin and Mast.
- "Molecular Theory" or "Folding and Unfolding of protein molecules theory" or Back contraction was put forward by - Goldacre and Lorsch.
- Fountain zone theory or Front contraction theory was put forward by - Allen.
- Most acceptable theory with regard to formation of Pseudopodia is - Sol - Gel theory or Change of Viscosity theory

**FORMATION OF PSEUDOPODIUM**
- The protoplasm which is thick, less in quantity, nongranular transparent and contractile is - Plasmagel.
- The protoplasm which is more in quantity less viscous, fluid like more granular and opaque is - plasmasol.
- The change of Sol into Gel, and Gel into Sol is a - Physico - Chemical change.
- The first stage in the formation of pseudopodia is - Hyaline cap formation.
- Hyaline cap contain - thickened ectoplasm at the advancing end
- The point of weakness in the elasticity of plasmagel develops below the - Hyaline cap.
- Conversion of plasma gel into plasma sol by taking water is called - Solution.
- Conversion of plasma sol into plasma get by losing water is called - Gelation.
- During amoeboid locomotion amoeba has - Two ends.
- Ectoplasm is - Plasma gel
- Endoplasm is - Plasma sol
- The smooth round end is - advancing end
- The outer region of plasma sol produces - Plasmagel tube.
- During pseudopodial formation conversion of sol into gel takes place near (gelation zone) - the advancing end
- The trailing or retractile or wrinkled ends is - Uroid end.
- The protein molecules present in the cytoplasm that are involved in the amoeboid locomotion are - actin and myosin.
- During pseudopodial formation, conversion of Gel into Sol takes place near the (Solation zone) - "Uroid".
- Conversion of sol into gel takes place near the - advancing end
- Gelation occurs at the - advancing end
- Solution occurs at the - Uroid end
- Gelation and solution occur - Simultaneously at the same rate
- Contraction of plasmagel tube at the trailing end exerts - Hydraulic pressure on plasma sol
- This results in the continuous flow of plasma sol forwares in the plasmagel tube and forms the pseudopodium.
- On the basis of action of protein molecules sol gel theory was explained by - Goldacre and Lorsch.
- When the protein molecules of Amoeba are in Folded or Contracted condition the endoplasm is said to be in - 'Sol State'.
- When the protein molecules are in relaxed or unfolded condition, the endoplasm is said to be in - Gel State'.
- Folded protein molecules unfold at the gelation point of the advancing end by - losing water.
- Relaxed proteins at the solation point below the uroid surface fold due to - The absorption of water molecules and their interaction with myosin molecules.
- The energy required for amoeboid locomotion is available from - ATP by the action of ATPase

**SWIMMING LOCOMOTION**
- The type of locomotion performed by flagellum and cilia is - Swimming.
- Flagella and cilia are called Undulipodia by - L.H. Hyman

**BENDING MOVEMENT OF FLAGELLUM AND CILIA**
- Bending movement is brought about by - the sliding of microtubules past each other.
- Dynein arms of each doublet attach to an adjacent doublet and pull the neighbouring doublet and slide past each other in - **opposite directions.**
- This process is repeated during the bending movement.
- As the doublets are physically held in place by the radial spokes, they can not slide past much, and cause - **bending movement.**
- Dynein arms show complex cycles of movements using energy provided by - **ATP.**
- The bending movements of flagellum and cilium play and important role - **in their locomotion.**

**UNDULATION MOVEMENTS**

- Flagellum shows - **Undulations and side wise lashing movements.**
- Undulation from the base to the tip causes pushing force due to which the organism is - **pushed backward.**
- Pushing force like a - **Propeller of a boat.**
- Undulation from the tip to the base causes pulling force due to this the organism is - **pulled forward.**
- Pulling force like a - **Propeller of an Aeroplane**
- When the undulations are spiral organism shows - **rotatory movements.**
- If the flagella bends, to one side and undulations from base to the tip, the organism moves - **Laterally in the opposite direction.**
- Sidewise lash movement consists of 2 strokes - 1) **Effective strokes** 2) **Recovery stroke**

**CILIARY LOCOMOTION**

- Ciliary movement is similar to - **Paddle movement**
- Beating of cilia in longitudinal row one after another is called - **Metachronous movement.**
- The Cilia of transverse row best simultaneously in one direction is called - **Synchronous movement.**
- Synchronous movement seen in the - **Transverse row of Cilia.**
- The stroke in which cilia bends backwards and beats the water is called - **Effective stroke**
- The effective stroke - **body moves forwards and water moves backwards.**
- The cilia by its backward movement regains to its original position is called - **Recovery stroke.**

**GLIDING LOCOMOTION**

- Small zig-zag movement in the protozoans caused by the contractions and relaxations of myonemes present below the pellicle is called - **gliding locomotion.**
- Gliding locomotion in the flagellates is called - **Euglenoid movement**
- Gliding locomotion in the sporozoans is called - **Gregarine movement.**

**METABOLY**

- In many protozoans the strips can slide past one another, causing wriggling motion called - **metaboly.**
- Pellicle in protozoans is composed of - **proteinaceous strips.**
- Proteinaceous strips supported by - **dorsal and ventral microtubules.**